

**Development of an Osteogenesis  
Imperfecta (OI) specific  
Quality of Life measure  
Volume 1**



The  
University  
Of  
Sheffield.

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## Abstract

Osteogenesis Imperfecta (OI) is a hereditary disorder effecting approximately 1 in 20,000 births. Symptoms include; low bone mass, recurrent fractures, varying degrees of short stature and deformity. There is currently no disease specific quality of life (QoL) measure for children with OI. This study uses a mixed methods approach to develop a QoL measure for the paediatric OI population. Patient reported outcome measure development is an iterative process, moving back and forth between concept elicitation, questionnaire development, pre-testing and psychometric analysis.

In order to encourage a balance between good content validity, alongside promoting a robust, reliable and responsive measure, the methods chosen involved several stages:

- Literature review to ensure no suitable QoL measure already existed and to begin eliciting themes.
- Interview and focus groups with the target population to uncover relevant concepts, develop a conceptual framework and subsequently validate themes.
- Questionnaire development; transforming themes into items, using the children's' language to ensure high content validity and acceptability.
- Pre-testing the instrument alongside a sample of the OI population, making revisions as required.
- Psychometric evaluation to assess validity, reliability and responsiveness of the questionnaire, informing potential item elimination and revision of the measure.

Interviews and focus groups with the target population uncovered six main themes when describing QoL in children with OI; being safe and careful, reduced function, pain, fear, independence and isolation. These themes and related sub themes informed the development of the conceptual framework, which alongside the children's own thematic based quotes, was used to develop the OIQoL.

Pre-testing of the OIQoL highlighted logistical issues and understanding, which lead to revisions of the initial version. The final version underwent field testing; concerns around construct validity and internal consistency reliability highlighted the need to undertake further psychometric techniques on a larger cohort prior to item elimination.

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## List of Abbreviations

OI	Osteogenesis Imperfecta
QoL	Quality of life
HRQoL	Health related Quality of life
UK	United Kingdom
PROM	Patient reported outcome measure
OIQoL	Osteogenesis Imperfecta specific Quality of life
AD	Autosomal dominant
AR	Autosomal recessive
FDA	Food and drug administration
AIDS	Acquired immune deficiency syndrome
HIV	Human immunodeficiency virus
BBS	Brittle Bone Society
AHPs	Allied health professional
HPs	Health professionals
PE	Physical education
GP	General Practitioner
SCH	Sheffield Children's Hospital
PF	Physical functioning
SPSS	Statistical package for social science
ITC	Item-total correlation
ICC	Intraclass correlation coefficient
VAS	Visual analogue scale
EQ5D	European Quality of life 5 dimensions
PedsQL	Pediatric quality of life inventory
PEDI	Pediatric evaluation of disability inventory
WeeFIM	Wee functional independence measure

HUI III	Health utilities index
SPPC	Self perception profile for children
CIS-20	Self report questionnaire checklist individual strength
CHQ	Child health questionnaire
CHIP-CE	Child health and illness profile-child version
KIDSCREEN	SCREENING for and Promotion of Health Related Quality of Life in Children
TEDQL	QoL measure-ability social and mood items
CAQ	Child asthma questionnaire
PUQoL	Pressure ulcer quality of life measure
SOHO-5	Self reported scale of oral health outcomes
DISABKIDS	Disabkids chronic generic measure
YQOL-R/Y	Youth quality of life instrument
HSCS-PS	Health status classification system preschool
KINDL	Quality of life questionnaire for children (German)
TAPQOL	TNO-AZL Preschool children quality of life questionnaire
TACQOL	TNO-AZL child quality of life questionnaire
SF-10	Short form- 10 items
CH	Principle researcher Claire Hill
WB	Supervisor Wendy Baird

**OI genes**

CRTAP	LEPRE1	IFITM5	SERPINF1	SERPINH1
COL1A1	COL1A2	FBK10	SP7	BMP1
PPIB	TMEM38B	Wnt1		

# Chapter 1

## Introduction

Osteogenesis Imperfecta (OI) is a hereditary condition affecting approximately 1 in 20,000 births with eleven recognized types of OI (Glorieux, 2008; Forlino et al, 2011). Children with OI have low bone mass, leading to recurrent fractures, varying degrees of short stature and deformity.

The overall aim of this thesis was to develop a paediatric OI specific quality of life (QoL) questionnaire for self completion by children aged 6-18 years.

Patient reported outcome measure (PROM) development is an iterative process, moving back and forth between concept elicitation, questionnaire development, pre-testing and psychometric analysis.

Specific secondary objectives were to:

- 1) Review the literature to ensure no suitable QoL measure already existed and to begin eliciting themes.
- 2) Interviews and focus groups with the target population to uncover relevant concepts, develop a conceptual framework and subsequently validate themes.
- 3) Questionnaire development; transforming themes into items, using the children's' language to ensure high content validity and acceptability.
- 4) Pre-testing the instrument alongside a sample of the OI population, making revisions as required.
- 5) Psychometric evaluation to assess validity, reliability and responsiveness of the questionnaire, informing potential item elimination and revision of the measure.

The overall research question was "Can we develop a condition/disease specific paediatric OI specific quality of life (QoL) questionnaire for self-completion by children aged 6-18 years?"

The following study uses a mixed methods approach to the development of a disease specific QoL measure for the paediatric OI population. Patient reported outcome measure development is an iterative process which involves moving back and forth between concepts and theme elicitation, questionnaire development and psychometric testing. This approach encourages a balance between ensuring good content validity, alongside promoting a robust, reliable and responsive instrument.

This chapter will introduce the reader to the different stages of questionnaire development, as evidence is gathered from both the literature and personal experience (primary researcher, experts – children, parents, health professionals) with the disease to inform the developmental process. The first sections of this thesis involve qualitative methods; eliciting concepts, validating themes and developing the questionnaire. The latter half integrates the qualitative and quantitative methods within chapters, which are written to document the process of patient reported outcome measure development sequentially, as the stages were undertaken, rather than describe the methodologies separately.

The initial stages involved reviewing the current and historical literature to ensure that there was no other previously developed QoL instrument (generic or appropriate disease specific questionnaire) suitable for children and adolescents with OI, which would negate the need to develop a new questionnaire. This literature review was then used alongside expert opinion, interviews and focus groups to inform the development of a conceptual framework portraying how OI can effect QoL in individuals with OI and how the nature of OI, its management and treatment effects a child's QoL.

The term QoL will be used to encompass both QoL and health related quality of life (HRQoL) throughout this thesis. The terms child, adolescent and young person may be used interchangeably when describing the paediatric OI population (0-18 years), but the QoL questionnaire will be developed for the 6-18 years age group to enable self completion.

Phenomenology was the qualitative method chosen to enable meaning and appreciation of the disease process, its management and the effect this has on the life and experience of children and their families with OI. Phenomenology involves close analysis of an individuals' lived experience to gain understanding of their thought processes related to their disease. Gaining access to this life experience, knowledge and meaning enables the researcher to understand common features of the population and draw out concepts and themes relevant to the research topic.

As the process of instrument development is an iterative one, the conceptual framework undergoes change and revision as further information and understanding is uncovered. This final framework is then used to develop the initial version of the questionnaire, with the concepts/themes used to inform the dimensional headings. Transparency of the processes used to develop the conceptual framework and the resultant questionnaire is vitally important. How the themes were uncovered, validated and finally turned into questions or items within the instrument needs to be clear. Preliminary testing of the questionnaire for acceptability, ease of completion and understanding is a necessity; changes are then made to the initial instrument following feedback from the target population to ensure the development of an acceptable and relevant questionnaire with high content validity.

Finally, after revision and improvement, psychometric testing of the newly developed questionnaire is required. This encourages the development of a robust, reliable, valid and responsive instrument, highlighting areas which although deemed important to the target population may not be statistically sound. At this stage the primary researcher should acknowledge the need to balance the content validity, as informed by the qualitative processes, against the requirement for a statistically robust instrument.

The local research ethics committee reviewed and approved the study protocol (Appendix 1).

## **Background (Chapter 2)**

The first half of this chapter reports on the background literature relevant to paediatric Osteogenesis Imperfecta (OI). It provides an overview of the incidence, symptoms and phenotype, alongside the medical, genetic, surgical and therapy management of

children with OI. The latter half provides an overview of quality of life (QoL) in children and the best methods available to measure it. It considers proxy or self reporting of quality of life, and sets the scene for the following development chapter.

### **Development of New Quality of Life Measures (Chapter 3)**

This chapter details best practice in patient reported outcome (PRO) measure development based on the FDA guidelines (2009) and the subsequent articles by Patrick et al (2011a & b). The background literature is reviewed surrounding QoL questionnaire development, concept elicitation and the methods used to achieve this, content validation, pilot or pre-testing and finally the methodology used to assess the psychometric properties of the newly developed questionnaire.

### **Systematically reviewing the literature (Chapter 4)**

This chapter searches for the answers to several questions; what would an appropriate QoL questionnaire for the paediatric OI population look like? What aspects of QoL would it include? Is there a suitable QoL questionnaire already in existence which will meet the needs of the paediatric OI population?

The chapter repeats a systematic review of the literature previously undertaken by Eiser and Morse(2001), McCabe (2003) and Stevens (2008). It examines the literature related to generic QoL measures for children, and any suitable disease specific instrument which might also meet the needs of the paediatric OI population. The lack of a suitable alternative QoL instrument highlighted the need to develop an OI specific QoL questionnaire.

### **Item generation and the conceptual framework – Interviews (Chapter 5)**

This chapter describes the methods undertaken to elicit themes for inclusion in the OI specific QoL questionnaire. At the start of this chapter the primary researcher provides the reader with a reflective statement describing their experience with the paediatric OI population, alongside their thoughts and feelings with regards to QoL and OI. The need for transparency and reflexivity during qualitative methodologies is the motivation for this approach to the chapter. An initial experience based conceptual framework is also documented.

This chapter then discusses the semi structured interviews undertaken with children, parents and health professionals with experience in the management of children with OI. Interviews were transcribed verbatim, undergoing thematic analysis and themes were extracted. An exhaustive list of uncovered themes/items is included within the appendix (Appendix 2). A second conceptual framework is documented to highlight themes elicited following the interviews.

### **Item validation and the revised conceptual framework - Focus groups (Chapter 6)**

This chapter documents the methods undertaken to validate the themes uncovered following the semi structured interviews, and ensure that no potential themes have been missed. Two focus groups were undertaken; previously elicited themes were discussed, and potentially missed themes were uncovered. The latter group was also encouraged to discuss the potential format of the questionnaire, the Likert scale and

suitable recall period. Revisions were made to the conceptual framework and this is documented towards the end of this chapter.

### **Questionnaire and item development (Chapter 7)**

This chapter describes the process of instrument development; the terminology used by the children and adolescents during item elicitation (Chapter 5) was used to design the items. Expertise was sought from primary school teachers and children to examine reading age and understanding. A copy of the 39-item OIQoL questionnaire (version 1) is included at the end of this chapter.

### **Pilot or pre-testing of the initial questionnaire (Chapter 8)**

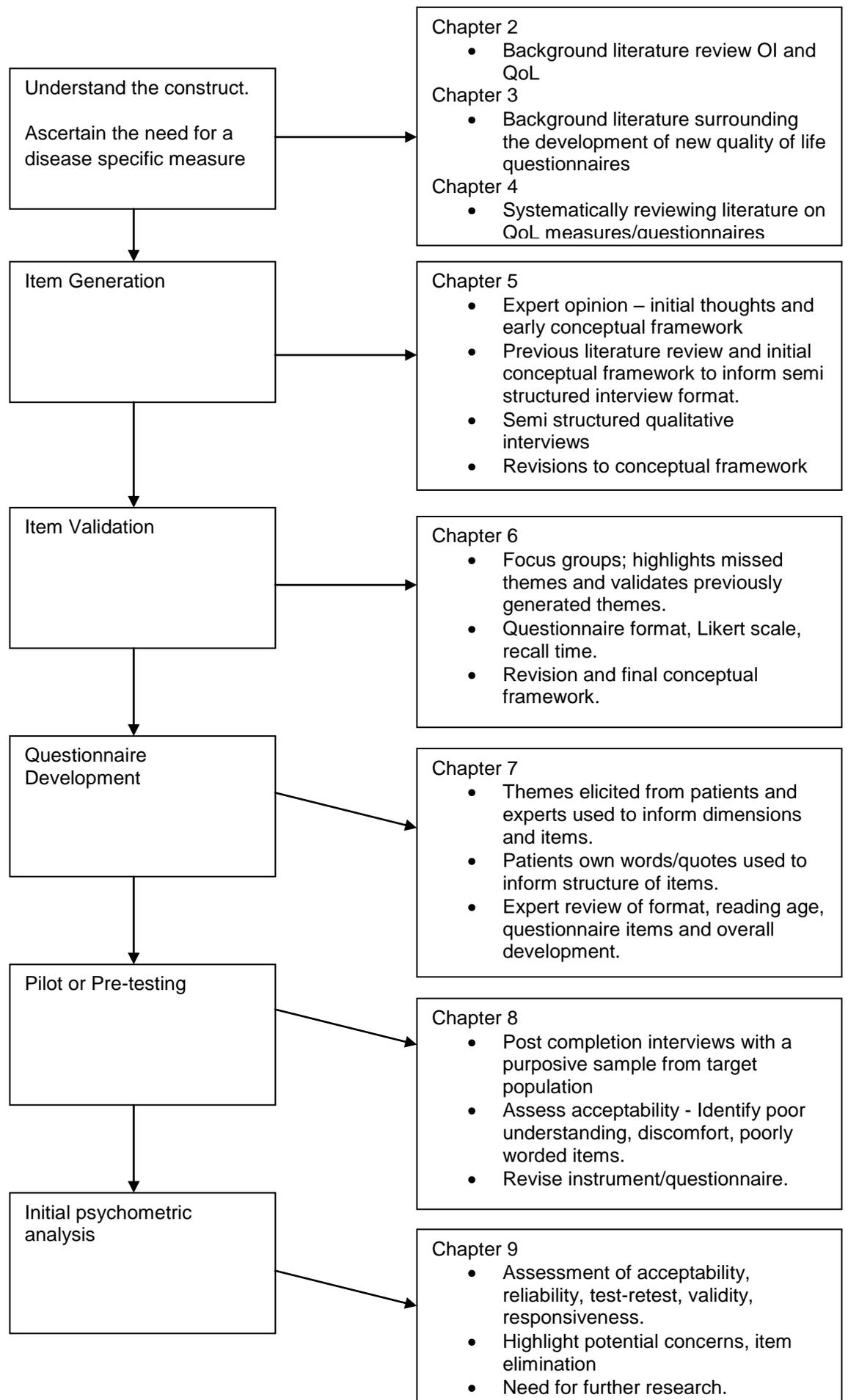
Pre-testing of a newly developed questionnaire to ensure acceptability, comfort and understanding is a necessity. This chapter documents the process of pre-testing the newly developed OIQoL on the paediatric OI population (on a sample of 25 children) and the results of post completion interviews. Changes to the instrument as a consequence of pre-testing are noted, and a copy of the OIQoL (version 2) is included at the end of this chapter.

### **Psychometric evaluation – reliability, validity, responsiveness, item reduction (Chapter 9)**

This penultimate chapter examines the preliminary psychometric properties of the newly developed OIQoL on a sample of n=95 children with OI measured at baseline, 1 and 12 weeks. Traditional statistical methods were used to investigate validity, reliability and responsiveness of the questionnaire at time points, baseline, one week and three months. The process of potential item elimination is discussed, alongside the reasons behind the statistical methods chosen. Plans for future research are acknowledged.

### **Conclusions (Chapter 10)**

This chapter describes the overall outcome of the research, highlighting the strengths and limitations of the methodologies used. Plans for future research are described.



**Figure 1.1** Overall flow chart of the planned methodology

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## Chapter 2

### Background Literature

#### 2.1 Osteogenesis Imperfecta

Osteogenesis Imperfecta (OI) is a disease with varying severity affecting the physical, social and emotional well-being of the child and their family (Hill, 2014). It is a hereditary condition affecting approximately 1 in 20,000 births with eleven recognised phenotypes (Glorieux, 2008; Forlino, 2011) and 15 genetically different types documented (Shapiro, 2014). Children with OI have low bone mass, recurrent fractures, often with minimal trauma, varying degrees of short stature and long bone deformity, scoliosis, kyphosis, pain, some hearing loss, and respiratory failure in the severest types which can be lethal.

The initial classification of OI (Sillence, 1979) was based on skeletal features alone. Smith et al (1983) describes the classification as being dependent on the age at which the diagnosis was made. Those individuals who had fractures at birth were considered to have OI congenital, those who were diagnosed later and exhibited fractures after birth were described as OI tarda, (gravis if fractures occurred in the first year, levis if fractures occurred later). Sillence classification (1979) described 4 types of OI. Type I included most of the tarda levis, milder presentation, with minimal skeletal deformity (Shapiro, 2014). Type II described patients with lethal OI, severe deformity, multiple fractures and death due to respiratory insufficiency. OI type III described patients with a progressively deforming variation, with scoliosis, short stature, bowing of long bones and white sclera. OI type IV describes a moderately affected individual with white sclera, moderate short stature and deformity.

Over time the above 'Sillence' classification began to appear over simplified. Individuals previously diagnosed as type IV OI began to behave unexpectedly. Some patients were noted to develop hypertrophic callus following fracture and were later described as type V (Glorieux et al, 2000). Others who had unusual histological changes when examined under polarised light were later denoted as type VI (Glorieux et al, 2002).

Mutations within the genes COL1A1 or COL1A2 which encode type I collagen, are thought to be responsible for 98% of cases of OI. More recently groups have uncovered recessive genes, which explain some of the variation seen within the more severe forms of OI (Barnes et al, 2010; Barnes et al, 2012; Kelley et al, 2011; Laine et al, 2013). Marini et al (2013) describe mutations in CRTAP and LEPRE1 which lead to a very severe phenotype with white sclera, broad long bones, thin ribs without beading and smaller head circumference. The table below details the OI type, phenotype and genetic back ground to the most up-to-date published information, although this continues to expand as new genes are uncovered.

**Table 2.1** Current Classification of OI Types

This table presents current classification of OI phenotypes and the associated mutations.

OI type	Phenotype	Inheritance	Genetic analysis
I Mild, non-deforming	Short or normal stature , blue sclera, mild joint laxity, no DI	AD	Null mutation due to premature stop codon <i>COL1A1</i> : normal collagen but ½ normal amount
II Perinatal lethal	Beaded ribs broad or narrow long bones, thin calvarium, Rhizomelia, severe pulmonary insufficiency	AD AR++	<i>COL1A1</i> and <i>COL1A2</i> structural alterations in type I collagen. <i>CRTAP, LEPRE1, PPIB</i>
III Severe, deforming	White or blue sclera, DI, short stature, severe scoliosis, wheel chair dependent	New mutation, AD	Structural alteration in type I collagen: <i>COL1A1, COL1A2</i> <i>CRTAP, LEPRE1, PPIB</i>
IV Moderately deforming	Moderate skeletal deformity, frequent use of aids to ambulation, blue sclera early that tend to lighten with age, scoliosis, DI	AR++	<i>COL1A1</i> and <i>COL1A2</i> mutations
V Mild to moderately deforming	Variable phenotype, mild to severe, white sclera, dislocation radial head, interosseous membrane calcification, hyperplastic callus, no DI. The defining feature of OI type V is the mesh type lamellation pattern on bone histology	AD	<i>IFITM5</i>
VI Hyperosteoridosis	Moderate/severe, white/blue sclerae. Early onset fractures, osteomalacia on bone biopsy	AD	<i>SERPINF1</i>
VII Moderately deforming	First Nations Quebec families, recessive inheritance, moderate to severe, rhizomelia, no DI	AR	<i>CRTAP, LEPRE1</i>
VIII Severe, lethal	South African black population, lethal or severe, bone deformity	AR	<i>CRTAP, LEPRE1</i>
IX	Moderate to severe phenotype	AR	<i>PPIB</i>
X	Moderate to severe phenotype	AR	<i>SERPINH1</i>
XI	Moderate to severe phenotype	AR	<i>FBK10</i>
XII	Moderate to severe phenotype	AR	<i>SP7/Osterix</i>
XIII	Moderate to severe phenotype	AR	<i>BMP1</i>
XIV	Moderate to severe phenotype	AR	<i>TMEM38B</i>
XV	Moderate to severe phenotype	AR	<i>Wnt1</i>

“In this table mutations associated with recessive disease are listed with OI Type II and type III categories because of the phenotype overlap. AD: Autosomal dominant inheritance; AR: Autosomal recessive inheritance; DI: Dentinogenesis imperfecta.” (Shapiro, 2014, pp16)

Osteogenesis Imperfecta (OI) cannot be cured currently, so the disease is managed rather than healed (Rauch, 2014). Treatment for children with OI is best placed within a multidisciplinary team, where medical, surgical and therapy/rehabilitation can be offered. Treatment aims to provide pain relief; reduce fractures; prevent deformity; improve mobility and facilitate independent function (Hill, 2014).

The current standard treatment for children with OI is Bisphosphonate therapy (Zeitlan et al, 2003), and this has been used for over fifteen years (Rauch, 2014). The initial hypothesis for using bisphosphonates was that the reduced osteoclastic activity, or bone reabsorption might strengthen the bone (Cheung and Glorieux, 2008). Their use within the treatment of OI increased and became better known following a publication by the Montreal group in 1998 (Glorieux et al), who presented a case series of children with OI who were treated with intravenous Pamidronate. This reduction in osteoclastic activity however did not improve the quality of the bone, it produced more of the same 'brittle bone', but the mechanical strength was improved by the additional increased bone volume. Bisphosphonates can be given both orally and intravenously; the latter necessitates a two to three day hospital stay in the case of Pamidronate therapy or a one day stay if Zoledronate is used.

Glorieux et al (1998) reported reduced fracture rate, when compared to historical controls. A process of healing of vertebral crush fractures has also been documented (Land et al, 2006; Letocha et al, 2005), when Bisphosphonates are given during growth. Moreover, other literature reports reduction in bone pain and an increased feeling of well-being (Lowing et al, 2007; Kok et al, 2007).

Non surgical management of children with OI aims to prevent and treat fractures; enhance motor development; muscle strength; range of movement; reduce contractures and deformity; improve functional ability and ambulation (Monti et al, 2010). From a skeletal and orthopaedic perspective children and adolescents with OI suffer numerous complications due to their disease. The moderately and severely affected can be born with long bone deformities, or these may develop over time, due to recurrent fractures and/or poor positioning. Deformities of the spine such as, kyphosis, scoliosis, spondylolithesis and spondylolysis can be observed, as can problems at the base of the skull (Platybasia, basilar invagination, basilar impression). These latter complications may lead to neurological dysfunction; the patient may complain of headaches, ataxia, dysphagia, hearing problems and signs related to hydrocephalus (Sawin and Menezes, 1997). Variation is seen in the literature in the reporting of scoliosis in OI. Incidences range from 26% in children under five years of age up to 82% in older children have been documented (Benson et al, 1978; Ishikawa et al, 1996), with agreement that increased age is associated with increased risk.

Many children undergo orthopaedic surgery to improve deformity and alignment or to stabilise fractures. The instrumentation used can take the form of fixed intermedullary rods or more often growing rods. Shapiro (2014) states the goal of orthopaedic surgery is to help the bone grow straight, reduce fracture rate and in the event of fracture, prevent bone displacement. Telescopic or growing rods were initially developed by Baily and Dubow (1963), but have since undergone development by Bell and colleagues (Stockley et al, 1989) who was instrumental in developing the Sheffield rod and Fassier-Duval (2001). These rods prevent the need for recurrent surgery to

replace intermedullary rods as the child grows, as they are fixed both proximally and distally and elongate with growth. However, complications can arise, such as; non telescoping; rod migration; disengagement of the male and female components (proximal and distal sections) and growth disturbance (Fassier and Gdaltvitch, 2014).

Therapy intervention for children with OI is best placed within a multidisciplinary team including; clinical nurse specialist; occupational therapist; physiotherapist; psychologist; social worker; dietician and speech and language specialist, but this is not essential. Early treatment involves educating the parents and carers in handling, positioning and caring for their new born. Prevention of increased deformity and facilitation of normal development is an important management approach from the onset. The motor development and functional ability of children with OI can be delayed and this is often related to the severity of the disease (Engelbert et al, 2004). Children with severe disease may be encouraged to remain reclined within the first year of life, with gradual progression into supported vertical sitting. This is done to prevent increased crush fractured vertebrae and poor spinal alignment.

Many children with mild and moderate OI achieve independent walking with or without equipment; some may use wheelchairs for longer distances. Some severely affected children may achieve household walking or therapeutic walking (Bleck, 1981). However fatigue, reduced exercise capacity and exercise intolerance is frequently reported to limit their activities of daily living (Van Brussel et al, 2008). Takken et al (2004) studied cardio-respiratory function in children with OI. They reported that exercise capacity and muscle strength were significantly reduced compared to their unaffected peers; fatigue was related to proximal muscle weakness and reduced peak oxygen consumption. They concluded intervention to increase exercise capacity and muscle strength may be beneficial.

### 2.1.1 *QoL Outcomes in Ostoegenesis Imperfecta*

Perceived competence in relation to impairment and disability in OI was discussed by Engelbert et al (2001). The group examined; joint range of movement; muscle strength; functional skills, using the Pediatric Evaluation of Disability Inventory (PEDI); mobility, using the Bleck; and perceived competence, using the Harter Self-Perception Profile. They found range of movement, muscle strength, functional skills and mobility differed significantly between the different severities of OI. They stated that overall perceived competence in children with OI was fairly to strongly positive, without any significant differences between the different types. Perceived athletic competence in mildly affected children was below average, whereas this was not a finding in those severely affected children, who, it was suggested, may not compare themselves so readily to unaffected children, or their use of powered mobility may promote perceived competence. Social acceptance correlated moderately with physical appearance, which in turn correlated highly with global self-worth.

Hill et al (2014) states previous attempts at measuring quality of life in OI have used several generic instruments including; PEDI; WeeFim; visual analogue scale (VAS); Bleck score; Health Utilities Index III (HUI III) and the Self Perception Profile for Children (SPPC). Seikaly et al (2005) examined the impact of Alendronate on QoL in children with OI. The group used the PEDI to measure mobility, the WeeFim to

document self care and well-being, and pain was measured on a VAS. They reported significant improvement in well-being and reduction in pain in those children treated with Alendronate, but failed to identify any improvement in QoL or function. No insight is given with regards to this lack of identified improvement; could poor measurement or the choice to use a battery of outcome measures in an attempt to quantify QoL be a contributing factor? They also demonstrate confusion around the difference between function and QoL, often using the terms interchangeably.

Van Brussel et al (2008) examined the physical training of 34 children with mild-moderate OI, who were randomised to two treatment groups (twelve week exercise intervention and control). They used hand held dynamometers to measure muscle strength, the self report questionnaire checklist individual strength-20 (CIS-20) to examine fatigue, the self perception profile for children to measure perceived competence and the child health questionnaire parent-form 50 (CHQ) to measure HRQoL. They found that exercise capacity and muscle strength significantly increased in the intervention group. Subjective fatigue levels, perceived competence and HRQoL showed some improvement, but lacked significance. The authors comment on the possible reasons for this lack of significant improvement in fatigue, perceived competence and HRQoL, with comparisons found in healthy children, but no suggestion of a more disease specific outcome measure is noted. Normative data within the healthy population is available on the CHQ, but there is no available normative data for children with OI and we have no evidence to suggest that the CHQ measures themes or items which are relevant to the OI population, therefore content validity may be low.

In 2009, Casillo et al conducted a systematic review into the effects of Bisphosphonates in children with OI. They concluded that although Seikaly et al (2005) had demonstrated positive impacts on self care and well-being, other studies were not able to replicate these findings. They do make note that several studies attempted to evaluate impacts made on mobility, ambulatory and functional status, but that no statistically significant change in the outcome was found.

Generic QoL measures such as the HUI III and the SPPC can be used to assess and compare a range of different disease states and healthy individuals, but they may not be responsive enough to detect the small changes in QoL experienced by a child with a particular disease (Hill, 2014). As a result clinically important aspects of a child's life related to their disease may be overlooked (Juniper, 1997). Due to the lack of a readily available disease specific QoL or functional measures for children with OI, several authors (Kok et al, 2007; Seikaly et al, 2005) have attempted to group together, in a battery approach, whole or parts of generic measures in an attempt to gain a suitable outcome measure for the paediatric OI population.

## **2.2 Quality of Life**

Quality of life is an important part in assessing children with chronic conditions; as survival rates have increased, it has become necessary to measure outcomes in relation to how that child has adjusted to or is coping with his or her disease and possible treatments (Harding, 2001)

Within the background for this research it is important to state that functional status/ability and QoL/HRQoL are not one and the same. Early models on QoL were largely concerned with function (Harding, 2001). Eiser (1996) defined these attempts as 'deficit centred models', as they assumed individuals with chronic conditions would necessarily show poorer functioning compared to their healthy peers, and that this potentially reduced functioning would automatically be reflected in a poorer QoL.

In some of the previous studies mentioned, within the OI population (Kok et al, 2007; Seikaly et al, 2005; Van Brussel et al, 2008; Engelbert et al, 2001) authors have stated their aim is to measure or observe change in QoL following a specific therapy or medical intervention. They then describe methodology that measures and documents their participants' function, level of activity or their ability to complete function activities of daily living. Although functional ability can be considered to contribute towards an individual's QoL, it shouldn't be used as a measure of their QoL. Care should therefore be taken when critiquing studies or previous research, that a relevant and valid questionnaire or instrument has been used to measure QoL.

Quality of life is described in differing ways by different authors. Bond (1996) considers there to be many elements that make up QoL including subjective elements; satisfaction with life; presence of social; emotional; physical and mental health; cognitive ability to evaluate life; happiness; psychological well-being and objective elements such as; socioeconomic status; functional status and housing.

Objective and subjective components to QoL are also discussed by Eiser and Morse (2001), who felt objective assessment focuses on what an individual can do, and what this ability means to the individual is the more subjective element. How different individuals appraise their objective ability can account for the different subjective QoL described by two individuals with the same objective health.

Fayers and Machin (2007) state that QoL means different things to different people, but agree that although aspects vary between studies; they can include; general health; physical functioning; physical symptoms and toxicity; emotional functioning; cognitive functioning; role functioning; social well-being; social functioning and existential issues.

Connolly and Johnson (1999) have a much more simplified outlook on QoL, and define it as physical, social and emotional aspects of a patients well-being that are relevant and important to the individual. They go on to state that HRQoL includes those aspects of QoL which can be influenced by health interventions. Difficulties arise when the aim of an intervention is to improve an individual's QoL, as this includes several components of QoL that are related to the environment and social setting of an individual, which are not often affected or influenced by healthcare or medical intervention (Eiser and Varni, 2013). As a result of this Eiser and Varni (2013) describe HRQoL as the patient's perception of the impact of an illness and its treatment. The key to measuring QoL appears to be the idea that all individuals have their own perspective on QoL. It is dependent on their current life style, past experience, hopes, dreams and ambition for the future (Eiser and Morse, 2001).

QoL or HRQoL measures can be generic or disease specific. Generic measures can be used to assess a whole range of different disease states and healthy individuals,

allowing comparison between cohorts and individuals to be made. Disease specific measures are more sensitive to one disease state; they are able to detect smaller, but potentially important changes in the patients' condition, allowing comparison of different interventions or treatments (Eiser, 1997; Connolly and Johnson, 1999). Generic instruments can be described as either health profiles, where several items, grouped into different domains are used to assess QoL or well-being; or preference based index measures. The latter provide a single overall score which is assigned to the health state of the individual.

Measuring QoL in children has added difficulties. Children see things differently to their parents, carers or health professionals. Children don't often share the same views as their parents about the impact of their illness and their ability to use rating scales and understand language varies with age (Eiser and Morse, 2001) and educational ability. Parent and carers can therefore be used as a proxy respondent when children are too young or too ill to self report. This however has its limitations and these are well reported within the literature (Eiser and Morse, 2001; Eiser and Varni, 2013; Connolly and Johnson, 1999). Parents and children can disagree on the child's reported QoL and their symptoms, yet there is no correct answer as to who is the most accurate reporter. Although Eiser and Varini (2013) do conclude that it is ultimately the child who knows best, with regards to their internal states such as; feelings of pain, emotional distress, fatigue or gastrointestinal symptoms. Evidence has shown that it is feasible, reliable and valid for children as young as 5 years of age to self report (Varni et al, 2007), particularly on concrete concepts such as pain or medication (Connolly and Johnson, 1999). However it is suggested that for subjective concepts such as behaviour or self esteem, a child of 9-10 years may be more reliable (Landgraf et al, 1996).

Upton et al (2008) states that within healthy children, parents often rate their child's HRQoL better than the child themselves; alternatively within children with chronic health conditions, parents typically describe their child's HRQoL worse than their child's self report. Parents and children are often more in agreement when describing objective physical domains such as physical function, but less so when emotional or social function, or pain and fatigue are rated (Eiser and Varni, 2013). Parental experience and psychological well-being also have an effect on how they report their child's QoL. Parents, who report higher levels of depressive symptoms and emotional distress, are more negative in their perception of their child's HRQoL (Janicke et al, 2007; Eiser and Varni, 2013). This relationship is stronger for mothers than fathers (Davis et al, 2008).

The relationship between child self report and proxy report (parent/carer) is a multi focal and complex one. Young children spend more time with their parents and may therefore report closer agreement in their QoL with their parents/carers, than an adolescent who has more independence (Eiser and Varni, 2013).

The ability to report QoL will vary with age, developmental level, comprehension and cognition. Moreover, children's cognitive and emotional development will affect the reliability of self reported health outcomes. For this reason, several QoL measures have different age ranges for completion (e.g. PedsQL), in an attempt to make the items more relevant and to aid understanding of the questionnaire as a whole. This

would initially appear straightforward, but difficulties arise if the child's age does not correspond to or reflect their educational ability, understanding or emotional maturity. A very mature eleven year old may find herself completing a questionnaire deemed valid for 6-11 year olds, when she may be more suited to completing the older child's version. Complications can also arise if the different age versions differ too greatly, or the item content differs between the child self report and the proxy version (Eiser and Varni, 2013). For these reasons a single questionnaire, allowing self completion by the child, over a wide age range may be more useful, allowing reliable monitoring of the child as they develop and transition into adult care. Moreover, Erling (1999) states that if the aim is to monitor health or QoL within a longitudinal study, a potential solution would be to use items which are not overly age-related, which would therefore allow children of all ages to complete the same instrument.

The following chapter goes into more detail about the development of new QoL instruments and the methods available to undertake this task.

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## Chapter 3

### Development of Quality of Life measures

#### 3.1 Background

Quality of Life (QoL) questionnaires and the items included within can be developed in several ways. Historically QoL instruments for children were developed from adult measures that were adjusted to suit the younger population. Landgraf (2005) states that adapting adult items by rewording them is not sufficient as the item should be relevant at both the concept and item level. Concepts uncovered from the adult population are often not suitable and relevant to children; their priorities, expectations and understanding are very different. It is well known that children are not just small adults. Kozinetz et al (1999) state that as the goal of adult functioning is to be self-sufficient and economically productive, as a result, adult-based measures of functioning or QoL are not suitable for adaptation and use within the paediatric population.

##### *3.1.1 Developmental methods of patient reported outcome measures*

Questionnaire development more recently has followed a different path, attempting to produce QoL instruments which have improved content validity, ensuring that newly developed instruments are suitable for the paediatric population. In the case of disease specific measures; that the items and dimensions are measuring what the target population feel is important and relevant to them. Schmidt et al (2001), state that an instrument is more likely to be acceptable to the population group, if it measures what they consider to be important to their QoL. This can be achieved if the specific population are involved in the uncovering and generating of the items and dimensions.

##### *3.1.2 Generating themes and uncovering concepts*

Themes or items for a new QoL questionnaire can be developed via a top down or bottom up approach. The first involves pulling items from the literature, previous well known QoL instruments or from expert opinion; the latter approach involves canvassing the patient population, using qualitative research methodology to elicit potential themes or items, and the development/production of a conceptual framework.

Some researchers describe the review of the literature as synonymous with the development of the conceptual framework (Maxwell, 1996). This is of course not the case; a conceptual framework based on theoretical publications would not necessarily ensure good content validity for a particular population, as they had not been involved in the generation of concepts, which may later prove to be irrelevant. Within the literature there is often a lack of transparency during questionnaire development surrounding the conceptual framework. Some authors use only top down methods to develop QoL instruments (Bevans et al, 2010; Starfield et al, 1995, instigating item pool generation from literature or expert opinion, followed by factor analysis to define the scales, statistical analysis and subsequent modification of the scale. This can lead to a scale with clinically curious item content and poor content validity. Other developers use bottom up methodology (Landgraf, 1996; Sandeberg et al, 2010), but offer little information about the experience of the research team/authors, or the process

undertaken, alongside the relevant population, to develop the conceptual framework and any revisions that may have taken place.

This bottom up approach of concept gathering from the participant population encourages good content validity and the boundaries of these concepts can be examined by triangulating them alongside expert opinion and literature review (Magasi, 2012).

The risk of a 'top down approach' is that it does not take into account the thoughts and opinions of the patients and how their underlying condition affects their QoL (Gorecki et al, 2010). This lack of patient perspective can lead to issues surrounding content validity and responsiveness to change, as it may not be relevant to the target population (Guyatt and Cook, 1994). The US Food and Drug Administration (FDA) guidance for industry (2009) detailed the process that should be undertaken when developing a patient reported outcome measure. This stimulated debate around content validity and exposed the limitations of some 'top down' methodologies (Hobart, 2013). Basch et al (2011) reports that some measures which were developed for clinician reporting, are now used as a patient reported outcome measures (i.e. McGill Pain Questionnaire). As the present pain intensity item of the McGill Pain Questionnaire was not developed with a patient-centred approach, its validity as an assessment of the patient experience associated with disease and treatment is questionable. Basch et al (2011) go on to state that patient-centred PRO measures need to be understandable to patients from varied backgrounds, and therefore need direct patient involvement during development.

### **3.2 Content validity and the conceptual framework**

The FDA guidance (2009) stresses the importance of content validity within instrument development, and alongside Patrick et al (2011a), encourage the development of a conceptual framework, informed by the themes uncovered from the patient population. This conceptual framework allows the manifestations of the disease, its treatments and how they affect the patient population to unfold and be explored. Interviews and focus groups are suggested qualitative methodologies through which to uncover these themes. Hobart (2011) describes the FDA guidelines as a line drawn in the sand, and a move away from a top down approach to patient reported outcome (PRO) development.

As a result of this FDA guidance, the importance of content validity within scale development to ensure good research practice, was raised and discussed further by the International Society for Pharmacoeconomics and Outcomes Research (ISPOR) within their two task force reports (Patrick et al, 2011a & b).

“content validity is defined by the empirical evidence that demonstrates the items and domains of an instrument are appropriate and comprehensive relative to its intended measurement concept, population and use.”

(FDA, 2009 in Patrick et al, 2011a, pp968)

The overall aim of the conceptual framework is to organise the process of concept elicitation and pictorially document the information uncovered from the literature and expert opinion (patient, family and health professional). This expert opinion can be

sought from several sources; one-to-one interviews, focus groups and postal/telephone questionnaire (Lasch et al, 2010). Consideration should be made to ensure that there is a representative sample of patients used to elicit the concepts, allowing the variation in severity and experience across the disease population to be represented and all views heard. On the basis of the final comprehensive conceptual framework, these initial concepts, the dimension headings and items within the proposed questionnaire/measure can be constructed.

### 3.2.1 *Interviews.*

There are three main types of qualitative interview; structured, semi structured and in-depth (Britten, 1995). Structured interviews are administered in a standardised manner, and questions are closed requiring a fixed answer (yes/no/sometimes/always).

Those which are less standardised are referred to as semi structured. They consist of an interview schedule with ideas for open-ended questions outlining the subject to be explored (Britten, 1995). These semi structured interviews explore participants' experiences of a particular subject matter and the meaning behind them (Tong et al, 2007). Each interview within the study may take a different structure, the interviewer may re-order the questions as the participants' experience and viewpoints are explored. Interviewers have some latitude to ask further questions in response to what are seen as significant replies (Bryman, 2004). The interviewer will try to use the participants own vocabulary to enhance the interview process and encourage the disclosure of more sensitive information.

In depth interviews may cover a limited number of topics, but in great detail. The interview follows the direction of the interviewee; further questions are based on what the interviewee said throughout the interview (Britten, 1995).

Interviews can be face-to-face or over the telephone. Structured interviews are easy to conduct in both settings; those with less structure are more suited to face to face situations. Telephone interviews are cheaper and the respondents' replies are not affected by the characteristics of the interviewer, but participants who have hearing deficit will find this form of interview more difficult. It is therefore not suitable for the OI population, who can suffer from some deafness (57.9% in Kuurila (2002)). Face-to-face interviews would therefore be a suitable method for the OI population, as it would allow participants the freedom to discuss their thoughts and opinions, suggesting new topics as they arose; enabling the researcher to delve deeper into topics where appropriate. The researcher would also be aware if the interviewee had misheard or not understood the question posed.

Patton (1987) suggests that interviews should start with simple questions then proceed to those of a more sensitive nature. Further questions may be introduced as the study progresses, and more interviews take place. The researcher becomes more in-tune with the study topic and may start to develop further areas of increasing interest. All stages of qualitative research are open to interpretation and influencing by the researcher. Therefore for this reason it is important to reflect the patient narrative accurately. The development of a clear interview guide avoids undue influence of the researcher (Patrick et al, 2011), and will discourage digression from the subject matter.

Various methods are discussed in the literature of how to record interviews. These may be as simple as contemporaneous notes, those documented afterwards or audio taping. Britten (1995) suggests that notes written at the time can interfere with the interview process, and those written after the event may miss vital details. It is often more appropriate to tape record the interview and transcribe later, but with an awareness that each hour of interview is thought to take 6-7 hours to transcribe. Maintaining a good auditing approach which includes complete records of all phases of interviews and/or focus groups; problem formulation, selection of participants, field work notes, interview transcripts, and data analysis decisions will increase the overall dependability of the study and enhance transparency of the process (Bryman, 2004; Clift et al, 2007, Tong et al, 2007). This latter technique is intrinsic to the transparency of the questionnaire development process, and should therefore be undertaken by the interviewer or the principle researcher, following each interview.

Qualitative research aims to reflect a diverse population, rather than simply representative (Mays and Pope, 1995a & b). Purposive or theoretical sampling allows the researcher a degree of control (Barbour, 2001). The investigator can identify the outliers within a population, allowing their views to be sort and discussed, as they may offer differing or varied thought processes. It is noteworthy at this stage to state that when purposeful sampling has been adopted, it is necessary to discuss its effects within the discussion section of the study, examining what, if any the differences were between the outliers in the group. Within this study it will be pertinent to examine the population differences and similarities between the views of families affected by severe and mild forms of OI. Unlike quantitative research, sample size calculations are not required for qualitative research. The uncovering of themes takes place in an iterative way, and the research process (interviews, focus groups or questionnaires) continues until no new themes are identified. This is called saturation of data, and occurs when no new information is heard or uncovered from the ongoing interviews (Hill et al, 2014).

Once transcribed the interviews are examined in detail to search out themes. Significant statements are identified and extracted from the transcripts and then organised into categories which become research themes (Parahoo, 1997). It is reported to be useful (Barbour, 2001) at this stage within the study to have another person to look over segments of the data to examine emergent themes. This may take place during supervision sessions or at research team meetings. Hummelinek and Pollock (2006) discuss the process of sequential analysis, where emerging themes and hypotheses are continually checked against the data. These themes are then refined and the coding frame work developed. Other findings are then mapped and used to seek associations between the themes and generate explanations for the findings.

### 3.2.2 *Focus groups.*

Kruegar (1994) described focus groups as a planned discussion, which attempts to gain the perceptions of a group on a defined area of interest in a permissive, non threatening environment. They involve a purposive sample from a specific population, but are not necessarily representative. The aim is to elicit a discussion enabling the researcher to see the world from the participants' perspective, and exploring the

rationale behind people's thoughts and behaviours. Until the 1980s focus groups had been used with adults only, until Heinmann-Ratain et al (1985) used this method to explore health in children. Heary and Hennessy (2002) state that children often respond in ways that they believe the researcher desires, and this has often been the threat to the validity of one-to-one interview situations. Focus groups remove this adult-child relationship, acknowledging the children as experts and therefore can have greater face validity. Fayers and Machin (2007) describes controversy when assessing the advantages of focus groups over one-to-one interviews, stating that both require the facilitator/interviewer to have good communication skills and an open-minded outlook. They feel one-to-one interviews allow greater expression from some individuals and more deviant cases, conversely focus groups are less likely to reach extreme conclusions and the results are therefore less polarised.

Focus groups in children can have their faults too. Children may be intimidated, choosing to adopt themes previously raised by other children, rather than offer new opinions of their own (Lewis, 1992). Fern (1982) found that some individuals reported greater anonymity when interviewed compared with participating within a focus group, and this may be a reason for non-participation in some children. McEwan et al (2004) described using techniques such as; writing down any issues that participants felt were too sensitive or personal to discuss to further improve anonymity.

Several researchers' state group size is an important consideration when undertaking focus groups with children. The optimum size is smaller than that of an adult focus group, often with 4-5 individuals to ensure three 'talkers' (Hoppe et al, 1995). Other groups recommend 4-6 participants (Greenbaum, 1988; Vaughn et al, 1996), stating that larger groups are often difficult to control. Larger groups can often lead to frustration as not all participants get chance to have their say, allowing larger personalities to be more dominant and therefore only a small proportion of the group are included within the discussion (Bloor et al, 2001). Larger groups are also more difficult to transcribe and correctly attribute the interaction taking place to the specific participant. Conversely smaller groups may result in limited discussion and are at risk of cancellation if only one or two participants fail to turn up, or could result in a small group interview rather than a group discussion due to lack of momentum (Green and Hart, 1999). A concern for focus groups that include people, who use wheelchairs or walking frames, is often space. Quine & Cameron (1995) advocated small groups with disabled elderly people, due to the space required for their mobility equipment. Overall, focus groups need to be large enough to avoid cancellation, but small enough to control, allowing all participants to feel satisfied they have had opportunity to speak and be heard. Bloor et al (2001) also makes a valid point when they state that focus groups are labour intensive in their recruitment, transcription and analysis, and for this reason it can be best to keep numbers to a bare minimum.

Bloor et al (2001) states the facilitator should attempt to facilitate a group and not control it; the interaction of some groups can be distorted by too much external control. The facilitator must encourage participation from all group members, and try not to allow some strong personalities to dominate the group. They go on to say that if one member makes a suggestion, but no other participants make any spontaneous murmurs of agreement, then the facilitator should check that the suggestion does in fact fit with the other views.

Focus groups involving children should be well moderated by someone who is familiar with the cognitive and social abilities of children of different ages (Heary and Hennessy, 2002). Those undertaken for health services research should be moderated by someone who is aware of the likely developmental changes in a child's understanding of their health and illness (Bearison, 1998). It is also the responsibility of the moderator to encourage interaction between participants in a relaxed and friendly way, they must be aware of when some members become bored, uncomfortable or confused (Porcellato et al, 2002). Focus groups with children should also involve the setting of ground rules; allowing the participants to feel at ease and comfortable in the knowledge their discussions will remain anonymous.

Vaughn et al (1996) state children over 6 years old can be very effective participants in focus groups, as they are likely to be spontaneous and exhibit fewer socially desirable responses. Their need to be socially acceptable is lower than their more mature peers. Older children often have higher anxieties about peer reactions; therefore report it is best to have broadly similar aged participants, due to both differing cognitive abilities and sensitivities of children of different ages. It is recommended that participants should not know each other prior to the group; this ensures no pre-existing relationships or patterns of leadership within the group (Krueger, 1994).

The development of a conceptual framework using triangulation from; literature review; expert opinion; interviews and focus groups with the relevant population are discussed at length in Chapters 4, 5, and 6 of this thesis.

### **3.3 Item development**

Ensuring that the newly developed instrument contains themes and concepts that are relevant to the target population, by accessing what they feel is important to their QoL, and developing a conceptual framework outlining these concepts is only the first stage. Hobart et al (2013) stated that scale construction is an iterative on-going process of hypothesis generation, testing and revision, requiring help from all available methods. During development it is important to remember that we are wrestling with two uncertainties; what is the definition of the variable and how best is it articulated with words. (FDA, 2009).

Patrick et al (2011a & b) proposed that the challenge, when developing a new measure, is to use a method that permits moving back and forth between hypothetic-deductive and inductive approaches. This allows the development aims and the prior knowledge of the developers to remain important to the PRO measure, whilst allowing their understanding to change in response to any new information. These steps are detailed below in table 3.1.

**Table 3.1** Good practice steps in PRO development

1. Determine the context of use (i.e. medical product labelling)
2. Develop the research protocol for qualitative concept elicitation
3. Conduct the concept elicitation interviews and focus groups
4. Analyze the qualitative data
5. Document concept development and elicitation methodology and results
6. Develop items based on findings from concept elicitation
7. Design cognitive interview process for the planned context of use  
Identify population
8. Conduct cognitive interviews
9. Make decisions to revise the patient-reported outcome instrument
10. Document cognitive interview results for evaluation of content validity

A limitation of using qualitative methods to elicit concepts is the reliance on good faith and judgement of the investigative team. Interpretation is made of which concepts are most relevant for inclusion, and could lead to bias within the developed questionnaire (Basch et al, 2011). They suggest that the best way to ensure no bias is to report all concepts felt important by the patients and then be transparent about the rationale behind which items were chosen for inclusion.

Early development of a PRO measure attempts to continue to promote high content validity and relevance to the target population. Themes uncovered during one-to-one interviews and focus groups can be used to inform dimensions and items within the new questionnaire; effort is made to examine the terminology used by the children interviewed and construct items/questions, where possible, on their phrases and descriptions. Carlton (2013), during the development of a HRQoL questionnaire for children with amblyopia, used the phrases vocalised by the children throughout their interviews to inform the choice of levels for the items. Phrases such as; “a little bit”; “a lot”; and “very” informed the development of her severity based Likert scale. Draft versions of items or the whole questionnaire can be reviewed by members of the relevant population or suitably qualified teachers to encourage feedback on content, readability and format. Stevens (2009) undertook interviews with children to elicit concepts and themes to inform the items within a preference based quality of life measure. She used the children’s terminology and phrases from the transcripts to inform the dimensions within the measure and to make decisions with regards to the use of a severity or frequency based scale, alongside gathering information on the most suitable recall period.

Ensuring readability and understanding is an important part of questionnaire development; keeping items/questions simple and relevant; avoiding double barreled questions; and where possible avoiding negatively worded items which may be distressing to respondents. (Stevens, 2009).

Demonstrating transparency when describing and documenting the development of a new QoL or PRO measure is vitally important. It should be apparent to the reader how the items or questions were derived, where and how the themes were uncovered, and

how they were transformed into suitable and relevant questions/items. Developers should acknowledge whether the items were suggested and therefore uncovered by the target population, or written by experts independent of the relevant patient cohort. The newly developed PRO measure in its initial 'version 1' format then requires testing alongside the relevant population, followed by revision and further feedback.

### **3.4 Pilot testing**

When examining the content validity of a new measure it is necessary to evaluate the importance and relevance of the dimensions and items within. Steps six to ten within the above table (table 3.1) refer to the piloting of the items within the initial questionnaire/instrument. Patrick et al (2011b) describe the use of short semi structured cognitive interviews following questionnaire completion to ensure participant understanding and comfort of the newly developed questionnaire. They go on to suggest that these post completion individual cognitive interviews, with a wide range of subjects from the target population should probe subjects on what they think the question/item is asking (item intent), and what answer they feel is required. Further questioning to ascertain whether this item is relevant to the dimension and population should also take place. Subjects should also be asked about specific words and phrases within the items, to examine their understanding and if this understanding matches the aim and ideas of the developers. This process of pilot testing is often more difficult with children; age, maturity, cognition and reading ability make ascertaining what a child thought about or understood whilst completing a questionnaire challenging. The ability of the child to then feedback their thoughts and understanding to the researcher can also add to this complicated process. Asking children to explain what they think a question is asking them, or why they answered in a particular way is beneficial, but needs to be undertaken in a non-threatening manner.

Patrick et al (2011b) states that the information gathered from these cognitive interviews can be influenced by a subjects characteristics such as; literacy, experience with the disease condition, or experience in completing questionnaires. This will be particularly relevant to the paediatric population, whose ability is varied across the age range, and therefore a sample used to address this content validity needs to be representative and include subjects of all ages.

It is important to clearly observe a subject completing the recently designed questionnaire. A note should be taken of any difficulties in reading or any facial expression which shows confusion. Listening out for comments about items often gains more information. Subjects may ask for more information about a particular item, or ask what is meant by a certain question. If a respondent chooses to quietly complete the questionnaire, time could be taken to ask them how they feel a particular item could be improved or reworded (Patrick et al, 2011b).

All of this information should be clearly documented throughout each stage. Notes can be written whilst observing the subject completing the questionnaire. This will enable a reflection of areas or items of concern; what issues have arisen during completion, and were any suggestions made for improvement. Where subjects have paused during completion, may not have been immediately obvious to them at the time, but if several respondents all pause at the same item, this may indicate difficulty in understanding or ability to recall that information. Post completion interviews can be recorded and

transcribed verbatim to enable thorough investigation of problem areas or items to take place. This process of pilot testing allows revisions to the questionnaire to be made at this stage, prior to psychometric testing. All changes made to the questionnaire as a result of the observations during completion and the subsequent interview should be documented to allow transparency.

Any bias can be monitored during pilot testing and questionnaire completion. Acquiescence bias or repeated positive 'yes' saying can be influenced by how the question is phrased, and the addition of both positively and negatively phrase questions can be used to reduce this (Smith et al, 2005). Social desirability or acceptability can also be a form of observed bias during questionnaire completion. This can be particularly prevalent in teenagers and young adults, as they strive to be like their peers. Some respondents may avoid using the far ends of the Likert scale, and demonstrate central tendency; this can be examined statistically by monitoring any floor or ceiling effects.

Walters (2009) states that psychometric techniques are only able to confirm validity by demonstrating that an instrument behaves as expected. Patrick et al (2011a) within their paper describing instrument development and content validity, states that the use of quantitative data in the absence of prior knowledge, conceptual frameworks and qualitative considerations can lead to a theoretical instrument generating scores with unknown meaning. For this reason initial assessment of validity, reliability and acceptability, alongside cognitive interviews and debriefing can assist in the development of an instrument with good content validity and more robust reliability. The acceptability of the questionnaire can be highlighted by examining the amount of missing data or observing any floor or ceiling effects. Missing data can be problematic when developing questionnaires.

Fayers and Machin (2007) state pilot testing should take place with a purposeful sample of 10-30 patients who are naïve to the earlier stages of concept elicitation and questionnaire development. However they express caution with regards to beginning the item reduction process too early. They feel it is important to maintain comprehensive coverage of causal items, as some symptoms may be rare, but may relate to a serious, extreme or life threatening state, which may be crucially important to those patients who experience it. In the case of severely affected OI patients, the need to be handled to move from one space or area to another, may have a large impact on an individual's QoL and should therefore remain included at this early stage in development.

### **3.5 Psychometric testing of the new questionnaire**

There is a balance or trade-off between a questionnaire with good content validity, represented by the conceptual framework and one with excellent psychometric properties, which may result from early item reduction (Smith et al, 2005). Eiser and Morse (2001) state that it is important not to undertake item reduction too early, as this may leave the developers with a psychometrically sound questionnaire which has poor relevance to the population it was developed for.

For a newly developed patient reported outcome measure or QoL questionnaire to be useful within the clinical and research fields, it must be robust. Information on the validity, reliability and responsiveness of the questionnaire should be readily available and the methods used to field test the questionnaire should be reproducible. Within their review paper published in 2011, Cano and Hobart suggest two important points:

“For these measurements to be fit for purpose they must provide clinically useful, meaningful and interpretable data.” (pp 280)

“The central problem with health measurement is that we cannot currently be sure what most rating scales are measuring. This is because the methods in place to ensure validity fall short of what is actually required.” (pp 279)

These two statements make demonstrating and assessing the robustness of a newly developed questionnaire a difficult process, and therefore developers have to make decisions around initially what is important to measure, and how best to go about it.

New QoL instruments, in order to be useful, should satisfy the four basic properties of validity, reliability, responsiveness (ability to detect change) and interpretability.

### 3.5.1 *Reliability*

Reliability is the stability, in QoL scores, between repeated administrations in a population who have not experienced any health change or change in QoL. This includes stability: over time (i.e. test re-test reliability); between raters or interviewers (i.e. inter-rater reliability); between location - such as between hospital and home. Another form of reliability is internal reliability or internal consistency reliability. QoL scales with multiple items, rather than a single global question, are thought to allow a broad coverage of the overall construct, and therefore improve the reliability of the questionnaire, as the amount of random error is reduced. For scales which use multiple items to assess a particular dimension of QoL, all items should be consistent, meaning that they should all measure the same concept (Walters, 2009). Fayers and Machin (2007) however offer a different opinion, particularly when causal items are involved. Causal items are often symptom related, and can therefore be highly correlated with a disease or treatment, but not necessarily be related to one another. Fayers et al (1997) suggest that if a patient suffers from a certain symptom or side effect, its presence may lead to a reduction in their QoL (i.e. vomiting in cancer patients). Hence it is inferred that the symptom may have caused the deterioration in QoL and therefore items describing these symptoms are causal. Conversely, items which may result from a perceived poor QoL, such as anxiety or depression, are named ‘effect’ or ‘indicator’ items. As causal items are often related to symptoms, there is no guarantee that they will be correlated with one another, and may therefore not behave in a similar way to effect/indicator items, which lend themselves to psychometric testing. Alternatively those items which are not highly correlated with each other, but are present within the same dimension, may indicate they are not well placed, or that the dimension is redundant. Care needs to be taken to examine these items closely; could they be causal items or items which are vitally important to the patient population?

### 3.5.2 *Validity*

Validity is the extent to which an instrument measures what it is intended to measure. Validity is a difficult and some would say impossible thing to prove in the case of QoL measurement, since there is no 'gold standard' (Fayers and Machin, 2007). There are several types of validity discussed in the literature.

Content validity looks to see if the items of an instrument are sensible and comprehensively cover the domain of interest. Face validity, which is often considered to be a form of content validity, assesses if the items in a QoL instrument, appear on the face of it to cover the domain of interest clearly and unambiguously. The main distinction between the two types of content validity is that face validity concerns the critical review of the items of a new instrument after it has been constructed but before use, whereas the item coverage and relevance is usually looked at during the instrument construction.

Ensuring high content validity has previously involved experts using their judgement to determine whether the items are relevant to the target population (Lynn, 1986). Children with OI and their families are considered as experts in their disease and its management. They are also the group who will be completing the newly developed questionnaire, and are therefore well placed to validate the themes and sub themes previously elicited.

Criterion validity is the extent to which the new QoL scale has an association or correlation with external criteria such as other established instruments or measures (which are generally regarded as more accurate) (Walters, 2009). Criterion validity examines the newly developed tool alongside the current gold standard. It is difficult to assess in the absence of a gold standard measure on which to compare the newly developed tool. This is often the case during the development of a disease specific instrument, as the reason for its development was the absence of a suitable alternative, and therefore a comparison to a gold standard is not possible.

Construct validity is the extent to which an instrument measures the construct or concept that it is designed to measure. This involves forming a theoretical model that describes the constructs being assessed and the expected relationships between these constructs. Data is then collected, and a judgement is made as to the extent to which these relationships are confirmed. If the results confirm prior expectations then the instrument may be valid.

Construct validity is usually divided into three types: known groups validity; convergent validity; discriminant validity. Known-groups validity is based simply on the assumption that certain specified groups of subjects may be expected to score differently from other groups, and the new instrument should be sensitive to these differences. A scale that cannot sensibly distinguish between groups with known differences is not likely to be useful. A more complex aspect of construct validity is convergent validity. Convergent validity shows that a postulated dimension of QoL correlates appreciably with those dimensions that theory suggests it should. Convergence can be assessed by examining the correlations between each item and the total score (Fayers and

Machin, 2007). Convergent validity is supported when item correlations are moderate (0.3 or greater).

Conversely, discriminant validity recognises that some dimensions of QoL are expected to be relatively unrelated and that their correlations should be low.

Convergent and discriminant validity are effectively the two opposite sides of the same coin and are usually considered together (Walters, 2009). Some psychometric methods can identify items which correlate highly with each other. This may be an indicator that one or several of these items are unnecessary; may be measuring the same concept or tapping into the same theme and are therefore possibly redundant.

### 3.5.3 *Responsiveness*

Responsiveness is the extent to which an instrument is able to detect a clinically or practically important change in QoL status. That is, when the concept changes, the scores for the QoL instrument measuring that concept should change. This is the sensitivity of a measure to health change. Strictly speaking it is a form of validity and hence again it is difficult to prove. It can be assessed by effect size statistics i.e. ratios of mean changes to standard deviations (Walters, 2009).

### 3.5.4 *Statistical methods*

Quantitative methods are often used to psychometrically test the newly developed questionnaire/instrument. Magasi et al (2012) feel these methods explore and confirm the dimensionality of multiple item scales, evaluating any item bias and examine the relationships among the health concepts. They go on to say that dichotomization of the qualitative and quantitative processes within questionnaire development is fool hardy; and that an iterative mixed methods process should be adopted.

Other areas of interest when examining and reporting the acceptability, data quality and robustness of a newly developed questionnaire are; missing data; missing forms; and floor or ceiling effects. Missing data within a questionnaire can occur if there is poor understanding of an item, or if a patient is uncomfortable with the subject matter; although this may be reduced if trained personnel are present during completion or the questionnaire is reviewed immediately after. These items, if deemed inappropriate, could be rewritten or if after careful consideration they are not felt vitally important to the participant population, they may be eliminated. To ensure important items are not eliminated it may be necessary to look back at the qualitative item generation and validation stages of questionnaire development. Items eliminated on statistical or psychometric properties alone may have a detrimental effect on content validity.

Floor and ceiling effects describe the number of individuals that lie at the lowest and highest end of available scores respectively. If there are a large percentage of individuals, or the majority of scores sit within the lower end, there is said to be a floor effect for that particular item. Ceiling effects are said to occur when the reverse happens. Some causal items related to symptoms may lead to floor or ceiling effects, especially if they are symptoms which are rare to the majority of participants, but may represent a severe situation, which is very relevant to those patients who are affected by it. (Fayers and Machin, 2007). This may occur when considering handling in the paediatric OI population; the majority of mildly effected individuals would never have

experienced being handled or lifted on a regular basis, and would therefore never have been fearful of being handled poorly. This would lead to a potential ceiling effect within any item which asks about fear of handling.

Psychometric scales have been used in health outcomes and health measurement since the 1980's. However QoL instruments consist of a group of items which are believed to relate to a general definition of QoL; including a mixture of both causal and effect items. Classic test theory uses a number of statistical methods to provide evidence of the scientific robustness of the newly developed questionnaire. Tests such as;

- Cronbach's alpha, to examine internal consistency;
- Pearson/Spearman correlations to identify similarities between dimensions within different questionnaires or the current 'gold standard' questionnaire, or to explore any known-groups validity.

This analysis is based on raw scores, or the transformation of raw scores to a 0-100 scale, and assumptions are made. Most health care scales or QoL measures construct scores by counting the responses to the items. Ordered or Likert scales are not necessarily providing interval data. That is to say the difference between 0 and 1, and 1 and 2 may not be equal. The same can be said for the total score; the change in summated QoL score from 5 to 10, may not represent the same amount of change that is observed from 25 to 30. Psychometricians however, argue that the ordinal scores generated by health measures or questionnaires are adequate approximations of interval-level measurement (Hobart and Cano, 2009).

Many papers suggest Cronbach's alpha is a suitable statistic to use when examining internal consistency of items to each other and to the item total (Ravens-Sieberer et al, 2010; Wiklander et al, 2013; Fayers and Machin, 2007). It is postulated that coefficients of above 0.7 are regarded as acceptable. Cronbach's alpha can also demonstrate the effect of removing an item from the dimension or questionnaire; if the reliability of the dimension remains the same after item removal, it may be that the item is contributing very little to the dimension or questionnaire as a whole. Item-total correlations (ITC) are another method to examine how well items within a scale are correlated. Nunnally and Bernstein (1994) suggest item-total correlations between 0.4 and 0.6 indicate items are moderately correlated with the scale; a higher value indicates greater correlation between items and the scale. In some instances where very high ITC values are noted, this may be an indication of item redundancy. Item-total correlations of < 0.3 demonstrate poor item fit within the scale or dimension.

### *3.5.5 Modern psychometric measurement*

Factor analysis can be used to further validate and confirm the structure and construct validity of the newly developed measure. Factor analysis can be either confirmatory or exploratory. The latter assigns no pre-assumptions to the data analysis; the initial (confirmatory factor analysis) looks to examine whether the initial questionnaire format

is suitably divided into dimensions and whether the items within the dimensions are a good statistical fit with each other and to the dimension as a whole.

Eiser and Morse (2001) suggest that there is discussion surrounding whether factor analysis is the ideal method for establishing construct validity. This method is often not possible when only small sample sizes are available for analysis, which can often occur in more rare diseases. In this instance it is important to examine other ways to divide the large group of items to produce separate dimensions of highly inter-correlated items. Fayers et al (1997) agree with the above notion and argue that less emphasis should be placed on factor analysis to inform construct validity in favour of less numerical methods; including debriefing questionnaires and consensus interviews.

More modern measurement methods such as Rasch theory attempt to obtain data which fits a particular or pre-defined model, they no longer just describe the data in relation to the sample used, as occurs in classical test theory, therefore the outcome is not sample dependent. Rasch methodology examines the relationship between the unobservable 'true' measurement of the attribute or trait, and the probability of responding to the particular response option of the item within the scale/questionnaire. Where a person lies on an interval-level construct, determines which response option they choose for an item, for example Hobart and Cano (2009) state they would expect a person with severe disability to be unable to complete as many functional tasks on a particular scale. They would therefore answer 'no' more frequently than their less disabled peers. This seems quite logical when discussing functional tasks or objective measurement of physical ability. However can we be sure that a more subjective topic such as QoL will behave in the same way? Will more severely affected individuals necessarily report poorer QoL? Can we predict who will respond about their QoL in a certain way from their ability or severity of disease? Teresi et al (2008) states, that individuals with similar ability should respond in similar ways to individual items, regardless of group membership. Rasch methodology aims to demonstrate that this is the case.

Cano and Hobart (2011) describe this model as examining the legitimacy of summing items to generate a score.

“The model sets out the requirements that must be met for the rating scale data to generate internally valid, equal-interval measurements that are stable across both items and people” (pp 284)

There are many conflicting recommendations for the minimum number of subjects required for carrying out a factor analysis. Fayers and Machin (2007) suggest that it may be necessary to include several hundred patients. Similarly, there are no definitive answers for what sample size one needs for an IRT analysis (Fayers and Hays, 2005, pp71). With polytomous and ordered categorical item responses (similar to the newly developed OIQoL), using a minimum of 250 respondents is suggested, but a cohort of around 500 is recommended for more accurate parameter estimates (Fayers and Hays, 2005, p71).

Factor analysis, item response theory and structural equation modelling can be used to further inform the quantitative testing of the newly developed instrument. This latter

quantitative evaluation is beyond the scope of this PhD research and will be further discussed in chapter 9 of this thesis. The following chapters describe the methods undertaken to develop the new OI specific QoL measure, adhering where possible, to the best practice guidelines described within this chapter.

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## Chapter 4

### Systematically Reviewing the Literature

#### 4.1 Background

The aim of this chapter is to document and describe the process undertaken to systematically review the literature surrounding suitable paediatric Quality of life (QoL) measures for the Osteogenesis Imperfecta (OI) population. As there is currently no known 'gold standard' QoL questionnaire for children with OI, it was necessary to examine QoL measures and assess their relevance in relation to the paediatric OI population. It was therefore important to systematically review the literature to ensure that no suitable instrument exists, prior to the development of an OI specific QoL measure. In addition it was anticipated that this review would also highlight additional concepts which are relevant to the paediatric OI population, and thus inform the initial/early development of the conceptual framework (see Chapters; 5, 6, 7).

Previous studies have reviewed and examined QoL questionnaires in the paediatric population (Eiser and Morse, 2001; Macabe, 2003; Stevens, 2008; Solans et al, 2008), and undertaken systematic literature reviews to do so. Others have used a systematic review to examine the conceptual framework behind paediatric quality of life measures (Davis et al, 2006; De Civitia et al, 2005) identifying the definitions employed and the resultant structure.

The different definitions used to describe quality of life or health related quality of life make reviewing the literature surrounding QoL measures a difficult task. For further information regarding the definition of QoL or HRQoL refer to Chapter 2. It is important to note at this stage however, that this chapter will attempt to review QoL and HRQoL measures developed for the paediatric population, and not those questionnaires developed to measure functional ability or assessments of QoL which focus on functionality. Additional concepts such as health status, functional ability and standard of living will not be included within this review.

Eiser and Morse (2001) examined QoL measures in chronic disease of childhood. Their literature review generated 19 generic and 24 disease specific questionnaires. Their search strategy is detailed below (figure 4.1), and included literature between January 1980 - July 1999. This search was repeated by McCabe (2003), who repeated the previous search from July 1999 - January 2002. This search strategy was again repeated by Stevens (2008) for the period January 2002 - December 2005. She excluded disease specific questionnaires, as she was examining the generic paediatric population. She found a further ten paediatric instruments and six adolescent versions which uncovered 12 unique instruments. An overview of these instruments can be seen in Table 4.1.

Solans et al (2008) examined previously published reviews, including Eiser and Morse (2001) alongside a new literature review (2001 – December 2006) of paediatric generic and disease specific QoL instruments. They found 30 generic and 64 disease specific instruments, of which 51 were newly uncovered. They comment that although many of

the instruments met acceptable standards for psychometric properties, there are additional benefits in involving children during the development of QoL instruments/questionnaire that relate to content validity which was not often commented on. The availability of information pertaining to the developmental methods used during QoL instrument construction is not always readily available and not consistently reported in previous reviews (Eiser and Morse, 2001; Solans et al, 2008). Solans et al (2008) also highlighted some of the limitations of the QoL instruments; discrepancies between child and parent ratings; the limited number of questionnaires available for child completion; and the cultural appropriateness of measures for use in different context from the original.

## **4.2 Objectives**

This chapter describes the process of repeating these literature reviews (Eiser and Morse, 2001; McCabe, 2003; Stevens, 2008), bringing the previous reviews up to date (December 2010, at the time of search) and assessing the relevance of the identified measures as a suitable QoL questionnaire/instrument for the paediatric OI population. If a suitable measure was deemed appropriate for children with OI; it's method of development was transparent and involved the paediatric population, and it was found to include themes potentially important to the paediatric OI population, then it may not be necessary to develop an OI specific QoL questionnaire.

### *4.2.1 Review Questions*

- What generic paediatric QoL measures are available for use with the OI population?
- Are any disease specific QoL measures available, whose population may describe similar symptoms to those of the OI population?
- Are these questionnaires both relevant and appropriate to this group of patients and do they allow self completion?
- Where measures are found that are suitable for the paediatric OI population, are these appropriately developed using a well informed and documented conceptual framework?

## **4.3 Method**

The search strategy sought to identify studies documenting paediatric QoL measures, which were either generic or disease specific, but relevant to the OI population (musculoskeletal bias).

The search was run (January 2006 – December 2010), attempting where possible to duplicate and therefore update the previous searches (Eiser and Morse, 2001; McCabe, 2003; Stevens, 2008) (See figure 4.1 for search strategy). The databases searched were: Medline; BIDS ISI science citation; BIDS ISI social science citation; psych info; Embase and CCTR. Reference lists were then hand searched for further papers describing QoL instruments, measures or questionnaires. Due to limited funding and the nature of this study (PhD study), papers were reviewed by only one individual (Claire Hill).

1. (Quality of life) and (Child\* or adolesc\*)
2. (Health status or functional status or well-being) and (child\* or adolesc\*)
3. Chronic illness or chronic disease or arthritis or asthma or cancer or cystic fibrosis or diabetes or epilepsy or AIDS or trauma or burns or technology dependent or low birth weight
4. 1 and 2
5. 2 and 3
6. 4 and (measure\* or scale or index)
7. 5 and (measure\* or scale or index)
8. Self report or self-report or self assessment or self-assessment or child\* report or adolesc\* report
9. 4 and 8
10. 5 and 8
11. 1 and 8
12. 2 and 8
13. (parent or mother or carer) and (report or assessment)
14. 4 and 13
15. 5 and 13
16. 1 and 13
17. 2 and 13
18. (6 or 7 or 11 or 12 or 16 or 17) and (reliab\* or valid\*)  
(Eiser and Morse, 2001; McCabe, 2003; Stevens, 2008)

**Figure 4.1.** Search strategy used for the review.

#### 4.3.1 *Study Selection Criteria*

##### Inclusion Criteria

- Generic QoL measures/instruments/questionnaires found on previous search strategies (Eiser and Morse, 2001; McCabe, 2003; Stevens, 2008)
- Newly discovered generic QoL measures/instruments/questionnaires (January 2006 – December 2010)
- Disease specific measures/instruments/questionnaires where the disease may have similarities to OI (i.e. skeletal dysplasia, fibrous dysplasia, joint or skeletal conditions).

##### Exclusion Criteria

- Studies describing non-English measures/questionnaires, or measures developed outside the UK and not appropriately anglicised.
- Functional assessments or health status questionnaires where no QoL or Health related QoL is described
- Disease specific measures for conditions unrelated to or dissimilar to OI.

#### 4.3.2 *Data Extraction*

Potentially suitable titles and abstracts were appraised; full text articles that fitted the inclusion criteria were reviewed. Data was extracted to include instrument title, respondent choice (child/proxy), included age range, number of items, title and number

of domains, and where available the stated purpose of the instrument/measure. Any information on method of development or conceptual framework was also recorded.

#### 4.3.3 *Data Synthesis*

Due to the nature of qualitative research it is unlikely that a standard systematic review with meta analysis would be an appropriate method to synthesise the data. The following review will therefore use a narrative synthesis type methodology. This refers to an approach to the systematic review and synthesis of findings from multiple studies that relies primarily on the use of words and text to summarise and explain the findings of the review (Popay et al, 2006). Key features of the questionnaires/measures will be highlighted; the main features will be tabulated to aid comparison; major patterns, similarities and differences within the instruments will be noted and the suitability of the instruments will be considered.

#### 4.3.4 *Analysis*

Previously acknowledged questionnaires or measures are documented separately to those recently generated (see tables 4.1 and 4.2). Where possible information was documented on the method used to develop the questionnaires; a transparent method of development is a requirement of a suitable QoL measure for the paediatric OI population. This allows openness and understanding of the conceptual framework behind each of the QoL questionnaires.

### **4.4 Results**

The updated search produced 369 articles, with 17 duplicates; therefore 352 abstracts were reviewed for possible inclusion. Forty-five articles discussed those previously documented instruments by Eiser and Morse (2001), McCabe (2003), Stevens (2008), Solans (2008). (See Table 4.1 for details of these previously reviewed measures). One hundred articles were related to disease specific or adult measures. These diseases (and their subsequent symptoms) were not closely related to OI or the symptoms described or exhibited by those living OI. As their validity for use with the OI population would be poor, these measures are not included for review

Seventy-seven articles were either not written in English language or were developed for non English cohorts. These were not included for review due to translation issues (time and funding) and cultural differences between differing paediatric populations. One hundred and twenty articles described quality of life in paediatric populations but not actual QoL measures/instruments/questionnaires. On closer examination of the abstracts this latter group included literature reviews, descriptions, qualitative interviews and commentaries related to QoL, but not describing QoL measures per se.

The remaining ten articles described nine instruments (scales/measures/questionnaires) which were either generic or disease specific measures where symptoms may be appropriate or similar to those described or observed in the paediatric OI population. See table 4.2 for newly described measures.

**Table 4.1** QoL measures previously reviewed by Eiser and Morse (2001), McCabe (2003), Stevens (2008).

Instrument	Respondent	Age Range	Number of Items	Domains	Purpose
Child Health and Illness Profile – Adolescent Edition	Child/ Adolescent	11 to 17 years	107 plus 46 optional disease/injury specific items	6 (activity, comfort, perceived well-being, disorders, achievement and resilience)	“The purpose of the instrument is to assess health in epidemiologic surveys, to determine the existence of systematic differences in health in subpopulations (including the socioeconomically disadvantaged), and to provide a basis for assessing the impact of changes in health services or health policies”. (Starfield et al,1995). Development of the questionnaire describes a mixture of literature review, focus groups with children and parents, alongside consultation with HPs and researchers.
Child Health Questionnaire	Child/Proxy (MAPI)	5 to 18 years (MAPI)	87 (youth form) <b>98 (parent form)</b> <b>50 (parent form) or 28 (short form) (MAPI)</b>	(CF87) 12 (physical functioning, role/social functioning, general health perceptions, bodily pain, role/social emotional, role/social behavioural, self-esteem, mental health, behaviour, family activities, family cohesion, change in health). <b>(PF50 and PF28) 14: general health, change in health, physical functioning, bodily pain/discomfort, limitations in school, work and activities with friends due to physical problems and due to emotional and behavioural difficulties, behaviour, mental health, and self-esteem. Emotional and time impact on the parent, limitations in family activities and family cohesion (CHQ)</b>	“The goal was to develop a comprehensive instrument that would be useful across a variety of healthcare settings and applications including academic research, clinical trials, physician offices, clinics, hospitals and health maintenance organisations”. (Landgraf et al,1996) Developed using literature review and review of other available instruments.

The Child Quality of Life Questionnaire	Child/Parent	9 to 15 years	45	15 (Getting about, doing things for self, soiling or wetting, school, out of school activities, friends, family relationships, discomfort due to bodily symptoms, worries, depression, seeing, communication, eating, sleep and appearance).	“assessment of quality of life in nine to fifteen year old children”. (Graham et al, 1997) Literature describes top down approach to development involving expert opinion and literature review.
Dartmouth Picture and Word COOP Charts	Child	12 years upwards	6	6 (physical fitness, emotional feelings, school work, social support, family communications and health habits).	“To assess health and social problems of adolescents”. For use as survey instruments and as a tool for detection of important problems. (Wasson et al, 1994). Developed using expert advice from clinicians and health measurement professionals.
Exeter Health Related Quality of Life Measure	Child	6 to 12 years	16 (reduced to 12 in a later version) (each measured twice)	1 (health related quality of life).	“The EHRQL is designed to determine the impact of disease on everyday activities from the child’s perspective and was constructed to assess self-reported HRQL in children from the standpoint of perceived discrepancies between actual and preferred or ideal selves”. (Eiser et al, 1999) Development based on a theoretical model; that poorer QoL is the result of discrepancies between an individual's actual and ideal self.
Functional Status II (R)	Parent	0 to 16 years < 1 year 1 year 2 – 3 years > = 4 years	43 (long) 14 (short)	8 (communication, mobility, mood, energy, play, sleep, eating and toileting).	The original FS I was developed to measure individual child health status and characterize populations, the FS II is a revised version of this measure. This instrument was primarily designed to be a measure of the health status of children with chronic physical conditions. (Stein and Jessop, 1990). Based on the Sickness Impact Profile which was developed using top down literature review and expert opinion.
Generic Health Questionnaire	Child/Parent	6 to 16 years (linguistically able children)	25	5 (general affect, peer relationships, attainments, relationship with parents, general satisfaction).	“To develop a measure suitable for assessing the quality of life for children with chronic illness”. (Collier 1997) Development unknown.

How Are You?	Child/Parent	8 to 12 years	29	4 (physical activities, cognitive activities, social activities and physical complaints).	“Developed in response to the need for a questionnaire that measures general as well as disease specific aspects of QoL children with a chronic illness”. The main purposes of HAY are to identify children who need additional care and to evaluate interventions. (Bruil et al,1997) Literature reports construction in co-operation with medical specialists followed by factor analysis.
KINDL	Child	8 to 16 years	40	4 (Functional capacity everyday life, psychological well-being, physical state, social relationship).	Takes a psychometric approach. Generic instrument for quality of life assessment. (Ravens-Sieberer, 1998). Literature reports interviews with children to uncover concepts, followed by two pilots including a total of 28 children.
Paediatric Quality of Life Inventory	Child/Parent	8 to 18 years	45 (15 core, 30 supplemental)	3 core and 8 supplemental (Physical functioning, psychological functioning, social functioning, pain, nausea, procedural anxiety, treatment anxiety, worry, cognitive problems, perceived physical appearance, physician/nurse communication).	“is designed to be a generic paediatric quality of life measure to be utilized non categorically ie across various paediatric chronic health conditions”. “to measure HRQoL outcomes for paediatric chronic health conditions”. (Varni et al, 1999). Generic questionnaire developed by interviewing patients and their families, alongside discussion with paediatric health professionals.
Perceived Illness Experience	Child/Parent	7 years upwards	34 (in original). Subsequently revised to include a further 2 items on the physical appearance subscale and a new food subscale. No details of how many items this contains.	9 (interference with activity, disclosure of illness, school/work, peer rejection, parental behaviour, manipulation, pre-occupation with illness, food and physical appearance).	Originally developed to measure perceived illness experience in people with cancer, but may be used with other groups of children/young people with chronic illness. “The study is an attempt to devise a method to assess the perceived impact of the illness from the child’s point of view”. (Eiser et al, 1995) (Eiser 1999). Literature reports semi-structured interviews with children and adolescents used to develop generic questionnaire.

Quality of Life Profile – adolescent version	Adolescent	14 to 20 years	54	3 and 9 sub domains: Being (Physical, Psychological, Spiritual) Belonging (Physical, Social Community) Becoming (Practical, Leisure, Growth)	“to develop a model and associated instrumentation to assess the quality of life persons with developmental disabilities”. (Raphael et al, 1996). Diagnostic tool developed by generating individual graphic QoL profiles based on responses to the EORTC-QLQ-C30.
TAPQOL	Parent	1 to 5 years	43	4, 12 sub domains Physical Functioning (sleeping, appetite, lung problems, stomach problems, skin problems, motor functioning). Social Functioning (problem behaviour, social functioning). Cognitive Functioning (communication). Emotional Functioning (positive mood, anxiety, liveliness).	“to measure parent’s perceptions of HRQoL in preschool children and to evaluate the impact of diseases and treatments on the different domains of young children’s lives”. (Fekkes et al, 2000). Discussions with HRQoL experts, paediatricians, psychologists and parents of children aged 1-5 year olds were used to develop this generic proxy instrument.
Warwick Child Health and Morbidity Profile	Parent	0 to 5 years	16 (ten primary and six subsidiary)	10 (general health, acute minor illness behavioural, accident, acute significant illness, hospital admission, immunization, chronic illness, functional health and health related quality of life).	“to provide a cross-sectional and longitudinal record of parentally reported health and morbidity of individual children and child populations”. (Spencer and Coe, 1996) “has been designed to give a comprehensive picture of child’s health and illness experience from the parental perspective”. (Spencer and Coe, 1996). A top down approach including expert opinion followed by a two tier pilot phase.

Health Utilities Index Mark 2	Child/Parent	6 to 16 (used in children down to 12 months in one study)	15	7 (Sensation, mobility, emotion, cognition, self-care, pain and fertility).	<p>“to construct a utility or social preference based multi-attribute health and well-being index applicable to children aged 4 – 16 years” (Cadman et al, 1986).</p> <p>“HUI evolved in response to the need for a standardized system to measure health status and HRQL to describe:</p> <ol style="list-style-type: none"> <li>1. The experience of patients undergoing therapy.</li> <li>2. Long-term outcomes associated with disease or therapy.</li> <li>3. The efficacy, effectiveness and efficiency of healthcare interventions.</li> <li>4. The health status of general populations”.</li> </ol> <p>(McCabe et al, 2005).</p> <p>Attribute levels designed to cover the full range of possibilities/abilities. The preference based measure was given to subjects who were asked to rate items on a 0-100 scale (VAS).</p>
Health Utilities Index Mark 3	Child/Parent	6 to 16 years	15	8 (vision, hearing, speech, ambulation, dexterity, emotion, cognition and pain).	<p>“For measuring the overall health status and health related quality of life of individuals, clinical groups and general populations “. (Furlong et al,1998)</p> <p>Improvements made to HUI II to construct this measure.</p>
16 Dimensions	Child	12 to 15 years	16	16 (mobility, vision, hearing, breathing, sleeping, eating, speech, elimination, usual activities, friends, physical appearance, mental function, discomfort and symptoms, depression, distress and vitality.	<p>To develop a generic self assessment HRQoL measure for early adolescents. (Apajasalo et al,1996a)</p> <p>Based on the 15D preference based measure, top down development followed by population survey comparing 15D to HUI III and EQ5D.</p>

17 Dimensions	Child	8 to 11 years	17	17 (mobility, vision, hearing, breathing, sleeping, eating, speech, elimination, usual activities, friends, physical appearance, mental function, discomfort and symptoms, depression, distress and vitality.	Generic measure of HRQoL measure for pre adolescents. (Apajasalo et al,1996b) As above for 16D
Quality of Well-Being	Parents/ Adolescent children	4 to 18 years	3 plus 27 symptoms	3 (physical functioning, social/role functioning and mobility) plus 27 symptoms	“The purpose of the system is to express benefits and side effects of the program in terms of equivalences of completely well- years of life”. (Kaplan et al,1989). Literature reports an exhaustive list of symptoms and problems being developed into a preference weighted measure of symptoms and functioning to express well being on a 0-1.0 scale. No information is given to state how the items were elicited.
TACQOL	Self (>8 years) Proxy (<8 years)	6 – 15 years	108 (parent form)	7 (parent form) (pain and symptoms, basic motor functioning, autonomy, cognitive functioning, social functioning, global positive emotional functioning, global negative emotional functioning)	“to develop a generic instrument to assess children’s HRQoL”. (Vogels et al,1998). Development based on existing literature and previously developed questionnaires of health status and HRQoL
SF-10	Parent/ Guardian	5 – 18 years	10		Developed to address the need for scientifically valid health status assessment for the paediatric population (Saris-Baglana et al, 2006). Parent completed measure adapted from the CHQ, top down development.

Child Health and Illness Profile – child version (CHIP-CE)	Self (child)/ Proxy (parent)	6 – 11 years	45 standard, 76 comprehensive parents report	5 (12 sub domains) for self (child) report (CRF). Satisfaction, comfort, resilience, risk avoidance, achievement. 6 (17 sub domains) for proxy (parent) report (PRF). All the above plus disorders.	To assess the health of children (Health Services and Sciences Research Resources Database).  “.. appears to be an effective tool for assessing children’s perceptions of their own health and well-being that can be used to describe the health and functioning of populations of children. It is likely to be useful in monitoring outcomes of policies and services”. (Riley et al, 2004). Development involved cognitive interviews with elementary school aged children.
KIDSCREEN	Self/Proxy	8 -18 years	3 versions: 52, 27, 10	10, 5, 1 Correspondingly 10 (Physical Well-Being, Psychological Well-Being, Moods and Emotions, Self-perception, Autonomy, Parent relation and Home Life, Social Support and Peers, School Environment, Social Acceptance (Bullying), Financial resources 5 (Physical Well-Being, Psychological Well-Being, Parents and Autonomy, Social Support and Peers, School Environment) 1 (General HRQoL Index)	Objective: “Designed to obtain a self-report and an external assessment of health-related quality of life in children and adolescents in a wide range of ages and independently of current health status” (Ravens-Sieberer et al. 2006). Literature reports focus groups with children from six European countries, parental questionnaires, a Delphi survey with health professionals and literature review to construct this generic questionnaire.

TedQL	Self/Proxy	3 – 8 years	4 versions: 22, 23, 30, 22	4 versions correspondingly:  5 (Physical competence, peer acceptance, maternal acceptance, psychological functioning and cognitive functioning) 5 (Physical competence, peer acceptance, family acceptance, psychological functioning and cognitive functioning).	To assess HRQoL in children aged 3 – 8 years (Cremeens et al, 2007). Development involved reviewing 53 previously developed child report measures and child interview data.
YQoL–R/YQoL-S	Self	11 – 18 years	2 versions: For group level perceptual: YQoL-S: (version for surveillance) 8 YQoLR: (version for program evaluation and research) 41	4 (self, relationship, environment, general quality of life)	“to assess multidimensionally the generic QoL of youth ages 11 – 18 (Patrick et al, 2002) Literature reports extensive review of adolescent HRQoL literature, alongside interviews with 11-18 year olds with and without disabilities and focus groups to develop this generic measure.
HSCS-PS	Clinician/ parent	2.5 – 5 years	3 – 5 levels per dimension	12 (vision, hearing, speech, mobility, dexterity, self-care, emotion, learning and remembering, thinking and problem solving, pain and discomfort, general health, behaviour)	To develop a multi-dimension health status classification system to describe pre-school children 2.5 – 5 years of age. (Saigal et al, 2005). Revision of HUI II and III alongside expert opinion was the methodology behind this instrument.

(Stevens, 2010)

**Table 4.2** QoL measures uncovered and reviewed from recent literature review.

Instrument	Respondent	Age Range	Number of Items	Domains	Purpose
Healthy Pathways Child Report Scale	Self	6 – 21 years	88	16 (Physical comfort, emotional comfort, negative stress reactions, physical activity, vitality, peer connectedness, family connectedness, teacher connectedness, active coping, aggression/bullying, peer hostility, bullying victim, life satisfaction, self worth, body image, academic performance, school engagement).	..to revise the CHIP by combining the 2 editions (6-11, 12-21) to create the Healthy Pathways report scale which improves the assessment of health and quality of life during transition into adolescence. (Bevans et al, 2010). Revision made to CHIP to develop this questionnaire. CHIP initially developed using bottom up methodology.
The Adolescent Pain Behaviour Questionnaire	Parent	11 – 19 years	23	(facial expression, socialisation, physical actions or body gestures, reactive pain behaviours, pain altered daily behaviours.	Parent report measure of adolescent pain expression, verbal and non verbal ways. (Lynch-Jordan et al, 2010) Development via top down methodology using literature review and expert opinion.
DISABKIDS - Smiley	Child Proxy – (younger children)	4 – 7 years	6	Single domain	“Assessment of general quality of life and level of distress caused by chronic disease”. (Chaplin et al, 2008) Themes and items uncovered from interviews and focus groups with the target population.
DISABKIDS – 37 Long version	Child/Proxy	8 – 18 years	37	6 (independence, physical limitation, emotion, social exclusion, social inclusion, treatment).	Assessment HRQoL in children and adolescents with chronic conditions and perceived impact of treatment. (Sandeberg et al, 2010) Bottom up development as above.

DISABKIDS – 12 Short version	Child/Proxy	8 – 18 years	12	2 (about your life, about your medical treatment).	As above but to transfer conceptual structure of the D Cam as a frame work for a shorter form. (Muehlan 2010 doctoral thesis) Development via bottom up methodology as above.
Multidimensional Student's Life Satisfaction Scale – adolescent version	Child/Self	8+ years	77	5 (family, friends, school, self, living environment).	To measure children's overall life satisfaction (Gilligan and Huebrier, 2007). Top down development involved review of life satisfaction and adolescent development literature alongside a pilot phase with adolescents.
Child Activity Limitations Questionnaire	Child/Proxy	5 – 18 years Self 8 – 18 years	21	1 (over last 4 weeks).	Designed to assess functional impairment secondary to chronic and recurrent pain in school. To assess the impact of pain on daily activities. (Hainsworth et al, 2007). Developed from the child activity limitations interview to enable a paper version, initial development was via a top down approach.
Paediatric Rheumatology Quality of Life Scale	Child/Proxy	0 – 18 years	10	2 (physical health and psychological health).	To develop a short and simple measure of HRQoL for children with JIA. (Filocanio et al, 2010) Developed using expert opinion, literature review and interviews with the target population, hence a combination of bottom up and top down methodologies were used.
Manchester – Minneapolis Quality of Life Survey	Child	8 – 11 years (child) 12 – 18 years (youth)	29	5 (emotional functioning, physical functioning, physical appearance, school functioning, social functioning).	To foster regular HRQoL assessment in daily life. The anglicised MMQL –UK was developed for use with both healthy and chronic conditions. (Hutchings et al, 2008) Anglicisation of a previous measure developed by top down methodology.

From the tables above it is easy to see that six measures were proxy only. 18 measures allowed completion by both self and proxy. Eleven measures encouraged only self completion.

## 4.5 Discussion

The following discussion considers the beneficial aspects of QoL instruments which the author believes to be important to the paediatric OI population. The main areas for deliberation were:

- Self completion by the child or adolescent, although younger children may require assistance with reading a lengthy questionnaire.
- The availability of a single questionnaire spanning the child-adolescent age group, allowing more reliable, sensitive longitudinal follow up.
- Transparent bottom up methodology involving the paediatric population to ensure good content validity for the intended cohort.
- A suitable questionnaire should include items which are relevant and purposeful to the paediatric OI population, again to ensure high content validity in the OI cohort, but also to encourage completion.

In the search to find a previously developed questionnaire that might meet all the above suggested criteria, each of these elements is discussed separately and the previously identified QoL measures (tables 4.1 and 4.2) are critiqued for these beneficial qualities. Should one of the generic QoL instruments or a suitably similar disease specific instrument meet all the criteria discussed, then it will be unnecessary to develop an OI specific QoL questionnaire. However, the lack of a suitable questionnaire will reinforce the need for such a measure with the paediatric OI population.

### 4.5.1 *Allowing self completion.*

An important factor when considering the suitability of a QoL instrument for the paediatric OI population is the ability to self report. A large amount of literature examines the ability of children to self report from an early age. From the age of five it is noted that children are able to self report their QoL (Varni et al, 2007; Connolly and Johnson, 1999). Working alongside children and young people with OI for the last 16 years has informed the author that this cohort are not limited in their cognition or leaning, and are therefore able to participate in instrument completion. Children and young people with OI spend a large amount of time attending hospital and are therefore accustomed to answering questions about their medical condition and general health. Many patients as they move into adolescence are keen to have their own voice heard and opinions justifiably acknowledged. Therefore the need for them to self report their QoL is paramount.

Previous research has examined the disparity between a child's self report and that of their proxy (often parent) report of their QoL (Eiser and Morse, 2001; Eiser and Varni, 2013). Eiser and Varni (2013) found that proxy reports often poorly correlate with self

report in subjects such as feelings of pain, emotional distress, fatigue or gastrointestinal symptoms. The need for an instrument that allows and encourages self reporting or self reporting with assistance, during the QoL measurement process is felt imperative for the OI population. The otherwise poor reporting of some dimensions (pain, fear, emotional distress) by proxy respondents may lead to low validity and poor measurement quality.

The DISABKIDS concept (DISABKIDS-37, DISABKIDS-12 and DISABKIDS-smiley) was developed in reaction to the child being placed at the centre of outcome measurement and the subsequent need for a child self report (Chaplin et al, 2008). The group also identified criteria which they felt was important for a QoL measure, such as self completion and the need for the measure to be brief and simple to complete. The DISABKIDS questionnaires do however have proxy components. However the group state that this contributes to the overall measure of HRQoL and is not a substitute for it. Many other instruments include a self completion questionnaire for children or adolescents (see tables 3.1 and 3.2). However, this is not the case for the Functional Status II (Stein and Jessop, 1990), TAPQOL (Fekkes et al, 2010), Warwick Child Health and Morbidity Profile (Spencer and Coe, 1996), SF-10 (Health services and sciences research resources database), HSCS-PS (Saigal et al, 2005), or the Adolescent Pain Behaviour Questionnaire (Lynch-Jordan et al, 2010), who all use proxy respondents only.

#### 4.5.2 *The availability of a single questionnaire.*

Scientific evidence highlights the need for continued health measurement from childhood throughout transition into early adulthood (Bevans et al, 2010). For this reason the availability of a QoL measure which allows continued measurement throughout childhood and adolescence would meet this need. The ability to review quality of life over time, alongside developmental progression and other potential influences ensures continuity and reproducibility. Many instruments use different scales and/or questions for differing age groups (DISABKIDS, Pedsql). For example they provide child, adolescent and young adult versions. These versions may appear to be similar in nature, but in fact may differ a great deal, with the addition or omission of age-related items or whole dimensions. This can make monitoring health care and QoL issues complicated as children transition into adolescence and later on to become young adults. QoL measures that provide age related modules fail to address the differing rates at which children mature. Consequently researchers and health professionals may find it difficult to ensure that they are using the correct module for the maturity of the child/adolescent in their care. For example some girls of 11 years old may be more mature than their peers, particularly when compared to their male counterparts (Bevans et al, 2010). Some instruments only allow completion by a narrow age range, often younger children or adolescents only (TAPQOL, Fekkes et al, 2000), Warwick child health and morbidity profile (Spencer and Coe, 1996), Dartmouth picture and word COOP charts (Wasson, 1994). This again does not allow comparison or monitoring throughout a child's development, questioning the validity of ongoing assessment.

Instruments such as the Healthy Pathways Child report scale attempted to address this confusion. They developed a questionnaire to incorporate assessment of children's opinion of their own health, illness and well being during periods of transition, particularly from childhood to adolescence (Bevans et al, 2010). As a result of this, the Healthy Pathways Child report scale is a single measure covering ages 6-21 years, which ensures continued measurement of QoL throughout childhood, into adolescence and beyond. The Child Health Questionnaire (Landgraf et al, 1996), Functional Status II (R) (Stein and Jessop, 1990), Generic Health Questionnaire (Collier, 1997), Perceived Illness Experience (Eiser et al, 1999), Health Utilities Index (II and III) (Furlong et al, 1998), Quality of well being (Kaplan et al, 1989), SF-10, Child Activity Limitations Interview (Palermo et al, 2008) and the Paediatric Rheumatology QoL scale (Filocamo et al, 2010) also cover a wide age range, ensuring measurement throughout childhood. In the United Kingdom, many children with OI are reviewed in tertiary and secondary NHS hospitals from birth, through childhood, into adolescence and through transition clinics to adult based centres. The availability of a single QoL questionnaire would ensure that individuals with OI were appropriately and reliably monitored throughout their complete childhood.

#### 4.5.3 *Transparent methodology*

The development of QoL instruments can follow different methods. Some developers use a top down approach; the literature is reviewed and discussed by a panel of experts, who then go on to develop a measure incorporating what they feel are the most valid and appropriate items and dimensions for inclusion. Others follow a more bottom up approach; the target population is canvassed via one-to-one interviews or focus groups to establish what they themselves feel are the most appropriate items or themes for inclusion. The need for rigorous development to ensure validity is an important factor within instrument development (Patrick et al, 2011). Finding a suitable and robust QoL instrument for the OI population that had been well developed and then psychometrically tested was required. Importance was placed on those instruments which had been developed with bottom up methodology, using a transparent conceptual framework involving children and/or their families. As this latter approach would ensure better content validity

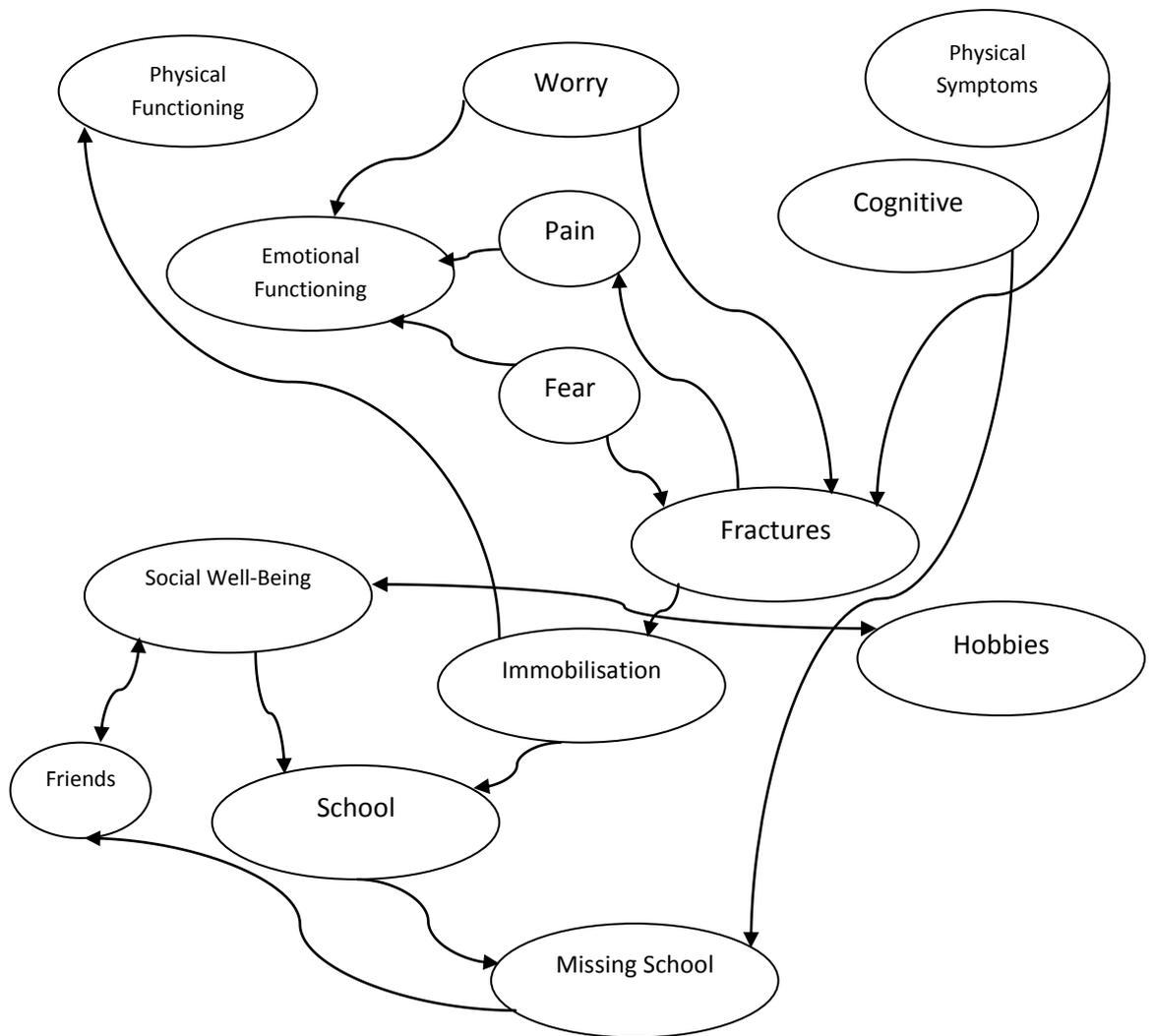
The Healthy Pathways Child Report scale (Bevans et al, 2010) includes items taken directly from the CHIP (Starfield et al, 1993) or from other well known measures, such as KIDSCREEN (Ravens-Sisberer, 2006). New additional items were developed by clinical experts, following a top down approach and not from the children or families themselves. This methodology was replicated by Lynch-Jordan et al (2010), who used a similar top down process during their development of the adolescent pain behaviour questionnaire, which included literature review and expert opinion. The HSCS-PS (Saigal et al, 2005), Child Quality of Life Questionnaire (Graham et al, 1997) and the Dartmouth Picture an word COOP charts (Wasson et al, 1994) all followed a similar top down approach, lacking input and incite from the target population. It is difficult to conclude that the items, dimensions and structure of the questionnaires are valid and relevant to the intended populations, when questionnaires are developed using this top down methodology.

A similar methodology was used by Hutching et al (2008) during the development of the Manchester-Minneapolis quality of life survey. Their aim was to anglicise and shorten the original version, but their only population involvement took place during psychometric evaluation. Ensuring the content validity of this shortened version may prove more difficult if the intended population was not involved in selecting which items were removed. Items deemed important and relevant by the participants themselves, may well have been removed prior to psychometric testing.

Conversely, the DISABKIDS instruments were developed using bottom up methodology, which included focus groups with the child and their parents. These focus groups identified the statements which, following a pilot phase later became the items for inclusion. A similar methodology was also used to develop the Child Health Questionnaire (Landgraf et al, 1999), who used a combination of literature review alongside focus groups and interviews with parents and children to develop their QoL measure. A combined use of both top down and bottom up approaches were used by Filocamo et al (2010) during development of the HRQoL measure for paediatric rheumatic diseases. The group included an expert panel of six Rheumatologists with 5 – 26 years experience, literature review, analysis of other paediatric HRQoL instruments and 37 face-to-face interviews with the relevant population. For further details of methodology used in questionnaire development see Tables 4.1 and 4.2.

#### 4.5.4 *Relevant and Purposeful concepts.*

For a questionnaire or measure to be valid for the OI population it would be necessary for it to include dimensions and items which were deemed relevant. The figure below (Figure 4.2) documents the initial conceptual framework as it was developed from the experience of the chief investigator during her 16 year history of working with children and families who have OI. There are clearly several concepts which are generic in nature and would be relevant to all children (physical functioning, worry, emotional functioning, pain, fear, cognitive, social well being, hobbies, friends and school/missing school). However, there are two concepts within the framework that are not necessarily generic and valid to all the population or other disease states; these two concepts are fractures and immobilisation. The addition of these two concepts, which are pertinent to the OI population, suggests that many generic questionnaires/measures are not sensitive to important themes within the lives of the paediatric OI population. Therefore the content validity of these generic questionnaires will be uncertain. For more information on the development of the conceptual framework see chapters five, six and seven.



**Figure 4.2** Original initial concept framework for QoL of children with OI - Researcher knowledge and experience

“The importance of content validity in developing patient reported outcomes (PRO) instruments is stressed by both the US Food and Drug Administration and the European Medicines Agency.” (Patrick et al, 2011, pp967)

Patrick et al (2011) describe content validity as the ability of a questionnaire to measure the concepts and themes that are important and relevant to the target population. These concepts should be present within the questionnaire for the content validity of it to remain high. The easiest and most practical way to ensure good content validity of a questionnaire is to develop it alongside the target population, eliciting themes from a purposive sample of the relevant population/cohort.

As previously discussed the DISABKIDS questionnaires (Chaplin et al, 2008; Sandeberg et al, 2010; Muehlan, 2010) were developed using focus groups with

parents and children to establish the concepts and statements to be included within the questionnaire. The questionnaires therefore have good content validity for the paediatric population. However, as the measures are generic in nature, they do not include any items which encompass fractures or immobilisation, and therefore the content validity for the OI population may be lower.

This chapter has discussed the criteria required for a previously developed QoL questionnaire or measure to be suitable for the paediatric OI population. It must include items, dimensions and therefore concepts which are valid for this group. It should also allow for self completion by children, as there are known concerns with regard to differences between the child and their proxy respondents (Eiser and Varni, 2013). The questionnaire must also have been well developed, using a suitable and well documented method, which involves the children and their families in the process of defining the conceptual framework. Finally, it should incorporate a single questionnaire format, covering a large age range, thus allowing sensitive monitoring throughout childhood into adolescence and transition into adult care.

None of the QoL measures, instruments or questionnaires reviewed included items related to fractures, or the immobilisation and resultant loss of independence and function. The Child Health Questionnaire (Landgraf et al, 1996) met two of the criteria deemed important for a suitable and appropriate QoL measure for the OI population. It involved the use of a single questionnaire covering the whole age group and allowed self completion of the questionnaire by the child. However it did not encompass any items which were related to fractures, and was developed using items from previous tools alongside expert opinion. A further measure which met two of the requirements was the DISABKIDS group of questionnaires (Chaplin, 2008; Sandeberg, 2010). The measures were developed with bottom up methodology, using focus groups with the target population and allow self completion by the child. However they are presented as several age specific questionnaires, which do not necessarily reflect the variation in developmental change of the child. This lack of a single questionnaire format reduces the flawless ability of the measure to follow developmental change of the child throughout childhood and transition into adulthood.

#### 4.5.5 Strengths and limitations

Reviewing the literature systematically to examine the readily available QoL measures/questionnaires has demonstrated that there is no current OI specific QoL measure already in existence. It has also highlighted that on initial examination there are several generic and a couple of disease specific measures, which on first glance may be suitable for the paediatric OI population. However on closer investigation they didn't meet the criteria required.

The inclusion criteria deemed necessary for this review was, with hindsight, very strict. This made the inclusion of some possibly suitable measures quite difficult. Had these criteria relaxed a little, some of the QoL measures uncovered may have appeared more suitable. However this would have proved a difficult undertaking, as it was felt important to include only well developed measures, where the methodology was transparent and involved children and/or their parents within the concept elicitation

phase, alongside the ability to self complete a single questionnaire covering a wide age range. Reduced stringency in relation to these strict criteria may have led to the acceptance of the Healthy Pathways Child Report scale as a suitable QoL measure for the OI population; but the questionnaire is lengthy (88 items) and includes some items which are not relevant to the Paediatric OI population. Further considerations with regards to this questionnaire will be discussed in chapters 9 and 10 of this thesis.

Although the aim of this research was to develop a questionnaire for self completion; an opportunity was missed to develop a parent/carer proxy QOL measure alongside the child self report. As described by the DISABKIDS developers, this would not be used as a substitute for the child self report, but would rather enhance the information gathered from the child or adolescent alone.

## **4.6 Conclusion**

This review demonstrates that there is currently (up to December 2010) no suitable, ideal QoL measure available for the paediatric OI population. Some of the instruments reviewed were developed well (DISABKIDS, Healthy Pathways Child Report) or allowed for self completion (child health questionnaire). Others provided a single questionnaire format, allowing accurate monitoring throughout development into transition (Healthy Pathways Child Report).

A small sample of instruments met two of the important criteria, required for a QoL questionnaire for the paediatric OI population (Child Health Questionnaire, DISABKIDS-smiley, DISABKIDS-37, and DISABKIDS-12, Healthy Pathways Child Report). However none of the instruments met all of the initial criteria. This highlighted the need to develop a valid OI specific QoL measure for the paediatric OI population, using transparent bottom up methodology, allowing self completion of a single questionnaire.

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## Chapter 5

### Concept/theme elicitation

#### 5.1 Aim

This chapter incorporates both the initial development of the conceptual framework and further theme generation (concept elicitation) with the use of qualitative interviews.

The chapter will highlight the experience and thought processes of the primary researcher prior to and following the systematic review (Chapter 4). This previous chapter highlighted the lack of a suitable Quality of Life (QoL) measure to meet the needs of the paediatric OI population. No previously available QoL questionnaire incorporated excellent development methodology, alongside valid items/dimensions which would ensure a robust patient reported outcome measure for this cohort. Within this chapter the need for transparency surrounding the experience of the principle researcher will be documented and discussed.

The chapter will also document the background, method and results of the semi structured interviews, which in turn elicited additional themes and concepts to further inform the overall conceptual framework.

#### 5.2 Introduction

##### 5.2.1 *Conceptual framework*

The development of a QoL questionnaire or patient reported outcome measure necessitates qualitative research and methodologies, particularly in the early stages during the elicitation of concepts from the target population and formation of a conceptual framework. To ensure transparency of all aspects of the developmental process, promoting openness and honesty, it is important to demonstrate reflexivity. The background and early evolving concepts, alongside the beliefs, assumptions and expectations of the researcher who is central to the process should be acknowledged, documented and discussed.

The conceptual framework is a diagrammatical representation of the key concepts or theories surrounding a particular topic, and the relationship between these concepts. In the case of the conceptual framework encompassing QoL in children with OI; it includes themes and concepts which are deemed important to this group, identified from several sources. These may include the patient cohort, literature review, personal experience of the researchers, the experience of parents/carers of children with OI, or exploratory research. The development of the conceptual framework and its place within the overall development of patient reported outcome measures has already been discussed in chapter 3.

The original conceptual framework for the development of the OI specific QoL questionnaire is shown in Chapter 4 (Figure 4.2). It was constructed from the knowledge and understanding of the researcher alone; from 16 years experience of working with children with OI. It was not documented using the literature per se, but will have incorporated reflections from the articles and reference material read by the

researcher over the years. It includes the initial thoughts of the researcher when considering QoL in children with OI.

There is a gap in the literature with regard to QoL in the paediatric OI population. Bowling (2009) commented that the most up to date research is not found within the written literature, and therefore experience and knowledge should be gained from all sources. Maxwell (2005) suggests that separating your research from other aspects of your life detaches you from a large source of experiential information and knowledge. This experiential knowledge needs to be acknowledged as subjective and an understanding of the origin of this experience needs to be transparent.

As it is important to be transparent about the experience and background of the researcher within the field of OI, it is necessary at this stage to document that experience and therefore the following narrative is written in the first person.

*I began working within the field of OI in 1999. I had had some experience of the condition prior to this date whilst working at a district general hospital, but began to develop a larger cohort of patients when a service was set up in Sheffield. I cannot really remember when I became more interested in a person's/patient's QoL rather more than their pure function. I am not sure whether it happened as I began to work more with the OI population. Whether I questioned myself about the need to be functional versus having a good QoL, and whether the two were interlinked, had a symbiotic relationship or were dependent on one another. I began to feel that having a good function or being able to function independently was not necessarily a pre requisite for a good QoL.*

*I remember a time before, when I felt to be independently functional must be my goal for all my patients. As I worked more with the teenage OI population I realised I could not push my drive for function onto them. They often did not want to know. I questioned myself whether they just could not be bothered to work towards improved function; stubbornly refused to take my advice; were happy with how they were; or were may be frightened to change or push their boundaries in case this resulted in fractures.*

*Overtime (I am not sure how long) I began to realise that you can function well, be independent, but not necessarily feel you had a good QoL. There are so many other important parts of life or factors that had an effect.*

*As I write this I realise it may have occurred during the time prior to my work with the OI population, when I worked alongside a Rheumatologist and now friend, Rod Amos. We ran a weekly clinic for children with arthritis and some children with non-specific aches and pains would often be referred. We talked at length about the effect family relationships, peer support and schooling had on the reported experiences and life style of children and teenagers. He would often quote 'a life changing experience may be required', for some patients whose physical signs did not match that of their reported QoL.*

*I now find I discuss my patient's function much more in the light of how it affects the quality of their life, and how things we may be able to put in place*

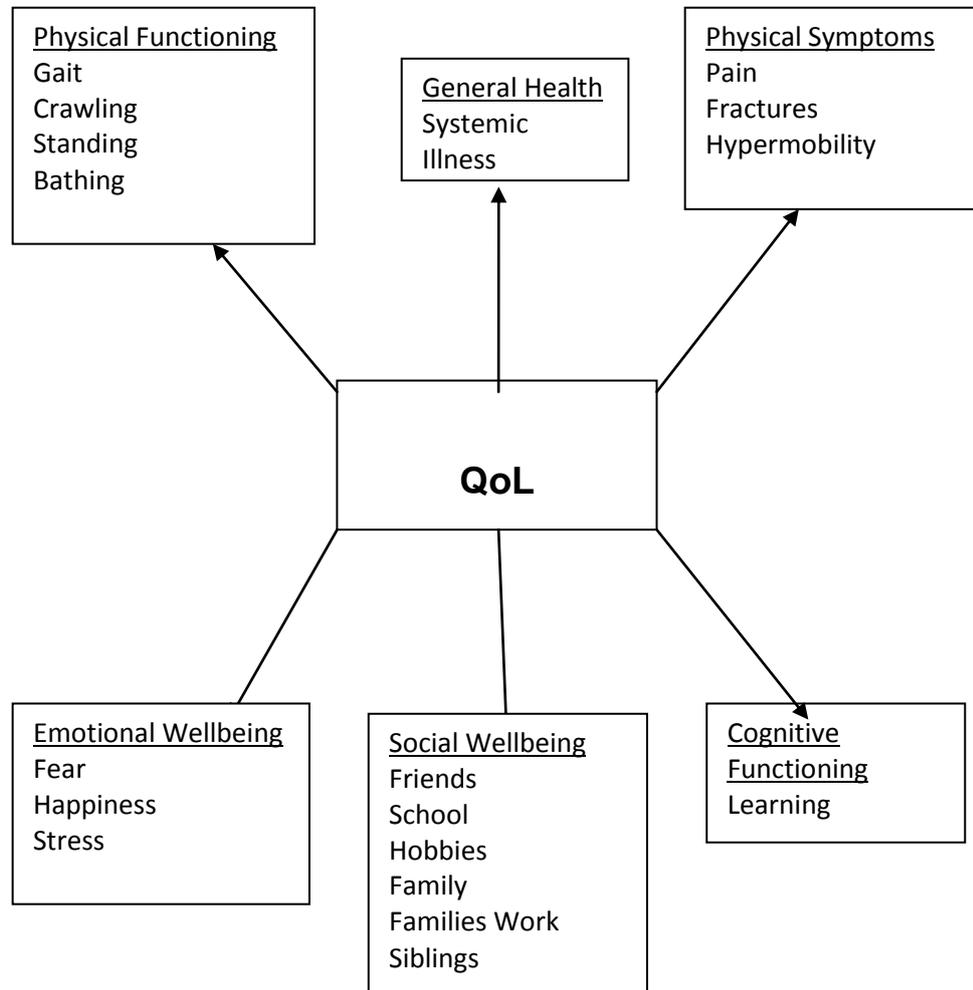
*may improve their function, and whether they feel this will have a positive effect on their QoL. Then finally whether they think this increase or benefit is worth, in their opinion, the effort it may take.*

*In 2009 I began to facilitate focus groups of young adults at the voice conference run by the Brittle Bone Society (BBS). Several of the participants described terrible experiences of physiotherapy as they had grown up. They had been pushed to be more functional, to gain standing often via the use of standing frames, and had suffered further fractures and pain as a result. This further confirmed my thoughts and mind set around function and QoL. With all the will in the world I can attempt to empower a person and encourage them to be more functional. I can give them a glimpse of what I think they may be able to achieve, but the truth of this process is that if they feel the effort required outweighs the functional improvement gained, then they will be less inclined to complete what I suggest. Everyone's view of what equates to a good QoL is different. Some may strive for function, and feel that to be more functional gives them a better QoL, others may feel more time spent socialising with friends is more important, and to some educational achievement may be the way forward. I have begun to realise that getting a grasp or glimpse of what is important to each individual and/or their family unit and what will have a positive effect on that person's QoL is more important than pushing for improved function.*

The review of the literature surrounding QoL and QoL in OI (Chapter 2) was used to produce a second conceptual framework (Figure 5.1). It documents numerous concepts and sub concepts which were thought by the researcher, following the review of the literature, to be relevant to QoL and the paediatric OI population. It does not describe the relationship between individual concepts, due to the nature of its origin in independent literature articles and books, but is a pragmatic list of those concepts suggested and discussed. Six main areas of QoL were documented, initially without any thought about the relationships between them:

1. Physical Functioning
2. General Health
3. Physical Symptoms
4. Emotional Wellbeing
5. Social wellbeing
6. Cognitive Functioning

The relationship of these six main QoL themes were then examined with regards to the QoL concepts discussed in the paediatric OI literature, this second framework can be seen pictorially in Figure 5.1.



**Figure 5.1.** Conceptual framework following review of the literature.

The penultimate conceptual framework is documented later in this chapter; following discussion and reflection the two previously documented conceptual frameworks (Chapter 4, figure 4.2 and Chapter 5, figure 5.1) were reviewed alongside the themes uncovered from the OI population. The relationship between the concepts and sub-concepts are noted within this latter framework (Figure 5.2). The differences between each of these frameworks (Chapter 4, figures 4.2 and Chapter 5, figure 5.1), and the progression within the development of the latter conceptual framework (Figure 5.2) is documented in table format in the discussion section of this chapter (Table 5.2).

### 5.2.2 *Review of qualitative approaches.*

The use of interviews as a means of eliciting concepts and themes to inform PRO development, alongside interview methodology has already been discussed in Chapter 3. Qualitative research relies heavily on interviews and focus groups to gain subjective information from a population. There are benefits and flaws with both types of methodology; interviews allow a private one-to-one narrative or discussion to take place in confidence, and therefore are more suitable for personal subjects or sensitive issues, which individuals may find difficult to discuss in front of others. Focus groups however allow more discussion; ideas and anecdotes are shared, and topics suggested by one participant often incite enthusiasm, encouraging information to be shared by another. Interviews were chosen as the most suitable method to uncover the themes relevant to QoL within the paediatric OI population. With minimal information regarding the subjective report of QoL in children with OI, the sensitivity of the topic was not known. The nature of the cohort which included parents and children who covered a wide age range (6-18 years), alongside varying degrees of disease severity, did not easily suit a focus group setting. Until more information was gained surrounding the sensitivity of the topic, interviews offered a safer environment in which to gain deeper understanding and insight.

Interviews were deemed the most suitable method, as they would allow participants the freedom to discuss their thoughts and opinions, suggesting new topics as they arose; enabling the researcher to delve deeper into topics where appropriate. The researcher would also be aware if the interviewee had misheard or not understood the question posed.

Shuy (2002) examined the difference between in person and telephone interviews. They concluded that face-to-face interviews are often longer than those conducted by telephone, but that interviews conducted in person were better for sensitive issues, allowed data from observation and enabled the interviewer to respond to signs of participant confusion and/or distress.

Britten (1995) states that experienced doctors and medical professionals may well already possess the skills required for a good qualitative interview, but may need to monitor their interview technique. To improve this transition, time should be taken to appraise previously recorded interviews, asking others to review and make comments. A pilot interview or pre testing of interview schedule will familiarise the interviewer with the questions and can infuse them with a greater sense of confidence (Bryman, 2004). The principle researcher has over 15 years experience of interviewing both children and their parents within a medical setting. Therefore the use of a pilot interview enabled this technique to be appraised within a research setting.

Patrick et al (2011) suggested conducting interviews and/or focus groups to inform the content and structure of the new instrument. They used individual interviews to elicit concepts from their population who suffered from pressure ulcers, as the data uncovered was quite sensitive. Participants included both newly diagnosed and long term patients, as it was thought the two subgroups may differ in their experience of their condition.

Gorecki et al (2010) during their study sought to refine and further develop their working conceptual framework for HRQoL, by undertaking face-to-face semi structured interviews with 30 patients, who were experiencing pressure ulcers, to elicit any new relevant information. Emphasis was placed on the importance of the qualitative phase of questionnaire development, in an attempt to ensure the content was both important and relevant to the patient population. They also highlighted the benefits of wide variation within the purposive sample, allowing observation of the differences between the subgroups within the population. Graneheim and Lundman (2004) agreed; they found that choosing participants with various and numerous different experiences increases the possibility of shedding light on the research question.

Brod et al (2014), during the development of their instrument, interviewed a purposive, convenience sample of growth hormone deficient patients, which allowed for as much variability in age, ethnicity and income, to elicit concepts. These new concepts were used to enhance the conceptual framework of previous themes extracted from the literature. Review of the literature and one-to-one semi structured interviews were also used to further inform a conceptual framework developed by Welk et al (2013), during the production of the patient-reported neurogenic bladder symptom score. They went on to produce a comprehensive potential item list of symptoms and complications, which was then reviewed by an expert panel for assessment of content validity.

Conflict of interest can arise within a study when a researcher is also a health professional known to the participants prior to study commencement. This is often an area which is not discussed within published papers, yet when its presence is acknowledged, it is important to remain transparent throughout all stages of the research; reflexivity can be used to aid this process. As I was both researcher and clinician throughout this research, I acknowledge that patients and their families may have felt both a duty to participate and to respond positively to my questions. Potential effects on the interview process are considered within the discussion section of this chapter.

### **5.3 Method**

As previously mentioned the population was well known to the chief investigator and this had allowed a hypothesized working conceptual framework for the health and related quality of life outcomes to be developed (Chapter 4, figure 4.2) using clinical expert opinion. Phenomenology was deemed the most appropriate methodology for this study. Phenomenology studies conscious experience as experienced from the first person point of view, and considers how individuals make sense of the world around them (Bryman, 2004). Through observation attempts are made to gain access to an individual's common sense thinking and how they interpret the reality within which they live. It was important to gain access to the paediatric OI population's thoughts, feelings and experience of living with their diagnosis and the effects it had on their everyday life. Gaining a closer, more thorough understanding of how they viewed their QoL and how this was affected by their disease, its treatment and the regular hospital visits this involved was vital. Without this closer understanding, any newly developed QoL instrument would not necessarily measure what was deemed important or relevant to the paediatric OI population, and this may subsequently effect their inclination to complete it. Alongside the paediatric OI patients' view, were the views of their

parents/carers and the health professionals involved in their medical or therapy care. Gaining insight into the similarities and difference between the children and the adults who cared for them was also an important adjunct. Proxy respondents have already been shown to be a poor replacement for self completion in several areas of QoL (Eiser and Varni, 2013); would the OI population report similar differences?

One-to-one semi-structured interview methodology with a purposive sample of children, parents/carers and health professionals provided a safe, confidential environment in which to provide opinions and beliefs about QoL, and how this QoL may have been affected by a diagnosis of OI. Although, unlike a focus group setting, it is acknowledged that the interview would limit discussion and a sharing of opinions, it was felt that at this early stage of concept elicitation a more secure situation would put participants at ease.

To permeate this experiential information twenty five semi-structured interviews were undertaken. These included; ten children aged 7 to 18, diagnosed with Osteogenesis Imperfecta (OI), who attended a tertiary Metabolic Bone Disease Clinic in the UK; ten parents of children diagnosed with OI attending the same clinic; and five health professionals specialising in the treatment of children with OI. The sample was purposive; children were balanced for severity and age, parents for severity of the child in their care and health professionals for their discipline.

**Table 5.1.** Characteristics of the samples

Participant	Length of interview (minutes)	Age	Severity of OI (child)	Profession (Health Professional)
C1 (Child)	28	16	Moderate	
C2	26	16	Mild	
C3	13	8	Moderate	
C4	44	12	Moderate	
C5	34	6	Severe	
C6	28	13	Moderate	
C7	34	14	Mild	
C8	30	10	Mild	
C9	26	14	Severe	
C10	34	17	Severe	
P1 (Parent)	52	30	Moderate	
P2	38	28	Moderate	
P3	50	38	Moderate	
P4	40	37	Severe	
P5	44	30	Mild	
P6	37	40	Severe	
P7	42	39	Moderate	
P8	18	42	Mild	
P9	43	44	Mild	
P10	42	52	Severe	
HP1 (Health Professional)	48	44		Occupational Therapist
HP2	20	54		Nurse
HP3	34	28		Occupational Therapist
HP4	37	33		Physiotherapist
HP5	30	52		Consultant Medic

The local research ethics committee reviewed and approved the study protocol (appendix 1). The participants (children and parents) were contacted by letter outlining the nature of the study (appendix 3), including an information leaflet (appendix 4) and asking for consent to discuss the research further. The information leaflet explained the nature of the interviews, who would be present and what to expect, making it clear that participants could stop the interview at any time. During their next hospital attendance, consenting individuals were then approached and given the opportunity to discuss the research and ask any questions. Consent was gained from participating parents and health professionals (appendix 5). For children who agreed to participate, consent was gained from both parents and young adults (16-18 years) and assent was gained from children (7- 15 years). Sample characteristics including; age, gender, severity of OI (of child), number of siblings, number of siblings affected with OI, parental history of OI, marital and employment status of parent were recorded

The interviews took place in a quiet room, away from the clinic or ward environment. Children were given the choice to be interviewed alone or with a parent or carer present. The interviewer was known to all participants as a Physiotherapist within the Metabolic Bone Disease clinic. It is acknowledge that this could lead to conflict of interest; with patients, parents and colleagues feeling a sense of duty to participate (Richards and Schwartz, 2002).

The interviews were semi-structured; parental and child interviews included a warm up question asking them to talk a little about themselves, health professionals were asked to describe their experience of working with the paediatric OI population. Participants were informed that there were no right or wrong answers and that their views and opinions were what was required. All participants were made aware of the dictaphone recording the interview. An interview schedule (appendix 6) was used to encourage on going focus throughout the interview. The interviewer was previously known to the children and parents in a clinical role. Consistent with qualitative methodology several warm up questions were used at the onset; parental and child interviews included a warm up question asking them to talk a little about themselves; health professionals were asked to describe their experience of working with the paediatric OI population (Hill et al, 2014). It was suggested the children interviewed, state their age, where they lived, who was in their family, where they went to school or college, if they had any hobbies or where they went on their last holiday. Following this starter question, participants were asked if having OI, or having a child with OI, had an effect on any of the activities they had described. The interview aimed to encourage participants to consider how OI affects children's quality of life. Parents and children were then asked to describe their usual day from getting up in the morning to going to bed at night; *who helped? Did they have to do anything differently because of their or their child's OI?* By asking both parents and children to discuss their daily routine, participants were encouraged to analyse their daily activities and explore how OI affected what they did or did not do. When interviewing the children probing was used to draw out any differences between themselves and their siblings or peers. *I asked the children what it was like to have OI; were there any good or bad things about having OI? Could they access the same hobbies and activities as their siblings or peers? How did having OI make them feel?* Parents who had more than one child were asked if they felt they

treated both children similarly; *was their child with OI given the same opportunities as their siblings or peers?*

Health professionals were asked; *What are the main problems that arise for children with OI and their families? How do OI and fractures impact on the life of a child? Again, can they access the same hobbies, schools and extra-curricular activities?*

The final question used for all participants was; *if you could change or improve one thing for children with OI, what would that be?*

The interviews were transcribed verbatim, and rechecked on several occasions for accuracy. Significant statements were identified, extracted and organised, undergoing framework analysis (Richie and Spencer, 1994). A sample of interview transcripts (n=5) were reviewed by an experienced qualitative researcher [WB]. The interview data was read, and re-read and reoccurring themes were identified. A tabulated framework was used to organise all themes and sub themes. Participant's quotes were placed directly into the table under theme and sub theme headings. Themes were then explored and any connections or overlap between themes considered. These were explored diagrammatically using a Venn diagram to enable a clearer picture of themes to evolve.

## **5.4 Results**

The first 25 individuals (10 children, 10 parents and 5 health care professionals) approached, agreed to participate in the study. The age range of the interviewees was; children 6 to 17 years, parents 28 to 52 years and health professionals 28 to 54 years. The parents interviewed had children with a mixed range of severity of OI; two of those parents interviewed were fathers. The health professionals included two occupational therapists, one physiotherapist, one specialist nurse and one consultant. All specialised in the treatment of children with OI with a wealth of experience, ranging from 2-16 years. Interviews ranged from 13 minutes to 52 minutes in length (See Table 5.1).

Most of the children appeared to feel at ease when discussing at length their daily routine, identifying times and situations where they needed additional support, or had to do things differently from their siblings or peers. Although one child was able to talk about her Osteogenesis Imperfecta (OI) and describe her daily routine, she became upset when the interview touched on differences between her and her peers/siblings so the interview was stopped to avoid undue stress (Hill et al, 2014). All other interviews went well; the parents and health professionals appeared comfortable and at ease with the subject matter.

A large number of topics were discussed by the interviewees. These included; being safe and careful, being different, needing extra support, the need for adaptations or equipment, feelings of fear, isolation, pain, fractures and reduced function following fracture, tiredness, independence, effect on siblings, altered family routine, time lost from work, letting go, planning, stress, motivation and determination. Health professionals due to their lack of constant proximity to the children and their families often discussed topics from both the child and the parent's perspective. Children described topics which were more relevant to them specifically; parents discussed

family based topics, often with emphasis around the additional planning and organisation involved in caring for a child with OI (Hill et al, 2014). An exhaustive list of elicited themes can be found in Appendix 2.

Six main themes were identified as relevant to QoL from the analysis; each included two or more sub themes. The six main themes are; being safe and careful; reduced function; pain; fear; independence and being different, these are documented in Table 5.2. These main themes were selected as they were reported by all three groups and were thought relevant to the child’s quality of life, rather than that of the parents or whole family. Although the complexity of the language varied, all participant groups discussed the impact of the six themes on the QoL of children with OI. However, the emphasis/spread was different for each group. Themes such as; reduced function (fractures and equipment) and isolation (being different) saturated quite early (n=5), within the children interviewed. Being safe was discussed readily by all children interviewed, but more frequently by parents. The themes fear and being safe saturated earlier within the parent group, and fear was more readily discussed by health professionals (Hill et al, 2014). On reviewing the interview transcripts all the main themes were identified within the first eight interviews (4 children, 2 parents, 2 AHPs), although not all the sub themes were identified at this stage, and required completion of almost all interviews to fully saturate.

**Table 5.2.** Main themes and sub themes

Main Themes	Sub themes
Being safe and careful	Avoidance of activities Trying to be safe
Reduced function	Reduced function with fractures Equipment/adaptation Tiredness/fatigue
Pain	General aches and pains Pain of fractures Pain relief
Fear	Fear of fracture Activities/handling Needle phobia
Independence	Pushing for independence Overprotection
Being different	Isolation from peers Being different

#### 5.4.1 *Being Safe*

Being safe was a theme most often identified by all three groups of participants. There was no difference between children of primary or secondary age in their identification of the need to be safe, the only difference was the way they described it. Younger children observed adults not letting them do certain activities to keep them safe and

noticed how their parents would stay close by to ensure safety (Hill et al, 2014). One child, when asked why they had a buddy for a certain activity, replied “to keep me safe of course”.

Secondary school aged children talked about having additional adult support to promote safety, but also how they avoided activities and busy areas to keep safe; for example:

Child (C7): Erm, there is an LSA that takes me into lessons, erm so that sort of if people were running and I sort of got knocked or something, there would be someone there.

Another more able bodied child did not need additional support to move around school, but stated “I leave at the same times as everyone else, I’m just extra careful”. Careful was a description used more often by the older children (Hill et al, 2014).

C2: I have to be careful about what I do in PE.

C6: The only thing is that I have to be more careful.

C10: you know another negative is that I am always breaking bone easily and it is always in the back of my mind, when doing stuff I have got to be careful cos if I break something, it comes with a lot of consequences you know.

Parents, like the older children, talked about keeping their child safe and avoiding fast and unpredictable activities. One parent felt she avoided activities that involved a lot of children running around; “a situation where accidents could happen”. Parents also observed their child remaining on the periphery of activities and not taking risks; for example:

Parent (P9): On reflection, she has been very danger aware from a very early age, so as a consequence I try to let her drive it.

P9: Yeah and what I would often see is she would do they same, but she would be right on the periphery.

P8: He wouldn’t do anything that would put him at risk, you know, he is not one for climbing trees, or sitting on someone’s shoulders or anything like that, so he is quite sensible (laughs).

Health professionals observed parents from an early stage doing everything they could to keep their child safe from fracture.

Health professional (HP1): they are very protected, and they are very cautious about who they allow near them, and so their social experiences are quite limited in those early days and the handling and the bonding is reduced.

#### 5.4.2 *Reduced Function*

Reduced function was also described by all three groups. There was no difference noted between those children with severe or milder disease. Primary school children reported using wheelchairs because they became tired, and that their function was reduced when on crutches. One young child described going in his wheelchair “Because my legs got tired”. Older children talked about having to do things in a different way. They did not always talk about missing out on activities, but had to adapt the activities or choose to do a slightly different activity alongside their more able bodied peers. This was especially apparent at times when a fracture involved a dominant hand (Hill et al, 2014).

- C9: It’s, sometimes it can restrict me, but...I don’t know, it’s, I’m not the same if that makes sense....Yeah, because you are in a wheelchair like, sometimes it’s like harder to do things that other people could do with ease.
- C2: Well I can’t do as much for myself, if it’s my right wrist I can’t write, I can’t open things, I can’t pick stuff up as I can’t do as much with my left.

Others described the different equipment they used to improve their function, these included walking with crutches and using wheelchairs for mobility. One teenager required a science stool with a backrest, and commented that her school had to order a special one. Another reported using “chunky pens, so that I can grip them easier”.

Parents and health professionals also observed reduced function, but commented more on the additional help children with OI required, particularly if they had sustained a lower limb fracture and were non-weight bearing. They described the tiredness they observed in their children when they had experienced a busy school day (Hill et al, 2014).

- P7: when Evie broke her leg last, in December, she couldn’t, they didn’t want her going on the stairs so, every time she went to the loo, I was behind her, or Pete was behind her and then we were in front of her when she was coming down from the loo. So I think the level of care that we provided when she was in plaster, was like really high and everywhere she, we didn’t want her walking, because I was worried about her other leg and we just sort of rallied around her all the time, so she didn’t make her snacks like she usually does, it was like no, you stay, because there is a step into the kitchen.
- P3: he doesn’t do any after school activities, because by 3 o clock he’s whacked, he is whacked. He comes in erm, and he can like lay on the sofa for half an hour, an hour and just not do anything.
- HP3: a lot of them don’t want to be reliant on someone to help them and they want to be able to manage by themselves but yet they have to accept, you know, help and just practical tasks like toileting and bathing and you know, getting in and out of bed of a morning, if you have a fracture, becomes that bit more difficult and time consuming.

Another health professional described the restrictions placed on some activities for older children such as; trampolining, horse riding, high impact sports and PE. They felt younger children were also restricted from simple activities such as slides at a play ground, which if pursued could lead to fractures, demonstrating a link to being safe (Hill et al, 2014).

#### 5.4.3. *Pain*

Pain was mentioned by children, parents and health professionals when discussing quality of life in OI. There was no apparent difference due to severity of OI noted. Younger children talked about “ouchys” and things “hurting”. Older children described pain, hurt and ache, often relating to fractures, but occasionally just the general aches and pains experienced by people with OI. One older child described his back ache as “always there, it comes and goes like a pain threshold”.

Parents talked about finding it hard to see their child in pain. Those who had OI themselves felt guilty for passing on the gene, when the pain experienced following a fracture was discussed. Some parents commented on how much pain their child had suffered before they had received Bisphosphonates. They talked about their child appearing lifeless and finding activities difficult due to their level of pain (Hill et al, 2014).

C10: when I have a fracture, it is obviously very painful, but what upsets us the most is the fact of the consequences, because I mean I have had that many I believe that I am used to the pain and in comparison the screaming and the crying as I grew up, now I don't really cry, I just you know, emphasise that I am in pain, but the worse thing is the consequences

P2: It's just really hard sometimes and for me when I see her in pain I feel quite guilty about that, because I know that it's obviously come from me.

Some parents discussed the advantages of early pain relief and splinting immediately following fracture and this was mirrored in the comments made by health professionals (Hill et al, 2014). They felt providing pain relief as soon as possible was a necessity, particularly following fractures.

HP4: Earlier pain management and almost the parent is the only person really who is there early enough, because you never get the same doctor twice and you never get the same treatment twice, and I think there needs to be some sort of care plan in place where the parents know that they are allowed to give.....

#### 5.4.4 *Fear*

Younger children had no concept of fear. However, secondary school aged children described how the fear of fractures would hold them back from undertaking some activities, they were fearful of busy or dangerous areas and some reported needle phobia (Hill et al, 2014)

- C1: More scared of breaking a bone, I was always, it would hold me back a lot from doing more activities. My Mum would say “do you want to go there?” and I would be like “oh I might break a bone so I won’t”.
- C6: Erm, I don’t mind hospital, it’s only the erm, needle, because I am partly needle phobic, and other than, once the needles in I aren’t too bothered.
- C7: but when I was younger, I was like scared about having a fracture, not so much my arms, but, I’ve done them enough times, but legs and stuff. You know what if I was in a dangerous area and I broke a leg or something.

Parents did describe fear in their children of all ages; they observed fear of some activities and needle phobia, but also reported their extended families fear of handling their child, and the fear they experienced when their child went to school. One parent described her brother as “panicking he might break her”, when she had asked him to hold her daughter, and noted that most of her family chose not to pick up and handle her. Health professionals observed fear in parents, children and other professionals with regard to handling and fractures; they did not differentiate for age or severity where fear was concerned. They noticed children with OI often restricted the number of family members that were allowed to handle them and pick them up. One health professional felt that older children often became anxious when they handled them for the first time, particularly if they had only been handled by their parents (Hill et al, 2014).

- P10: I think...there’s always a fear that he is going to break a bone, at all times.
- P7: I’d love to take the kids there, but I couldn’t, I’d, I’d, I’d just be too scared, I’d be just, there’d be too many people who were going in their own directions and I would be too frightened to do that.
- HP1: When they first go to school, schools are terrified of them whether they are mildly affected or severely affected, it doesn’t really matter, they are all terrified. And the child will be excited about going to school, and everybody is missing that.

#### 5.4.5 *Independence*

Parents and children differed in their discussions around independence. Secondary school children described striving for independence and preferring to be independent even when they had sustained a fracture. One child described having pushed to be like everyone else at school, only agreeing to sit out of PE when her legs got too tired to carry on. Others talked about walking or propelling themselves to school with their friends (Hill et al, 2014).

Younger children did not talk about independence at all; this may be due to age and expectation. Young children of all abilities are cared for by their families; therefore striving for independence is often not anticipated in this age group. Alternatively parents described struggling from an early age with letting go and over protection.

They observed their child's drive and motivation for independence, but often reported a need to accompany children to extracurricular activities, and in some cases acknowledged their inability to let go (Hill et al, 2014).

- C2: I've always been independent, because I'd prefer to be independent. They have said I can have a scribe for my GCSEs, but I don't want one, I'd rather write it myself.
- C10: Erm, but for doing stuff such as washing, erm cleaning my teeth etc, I normally just get into my wheelchair, which I park next to my bed, and erm, wheel up to the sink and do that with no problems.
- P7: because they are very independent now they have been on pamidronate, well, no, Erin especially, she doesn't rely on wheelchairs very much at all now, so she's her own independent 12 year old.
- P9: she used to say to me "do you have to come" and I used to say I do have to be there, I'll get out of your face, I'll get out of your hair, I'll deal with another group, I won't be anywhere near. May be it was mine on reflection, the more I think about it, maybe it was me that actually need to go.

The health professionals frequently observed the conflict within the child's life when they struggled for independence with the overprotection of their families and school. They also commented on the difficulties surrounding children moving into education where they were no longer within the sole care of their parents. All health professionals described the young OI population as a motivated and determined group, striving for independence (Hill et al, 2014). One stated "they are a great example of what can be achieved by determination and courage".

- HP1: when it comes to independence at home, and thinking about faster wheelchairs and leaving home, going to college and all that sort of thing, there becomes this new anxiety, the children, the youngsters want it, and the mums think they are going to stay at home forever. And there is this sort of letting go process, and they learn to drive, and have their independence that way and it's a very exciting time for them, but it is very nerve racking for families to let them go.

#### 5.4.6 *Being Different*

The final theme described by all children, parents and health professionals was the feeling of being different or isolation. Younger children talked about not being allowed to play football or run fast. They described feeling left out of some outdoor school trips, not being invited to parties, and feeling sad that there were things they could not do. One child became upset when she talked about being unable to skip or run and the interview was terminated as a result. The older children echoed the thoughts of the younger ones; they felt excluded from some activities which were potentially dangerous to them because of their OI. In addition they found some extracurricular activities

became too physically demanding as their peers became older and stronger (Hill et al, 2014).

Interviewer (I): Why did you finish scouts?

C1: It was venture scouts after that and that's a lot more physically demanding, more camps and I just couldn't handle it....I did try it. I got too tired.

I: How did that make you feel?

C1:... bit sad that I couldn't join, cause all the scouts upgraded to venture scouts, and all my mates went up to there.

C8: It makes me feels a bit left out because I can't do a lot of things that I want to do.

Parents and health professionals observed this isolation in the children they cared for. They reported children being excluded from PE and sports day, but also not being able to keep up with their peers or siblings. In some instances parents commented on their child looking different because of the equipment they required, and the effect this had on a child who wanted to look like everyone else. This was not severity dependent and was echoed across the different severity groups. One health professional felt that children with OI could access most opportunities with some modification, but added this took "extra effort from teachers and schools, social groups and medical professionals." (Hill et al, 2014)

P1: Erm, for sports day we don't usually tend to take him, because he feels too left out, you know because like 100m sprints. He can take part in like the bean bag throwing you know, but that's just like one event. There's all the rest like egg and spoon, so he can't wheel himself and hold that. So we tend really not to send him,

P9: The birthday party invite would come, it's a skating party, it's a roller blade-ing party. It's a horse riding party, no we can't go.

HP5: They are not going to be able to engage in the same range of activities. They may be limited sometimes in terms of what they do, not simply in terms of their physical disability, but by other people's perceptions of what that disability means.

The overall process of concept elicitation, followed by the development of the conceptual framework, started with themes derived solely from expert or clinician opinion (figure 4.2. Chapter 4). These were then appraised alongside the themes identified within the literature (figure 5.1 Chapter 5), which were then finally reviewed and enhanced by the themes revealed following the one-to-one interviews with those individuals living with or experiencing OI on a daily basis (figure 5.2). Table 5.3 denotes the themes identified at each stage of this process and the commonality between stages.

**Table 5.3.** Overview of conceptual frameworks

Researcher (fig. 4.2)	Literature (fig. 5.1)	Interviews (fig. 5.2)	
		<b>Main Themes</b>	<b>Sub Themes</b>
<b>Physical functioning</b>	<b>Physical functioning</b>	<b>Reduced Function</b>	<b>Reduced function due to fractures</b>
<b>Physical symptoms</b>	<b>General health</b>		<b>Tiredness/fatigue</b>
	<b>Physical symptoms</b>		<b>Equipment/adaptation</b>
<b>Pain</b>		<b>Pain</b>	<b>General aches &amp; pains</b>
<b>Fractures</b>			<b>Pain of fracture</b>
<b>Immobilisation</b>			<b>Pain relief</b>
<b>Emotional functioning</b>	<b>Emotional wellbeing</b>		
<b>Fear</b>		<b>Fear</b>	<b>Fear of fracture</b>
<b>Worry</b>			<b>Fear of activity/handling</b>
			<b>Needle phobia</b>
		<b>Being safe and careful</b>	<b>Avoidance of activities</b>
			<b>Trying to be safe</b>
<b>Cognitive functioning</b>	<b>Cognitive functioning</b>	<b>Independence</b>	<b>Pushing for independence</b>
			<b>Overprotection</b>
<b>Social well being</b>	<b>Social wellbeing</b>	<b>Being different</b>	<b>Isolation from peers</b>
<b>Hobbies</b>			<b>Being different</b>
<b>Friends</b>			
<b>School</b>			
<b>Missing school</b>			

## 5.5 Discussion

This section of the thesis describes the use of qualitative interviews with children, parents and health professionals to identify how OI impacts on the quality of life and well-being of children and their families and what issues are important to them. These issues/themes were then used to inform and further develop the conceptual framework, ensuring high content validity within the development of the OI specific QoL measure (Figure 5.2).

There is a paucity of research on the views of both children and parents on the impact of OI on QoL (Hill et al, 2014). From the 25 interviews undertaken, six main themes were identified, extracted and organised using framework analysis and included; being

safe, reduced function, pain, fear, independence, being different. A recent Portuguese descriptive case study described some similar themes to those identified here. They interviewed children with OI, their siblings and parents and reported themes such as; consequences of fractures and impairment, weakness and vulnerability, exclusion at school, worries surrounding pain and susceptibility to fracture and positivity (Santos and Barros, 2011).

Stevens (2010) interviewed 74 children aged 7-11, from two city schools, about their quality of life. The aim was to develop a health utilities index for children using the interviews as a means to identify themes. The majority of children were in good health (93%), no individuals reported complex disability. Her themes included; worried, sad, annoyed, hurt, learning, daily routine, tired, joining in activities, sleep, embarrassed and jealous. Although some of the themes she uncovered were similar to those highlighted by the paediatric OI population (worried, hurt, tired, daily routine), others were not. This may be explained by the lack of children with complex needs within her cohort.

Quality of life is a difficult concept to describe, and descriptions vary across the literature. Previous definitions (Fayers and Machin, 2007) are focused on functional ability and health status. However, both experience and the literature tells us that quality of life is not necessarily based on a child's ability to function, and there is no evidence to suggest this is the case (Davis et al, 2006). Difficulties arise when attempting to measure quality of life if it is not well predefined. Some studies define it as functional ability or a sense of wellbeing (Solans et al, 2008), others report health related QoL (Muldoon et al, 1998). It is difficult to make comparisons between research papers, if different definitions are used. From the number of themes identified within the interviews, only a small proportion relate to functional ability. Reduced function was more often mentioned if the child had sustained a fracture. This was true for all ages, severity of disease and interviewees (Hill et al, 2014).

Several studies have discussed the difference found between children and their parents with regard to their understanding of QoL (Eiser and Morse, 2001a; Eiser, 1997; Upton et al, 2008; Waters et al, 2009). This research supports the view that differences also exist between the children and their health professionals (Morris et al, 2007). It also highlights a large number of similarities between children and their parents within the six main themes identified, although there were several important disparities apparent within the interviews. Parents talked about how their child's OI affected their own QoL; their ability to work; undertake family activities; and the additional planning required to achieve some outdoor pursuits. Parents on the whole, failed to mention their child's independence, without discussing the over protection they felt it necessary to provide. Eiser (1997) suggests strong correlations between parent and child ratings are unlikely. However, it is important to identify those contexts in which parents can be expected to make an accurate judgement. Parents are not therefore, necessarily considered an accurate source of information when identifying issues around their child's QoL (Eiser and Morse, 2001b; Upton et al, 2008; Theunissen et al, 1998). Thus parents of children with OI may well be a suitable advocate when reporting on themes such as; reduced function, being safe and careful, and pain, but may not be an adequate proxy overall.

The research undertaken found strong agreement between the groups for themes; being safe and careful, functional ability particularly following fracture, isolation from activity and pain. Although all three groups agreed on the nature of these themes, their justification for the theme was different. There was not agreement however when discussing independence and fear. Young children of all abilities are cared for by their families, so therefore independence is often not anticipated in this age group. With the exception of the very young children, fear was a theme reported by all those interviewed. The impact of fear varied across the group; children had a fear of certain activities that previously resulted in a fracture, parental fear related to anxiety of handling and of safety/separation when the child was at school/nursery or play dates. As expected, younger children were unaware of the over protective actions of their parents, which is a stark contrast to the older children expressing their dislike of parents' attempts to keep them safe and doing everything for them (Hill et al, 2014).

As anticipated many of the themes have a link to fractures; the fear surrounding potential fracture, the avoidance of sustaining a fracture, the resultant pain and reduced function following fracture, and the effect of repeating an activity which previously lead to a fracture (Hill et al, 2014). It has been previously acknowledged (chapter 3) that no other literature or QoL measure contains any link to fractures and the effect they can have on a child's QoL.

Several of the themes identified from the interviews are similar to those in other quality of life measures. This similarity does not however cover all themes identified. Some established QoL measures contain elements of these themes, but no one current QoL measure covers all themes identified, and therefore supports the need to develop a disease specific QoL measure for children with OI. This is particularly relevant for the cross cutting themes being safe and careful and fractures. The CHIP-CE includes the theme 'Risk avoidance', but attempts to assess more risk taking behaviour and its social implications (Riley et al, 2004), rather than the need to be careful in an attempt to stay safe and fracture free.

Themes such as independence, function and some items related to discomfort and pain are included in the Child Health and Illness Profile (CHIP-AE) (Starfield et al, 1995), TACQOL (Vogels et al, 1998) and DISABKIDS-37 (Bullinger, 2002).

The KIDSCREEN 52 (Ravens-Sieberer et al, 2007), has several similarities with the themes identified from the interviews. Its dimensions include; social acceptance, autonomy, moods and emotions, self perception, physical well being, social support and peers, but lacks a dimension which is equivalent to the theme being safe and careful.

Being safe and careful was a recurrent theme throughout all interviews. Parents and children of all ages and severity continued to describe times and events when they had to be safe and careful, all in an attempt to avoid fracture. Children avoided busy areas at school, often choose not to attend parties which involved some form of risk and steered clear of activities such as roller blading and trampolining. Parents and health professionals observed this risk avoidance, often watching the child with OI standing on the periphery of activities. By constantly attempting to ensure safety, it is suggested that both the children and their parents are endorsing a level of isolation.

Isolation was another theme described by both parents, children and health professionals, but there was disparity in their explanation. Health professionals talked of isolation from school following fracture; parents voiced concern regarding isolation from parties and some activities; and children more often described the social isolation of being placed in the learning support area during school break time. This was often instigated by adults to maintain their safety, highlighting potential cross cutting between the themes being safe and isolation.

Pain was described throughout all interviews. Children of all ages and severity described the pain they experienced following fracture, the aches and pains of daily life with OI, and the need for pain relief. The words used to describe the pain were all that differed, with younger children using immature language. Parents and health professionals also reported the effects of pain on the child in their care and the need for immediate pain relief following fracture.

Most of those children interviewed only reported reduced function at times of fracture. Several of those interviewed were wheelchair users, but only one teenager with severe OI reported reduced function compared to her peers on a daily basis when fracture free. It is difficult to ascertain from the interview whether this adolescent had better insight, or was just prepared to be more honest. Parents described reduced function related to fractures and made comparisons between the amount of additional care and practical support required compared to their siblings and peers.

With the exception of the younger children (6-12years), fear was a theme reported by all those interviewed. The impact of fear varied across the group; children had a fear of certain activities that previously resulted in a fracture, parents' fear related to anxiety of handling and of safety/separation when the child was at school/nursery or play dates (Hill et al, 2014).

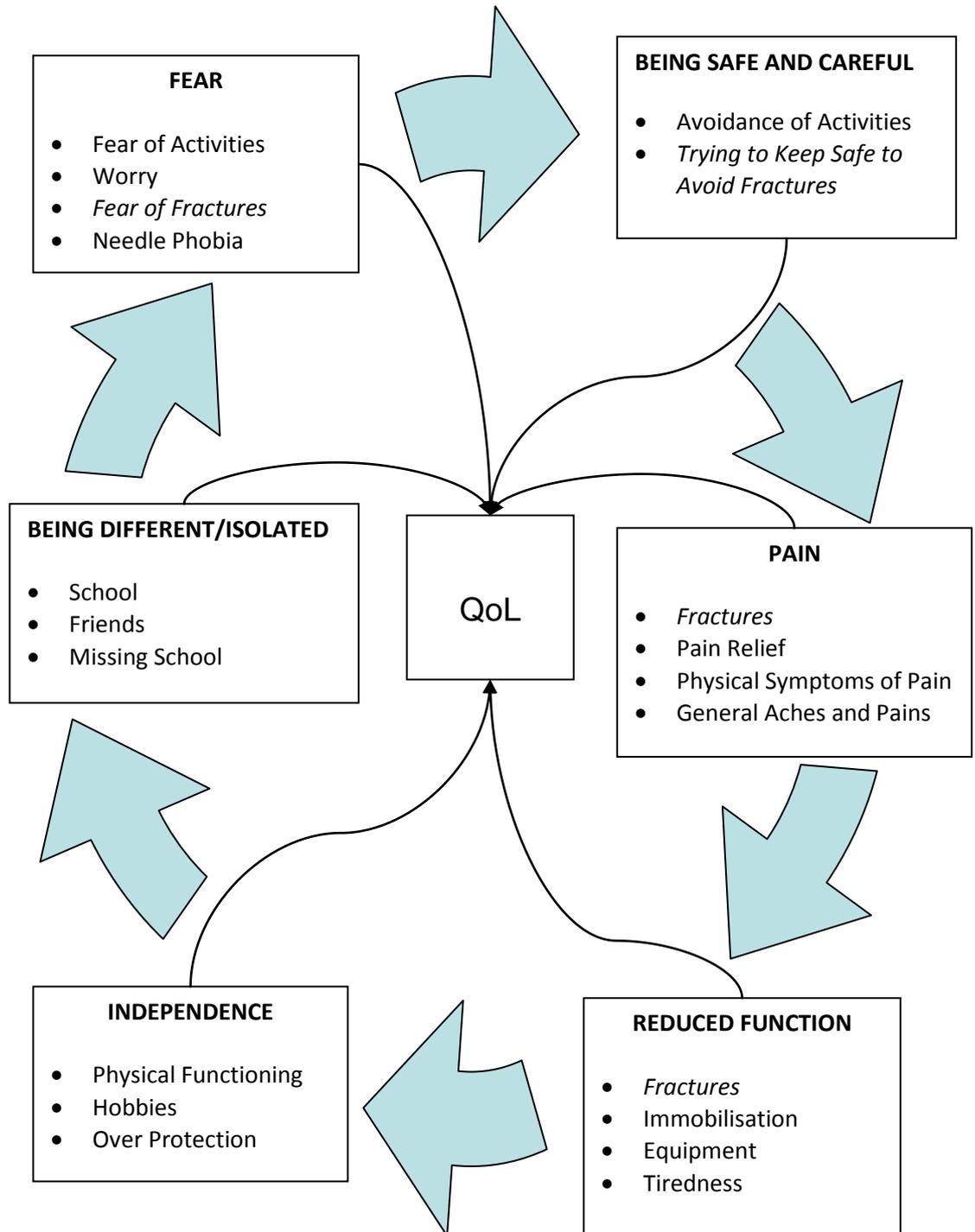
Wright and colleagues (1993) describe the "vulnerable child/overprotective parents" syndrome, where children who are perceived as physically weaker by their parents may receive less encouragement to achieve their maximal physical and emotional capabilities. This is a view which is supported with a degree of conflict between the overprotective parents, the health professionals encouraging independence in activities of daily living and the older child striving for independence. As expected younger children were unaware of the over protective actions of their parents, this is not echoed by their older counterparts who repeatedly expressed their distaste.

As anticipated many of the themes have a link to fractures; the fear surrounding potential fracture, the avoidance of sustaining a fracture, the resultant pain and reduced function following fracture, and the effect of repeating an activity which previously lead to a fracture (Hill et al, 2014). Initially, the theme fractures was considered to be an independent dimension; with further investigation it became apparent that fractures was a theme cross cutting many other more independent themes and was therefore not distinct enough for a dimension of it's own. This link was neither age nor severity dependent.

### 5.5.1 *Conceptual Framework*

The updated conceptual framework is documented in Figure 5.2. It incorporates the information and concepts documented within the previous two frameworks, but places greater emphasis on the concepts elicited from the children themselves and those elicited from parents and health professionals relating directly to the child's QoL. The decision was made to document the framework in this way, as the overall aim of the research was to develop a QoL questionnaire for children and young people with OI. Less emphasis is therefore placed on concepts related to the QoL of parents.

The overriding, most frequently discussed and therefore most important theme was being safe and careful. Although not discussed within the literature it appeared to be linked to several other previously discussed themes. Children avoided crowds and busy areas; choose not to attend parties or take part in high impact 'dangerous' activities; their parents handled them with care; all to avoid having a fracture. Thus, 'not' being safe and careful can lead to a fracture, which in turn causes pain, reduced function and a lack of independence. This in turn can make a child or young person isolated from school and their peers. As a result children with OI and their families become fearful of activities and environments which may result in a fracture. This suggested cyclic nature can be seen in Figure 5.2, however further validation of this cycle alongside the OI population is required.



**Figure 5.2.** Cycle of main themes and sub themes following interviews in the event of a fracture  
 Note cross cutting of sub themes relating to fractures in *italics*.

The commonalities between the themes and concepts derived at each stage of this phase of the research are demonstrated in Table 5.3. Those early postulated clinician based themes, such as; physical functioning; pain; fear/worry; cognitive functioning and social well being, have unity with both themes uncovered from the literature and one-to-one interviews. This enhances the validity of these themes and their place as potential dimensions or items within an OI specific QoL measure. However some themes uncovered from the literature were less closely linked to those identified from the one-to-one interviews or clinical experience. Participants didn't describe their general health as a problem when discussing their QoL and only spoke of their emotional well being in relation to the worry and fear of fracture. This further highlights the previous notion that a generic QoL measure would not fully meet the needs of the paediatric OI population.

Throughout this stage of the research the role played by the principle investigator has included both researcher (interviewer, transcriber, analyst) and clinician. This has necessitated transparent thought processes (previous narrative), methods and analysis. The gradual developmental process undertaken to develop the final conceptual framework (Figure 5.2) has allowed the reader to observe this journey and assess the outcome. It is important to be transparent about the effects of being both clinician and researcher during this process, and acknowledge potential conflict of interest. That the researcher was previously known to the participants could have had an effect on their decision to participate. Notably all those subjects who were approached, did agree to take part. Richards and Schwartz (2002) suggest that when a participant has prior knowledge of the interviewer, they may feel a sense of duty, and feel pressurised to participate. However, those participants who have no prior knowledge of their researcher will have a different set of bias; such as confidence with strangers, lack of trust, fear and anxieties of the unknown (Hoddinott and Pill, 1997).

Hoddinott and Pill (1997) investigated whether it was possible for a GP to 'wear two hats'. They interviewed pregnant women about their thoughts behind breast feeding. Some of the women were from the interviewer's own practice, the others from an independent practice. Interviews were more successful with those participants who knew her profession, as they had a pre existing trust in their GP. Indeed, she found it took considerable effort to establish a relationship with those participants who knew her as a researcher only. They concluded that whether a GP could interview their own patients depended on the research question, and how closely associated it is with aspects of medical care. Our participants were interviewed with regard to how their OI affects their QoL, and were not asked directly about the service and treatment provided.

Richards and Emslie (2000) state that professional background does have an effect on the interview process, as does personal characteristics such as gender, age, social class and ethnicity. A doctor and sociologist respectively, they interviewed 60 middle-aged men and women with heart disease who were informed of their professional status. They concluded from their interviews, observations and reflective diary that often the professional background of the interviewer (in this case doctor) muted the other characteristics such as age and gender, which did not occur when the participants were interviewed by a 'researcher'.

This prior knowledge of participants can produce mixed results; during this piece of research it enabled the researcher to be aware of subtle signs of distress within the interviewees, and probably lead to the awareness of emotional upset within the interview which was subsequently stopped. Having a prior knowledge of the disease and its manifestations also allowed the researcher to become readily immersed within the subject matter and demonstrate empathy with the participants, encouraging a rich source of interview data from which to extract themes. Conversely, this prior immersion dictated a need to record each stage of the development of the final conceptual framework to prevent confusion between themes already known and felt by the researcher (as a clinician) and those uncovered from the literature and one-to-one interviews. It has already been acknowledged that some of the information documented within the initial conceptual framework (Figure 3) may have been influenced by the literature that the researcher has previously read to inform her role as a clinician.

Reflexivity implies having a self awareness about prior knowledge and preconceptions. By representing previous personal and professional experience, preconceived ideas about what is to be investigated, and the motivation behind the research, transparency can be addressed (Reventlow and Tulinius, 2005, Malterud, 2001). Throughout the research reflective information was recorded; thoughts and feelings were documented following each interview, which allowed transparency and self critique of the methods undertaken.

## **5.6 Strengths and limitations**

This phase of the research included one-to-one interviews directly with children aged 6-18 years, parents and health professionals, eliciting concepts from those individuals who have first-hand experience of Osteogenesis Imperfecta. This methodology ensured good content validity of the themes and concepts uncovered. Including children aged 6-18 years allowed concepts to be uncovered from the full age range of the target population, ensuring no individual's opinions were missed. The interviews which took place with parents allowed a comparison of the concepts described by the parents and children to be made, and offered an element of triangulation and validation of these concepts.

The decision to use interviews at this stage of the research rather than focus groups was a further strength; it allowed an initial incite and understanding into QoL in OI in a non threatening, safe, one-to-one based setting prior to discussion within focus groups.

The six main themes were described by both the parents and the children; however the parents also referred to some concepts related to parenting, work commitments, holidays and family outings. These additional themes may have enabled the early development of a parental QoL questionnaire; a missed opportunity which would benefit further consideration and research at a later stage. A further limitation and missed opportunity was the chance to develop a parental proxy questionnaire to enhance the child/adolescent self-report, but not replace it.

The main limitation to this phase of the research was that the principle researcher was also known to the children and parents as a paediatric physiotherapist. This could have encouraged individuals to participate, as they may have felt more comfortable doing so with someone they already knew. Had the subject matter have been to do with patient care or treatment that the families were receiving, the principle researcher as the interviewer would have had a detrimental effect on the trustworthiness of the data. However this was not the case; the topic of conversation was not related to treatment or hospital care, and therefore less affected by the interviewer.

## **5.7 Conclusion**

This data presents an early step in developing items for a disease specific QoL measure for children with OI. Six main themes were identified; being safe and careful, reduced function, pain, fear, being different and independence. There was generally good agreement between the three groups of interviewees, although discrepancies did occur between parents and children with regard to the themes independence and fear. Consequently although parents may well be a suitable advocate when reporting on themes such as; reduced function, being safe and careful, and pain, they are not an adequate proxy overall (Hill et al, 2014).

Several of the themes uncovered showed similarity to other QoL measures, but the addition of being safe and careful, particularly in relation to fractures, demonstrated the need for a disease specific measure for children with OI (Hill et al, 2014).

The next chapter will therefore endeavour to document the next phase in the development of a disease specific QoL measure for completion by children aged 6-18 years. Further generation of potential missing data/themes, followed by validation of previously uncovered themes will be sort within the next phase of questionnaire development.

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## Chapter 6

### Concept Validation

#### 6.1 Aim

The following chapter describes the background, method and results of theme and concept validation for the prospective OI specific quality of life (QoL) tool. Six main themes were uncovered during the item generation phase, involving 25 semi structured interviews, documented within the previous chapter (Chapter 5). These themes were:

- Being safe and careful,
- Reduced function,
- Pain,
- Fear,
- Being different
- Independence.

The main aim of this chapter was to validate the previously elicited concepts (themes and sub themes) and ensure no relevant items or themes had been missed. The method chosen to achieve this triangulation was qualitative focus groups with children and parents who have experienced OI. This validation process would further inform the conceptual framework and ensure high content validity of the proposed disease specific QoL instrument.

#### 6.2 Background

The background and methodological aspects of focus groups have already been discussed in more detail in Chapter 3. This section will report some of the literature where focus groups have been used to identify or validate concepts and themes for inclusion in patient reported outcome measures or quality of life questionnaires; the usefulness of these methods is also considered.

Eiser and Morse (2001) state that a common way of defining items for a QoL measure is to undertake preliminary interviews with patients and clinicians, ensuring a newly developed questionnaire is relevant to the target population. However they express concern with using this methodology alone, as the items generated may be based on the views of only a small number of patients, who agreed to take part, and may not be a good representation of the population as a whole. For this reason further qualitative methods to validate the concepts uncovered and explore any missing themes with additional groups from the target population is thought to further increase content validity.

For logistical reasons it is impossible to interview all individuals effected by a particular disease to ensure all concepts are uncovered, for this reason a representative sample are invited. As discussed by Eiser and Morse (2001), if this sample is a poor representation of the population as a whole, the items generated may not reflect the true picture. A process of validation thus strengthens the confidence in the uncovered

themes and makes certain no items are missed. Questionnaires which are not valid or deemed relevant to the target population will not be as acceptable and completion rates may be low as a result. Focus groups offer further opportunity to gather information about QoL in OI; what patients think about having OI and how it can affect their QoL. Previously generated concepts and themes can be revealed to the focus group participants and they can be encouraged to discuss the concept further, making note of any themes or concept they may feel are missing. The following paragraphs give an overview of previous research studies which have utilised focus group methods.

Heary and Hennessey (2002) reviewed 93 articles where focus groups had been used in children. This review was in an attempt to bridge the gap in knowledge base within the literature, and provide some guidelines on how to involve children in focus groups. More than half the studies were exploratory, involving topics such as; informing health promotion programs, development and expansion of health services and to guide the application of a theoretical model. They reported some studies using focus groups to pre-test a tool by assessing its acceptability to potential respondents.

Amos et al (1997) and Mwanga et al (1998) used focus groups to generate initial themes and subsequent items for inclusion within a questionnaire, although neither group made explicit links between the focus group data and the questionnaire items. There is therefore no understanding of how the themes generated by the focus group were developed into the items within the questionnaire. One exception however was French et al (1994), during their development of the Childhood Asthma Questionnaire (CAQ). They asked a mixed group of children, some with asthma and some without, to discuss some aspects of their lives. These included activities after school, games and physical education. The factors of greatest importance that were generated by the children were subsequently turned into questionnaire items. Their discussion also directed the format of the tool. Their later research (French et al, 1998) used focus groups again to modify the CAQ for another culture.

Stanton and Aronson (1993) triangulated data from focus groups and interviews they undertook with children. They compared the data obtained in focus groups with that obtained via interviews using a pile-sorting technique. Individuals were asked to organise cards with phrases or pictures into clusters or categories based on a perceived shared dimension. They reported the benefits of this technique, as age and gender differences emerged from the pile-sorting, which were not apparent from the initial focus groups. Heary and Hennessey (2002) found credibility was only addressed by a couple of studies they had reviewed. Kidd et al (1997) presented each focus group with the themes that had emerged from the previous groups for discussion and clarification. Running more than one focus group allows a process of verification and deepening of findings from the earlier groups. It allows the moderator to feedback information from the previous literature, focus groups or interviews.

Focus groups can vary in length, but Heary and Hennessey (2002) following their article review found focus groups for under ten year olds were less than 45 minutes, 10-14 year olds maintained discussion for approximately 60 minutes, and young adults talked for a maximum of 90 minutes.

Recording focus groups can involve making notes contemporaneously during the group discussion, making notes of the focus group immediately after the group, or recording the focus group onto either audio or video/DVD media. The audio recording equipment needs to be placed centrally to enable all participants' contributions to be heard. All attempts should be made to reduce the external noise, as this will make the transcription process more difficult. A hospital setting is often not the best place in which to run a focus group, due to extraneous noise, such as ambulances (Bloor et al, 2001). The use of a video tape will aid the transcription process, allowing the transcriber additional visual clues as to which participant is talking and when. Of course this may necessitate a second moderator, who is seated outside the core participants within the group.

### **6.3 Method**

It was deemed necessary to assess the content and suitability of the themes/items generated from the concept elicitation phase of this research (Chapter 5) and the resultant conceptual framework. Examining if the relationship between the uncovered themes and sub themes is well represented within the conceptual framework, alongside ensuring that the target population are in agreement with the themes and the framework was the aim of this chapter.

The conceptual framework (see Figure 5.2, Chapter 5) was developed directly from the paediatric OI population (children, parents, HPs) in conjunction with expert opinion/experience and literature review; reasonable content validity was therefore assumed within this sample of the OI population, but this required further validation with an independent cohort, some of whom were naive to the previous concept elicitation process.

The methodology chosen to validate the conceptual framework or assess the credibility of the themes was focus groups. This methodology was considered appropriate as it attempts to allow a planned discussion in a non threatening way, enabling the researcher to explore the thoughts and opinions of the group with regard to the concepts previously elicited. It was proposed that using focus groups for this purpose would encourage active discussion surrounding the themes, empowering the children to behave as experts within their field. The use of 'theme/sub theme' cards had the potential to act as a visual prompt to the discussion taking place. The justification behind running more than one focus group was to encourage further verification and a deepening of findings. As children and young people with OI have no limitation with learning and are anecdotally often outgoing as a result of a large degree of adult contact, they are well able to communicate and voice their opinion.

It is important to mention at this point in the thesis that the principle researcher had initially planned to run focus groups with all ages of children, for whom the QoL questionnaire would be developed. However this was not possible; the local ethics committee did not offer a favourable opinion to the original plan to hold focus groups for younger children, or the suggestion of running a focus group that included mixed ages. The preliminary method had to be adjusted, and for that reason the focus groups were as described below.

The aim was to recruit children of similar ages, ensuring there were no previous relationships or friendships within the group, to reduce any potential intimidation which may be encountered. Recruitment aimed to achieve a small group of young people, ensuring enough individuals to elicit discussion, but not too large to allow all voices to be heard. Many children and young people with OI have altered mobility and use wheelchairs or walking aids, this leads to larger space requirements for the running of the focus group. As a clinician already known to the cohort, this allowed prior knowledge of the cognitive and social abilities of participants, and therefore aided the planning and moderation of the group.

Two focus groups were chosen; the first group's purpose was twofold; to validate the themes already discovered, uncovering any items which may have been missed and secondly to place the themes in order of importance. The second focus group was used for further validation, but also to uncover information and opinions regarding the most suitable format, the potential measurement scale and recall time for the OI specific QoL measure.

Potential participants were approached via post with an invitation letter and reply slip (see appendix 3) detailing the study. They were made aware that the study was multi faceted with three phases, and informed that they may be approached for inclusion to other phases of the study. An information sheet and consent form (see appendix 4 and 5) were also included in the mail out. Two weeks following receipt of the returned reply slip, possible focus group participants were followed up by a telephone call, to answer any questions and discuss possible inclusion.

Potential participants were asked to travel to SCH for the focus group. Attempts were made to arrange the focus group to coincide with routine appointments, although this was not possible for all participants.

**Table 6.1.** Inclusion and Exclusion criteria

	Recruitment	Inclusion	Exclusion
<p><b>Focus Group 1</b> Up to 10 children and adolescents</p>	SCH patients	<p>Age 13-18 years. Medical diagnosis of OI. Attending SCH for out patient review or inpatient treatment. Ability to understand English. Consent/assent from patient and/or parent/carer.</p>	<p>Unknown diagnosis. Non consent. Previous inclusion in semi structured interviews.</p>
<p><b>Focus Group 2</b> Up to 10 children, adolescents and parents</p>	SCH patients, and parents of SCH patients	<p>Patient aged 13-18 years with medical diagnosis of OI OR Parent of child (age 0-12 years) with medical diagnosis of OI. AND Previous inclusion in semi structured interviews. Ability to understand English. Consent/assent from patient and/or parent/carer.</p>	<p>Unknown diagnosis of patient/child. Non consent.</p>

### 6.3.1 Focus Group 1 (FG1)

The initial focus group took place in a meeting room at Sheffield Children’s Hospital on 20<sup>th</sup> October 2011. It included 4 adolescents aged 13 – 16 years old, three females and one male. None of the focus group participants had taken part in the initial item generation interviews. The group were seated around a circular table, two of the group were wheelchair users and therefore good accessibility was ensured. Biscuits and drinks were readily available to enhance comfort. The use of a table in the centre can make children feel less self conscious (Henessey and Heary, 2005).

The focus group was video and audio recorded, and therefore required two facilitators; one to moderate the interaction of the group and the second to use the DVD recorder. A dictophone was placed in the centre of the group to provide good audio coverage of the conversations taking place within the group. Initially a warm up topic was used to encourage conversation and assist the participants to feel at ease. It was suggested

the group tell each other their name and something about themselves, such as an activity they like to undertake. Both facilitators took part in this activity, promoting a relaxed comfortable atmosphere.

An interview schedule (appendix 6) was used to aid on going concentration on the topic; cards denoting main themes and sub themes were used to encourage conversation around the themes previously uncovered within the one-to-one interviews (Chapter 5). Attempting to validate these themes and therefore enhance credibility. The facilitator encouraged conversation around any possible new themes, attempting to identify any topics thought relevant to QoL in OI, which had been missed from the previous one-to-one interviews. If discussion became slow the facilitator asked questions about the participant's thoughts and opinions around a theme to encourage further conversation and discussion.

Towards the end of the focus group the adolescents were encouraged to place the main themes in order of importance or relevance to quality of life in children with OI. This was done practically by ordering the cards with main themes on the centrally placed table. Participants were asked to discuss why they had placed the cards in the chosen order.

Once the focus group came to an end, individuals were thanked for their participation and both the DVD recorder and dictaphone were switched off.

### 6.3.2 *Focus Group 2 (FG2)*

Focus group 2 took place on 21<sup>st</sup> December 2011. It included two adolescents affected by OI, aged 14 and 17 years old and a parent of two young children affected with OI, who had all been previously interviewed. It was deemed important to capture the opinion of the previous interviewees regarding the suitability and credibility of the quality of life items generated. Whether they felt those themes included were pertinent and similar to those they had expressed during their one-to-one interviews.

The focus group was again video and audio recorded, requiring two facilitators/moderators to accommodate this. A dictaphone was again placed in the centre of the group to provide good audio coverage of the conversations taking place. Similar warm up activities were used to encourage the participants to feel at ease with each other and their surroundings. This group differed slightly in that the participants had arrived early, met in the waiting room, and had therefore begun chatting immediately prior to the focus group taking place. Again an interview schedule (appendix 6) was used to encourage on going concentration throughout the focus group. The topic cards and previously ordered themes were used as visual cues. The moderator encouraged discussion around the uncovered main and sub themes, attempting to discover whether the participants deemed them appropriate and relevant to their or their child's quality of life. Attempts were also made to ascertain whether they had remembered expressing similar themes previously during their one-to-one interviews. Discussion was also encouraged around the format of the quality of life measure, the possible suitable recall time for children; and number of options within the suggested Likert scale was considered. The inclusion of adolescents and a parent

enabled sensible discussion with regard to recall time of children and young people, and therefore all ages of child could be discussed.

Both focus groups were transcribed verbatim, and rechecked on several occasions for accuracy. Significant statements were identified, extracted and organised, undergoing framework analysis (Richie and Spencer, 1994). Agreement or disagreement was noted between the initial themes uncovered and the feedback within the focus groups. Any new main or sub themes were identified and their relationship with previously identified themes was explored.

## 6.4 Results

### 6.4.1 Focus Group 1

Ten young people were contacted via a letter for possible inclusion within the focus group. Eight agreed to take part, but due to timing of the focus group, other appointments and travel to Sheffield Children Hospital, four declined to take part for logistical reasons. Therefore focus group 1 included four young people; a male aged 13 years, and three females aged 13, 16 and 16 respectively (See Table 6.2).

**Table 6.2.** Characteristics of the samples

	<b>Participant*</b>	<b>Age (years)</b>	<b>Severity of OI</b>	<b>Previously Interviewed</b>
<b>Focus Group 1</b>	Amelia	16	Severe	No
	Lola	16	Moderate	No
	Olivia	13	Moderate	No
	Harry	13	Mild	No
<b>Focus Group 2</b>	Jenny	Parent	Moderately effected children	Yes
	Juliette	14	Mild	Yes
	Sam	17	Mod	Yes

\*Pseudonyms used to replace given names to ensure anonymity.

The participants arrived with their respective parents, and gathered for only a short time within a waiting area, but had not formally met or introduced themselves. A couple of the participants had arrived slightly early and their families had been introduced; they therefore had already begun to become at ease with each other. The focus group took place in a small room away from parents and carers, with the participants seated around a circular table. The DVD recorder was set back from the group towards the corner of the room; the Dictaphone was cited more centrally on the table.

The duration of the focus group was 42 minutes. Three of the participants were quite chatty from the onset, one participant was less so, taking longer to warm up. Once all participants had warmed up to the subject matter conversation flowed well, and all participants appeared to be at ease. The group consisted of young people and therefore a lot of joking, laughing and storytelling took place. The young people

compared stories about fractures taking place, canulations going badly and parties they had or hadn't attended in an attempt to gain common ground.

Harry: May be we are like partially solar powered, cos if I'm warm I don't hurt and I've got more energy.

Amelia: It's true.

Lola: Yeah, like when it snows and that I get like right stiff.

Moderator (M): Ah ha.

Lola: It pains

Amelia: I just feel like tin man me when it's cold.

Lola and Olivia: (laugh).

M: Does someone need to oil you?

Amelia: (laughing) yeah, you just feel like you can't move and you are like 'ahhhh'

Harry: They were incredibly over protective; it took me until year 5 until I was allowed to go to the toilet.

All: (huge amount of laughing)

Harry: They wouldn't let me go on my own to the toilet until year 5! And then at lunch time I was either sat

Amelia: Where were you peeing then?

Lola and Olivia: (laughing +++)

Following a warm up question the first theme was set on the table. The main theme card was placed in the centre of the table, with the sub themes 'being safe' and 'being careful' placed around the main theme. The facilitator introduced this theme 'Being safe and careful', and asked the participants what they thought about it, whether it was relevant to their quality of life and if they felt it should be included within the quality of life questionnaire.

Initial thoughts were similar to those described within the one-to-one interviews; the participants were describing trying to be safe and careful, avoiding busy areas, crowds and difficult environments in an attempt to avoid a fracture.

Amelia: I think, I don't ever let myself get into that situation. So when I'm in that situation I think right I'll do this and then I'll be fine.

Moderator (M): Do you?

Amelia: Yeah, so say if there's like a crowd, I'll try and avoid it and just go to one side till that crowd has gone.

M: Yeah.

Amelia: Or if I'm near anything dangerous then I'll try and move around it.

Harry: Yeah if there's a crowd I always go a few minutes early at least.

M: Yeah, do you do that at school?

Harry: Yeah, it's like if you are not 5 minutes early then you have to go 5 minutes late.

Lola: Yeah, I do that.

M: Yeah. And what is it that you are kind of being safe and careful from?

Amelia: Breaking.

Lola: Yeah

An interesting discussion took place in relation to blue sclera and fracture risk, with participants commenting on their eye colour as a warning sign for imminent fracture. This is a topic that has been talked about for a number of years within the OI population, but as far as I am aware no research exists currently to prove or disprove this link. It demonstrates how the group will use this potential link to further avoid risk taking behaviours when they deem their scleral colour changing. Although a proportion of individuals with OI do not exhibit blue sclera, and therefore not all have the ability to monitor the intensity of this colour change in relation to imagined fracture risk.

Amelia: My eyes go blue as well.....They go really blue at the bottom, I don't know why

Lola: Yeah (nodding).....

Harry: My Mum has this thing, if it's really blue then you are going to break today

Amelia: uhha

Harry: If it's not very blue then you're probably not going to break

Amelia: Look in a mirror on a morning and then.....

Lola: (interrupts) that's why I always look at my eyes.

Olivia: Do you do that?

Amelia: I do sometimes, like if I'm going out with my friend, I'll look in the mirror and look at my eyes and see if I am weak, or not, and then I'll decide what I'm gunna do that day. I don't know why, I'm not normal.....

Lola: No cos my Mum's told me if your eyes are right blue then you might fracture, so I look in the mirror every day at my eyes.

The second theme to be introduced to the group was 'Reduced function', this main theme card was again placed in the centre of the table, with sub themes 'tiredness', 'fractures', 'equipment' and 'adaptation' placed around the main theme. In this instance, several participants began nodding their heads in agreement, particularly with the sub theme 'tiredness'.....

M: ..... and also another thing that came up was tiredness.

Amelia: Emmm (laughs) (nods)

M: Oh you nodded your head then.

Amelia: (laughs).

Lola: Yeah, (nods).

Harry: (Nods) yeah tiredness.

M: When do you get tired?

Amelia: Near pamidronate time.....

Harry: (nodding) Yeah, one to two weeks usually.

Amelia: Yeah, 2 weeks before I go really tired and sore.

Lola: I'm always hyper after I've had my pamidronate.

One participant made a small link to feeling tired once she had sustained a fracture. A further participant made a link between pain and tiredness; as I watched him make the link he appeared to have the realisation that from his experience the two themes could not be separated, one precipitated the other, he almost questioned whether they were one and the same theme.

Lola: When I get fractures I'll feel right tired, I go right tired and achy

Harry: I think they actually intertwine, don't they? Because if you have got pain, then it makes you tired.

Amelia: Yeah true.

Harry: And you have to fight it.....(inaudible)

Amelia: Yeah that's true that I never thought of that.

This link appeared to remain strong for him and the other participants throughout the rest of the focus group

Amelia: I must admit though that I did break my rib a few months ago and that I was still a bridesmaid the day after.

M: Were you?

Amelia: Yeah. I was in the bridesmaid fitting and broke my rib, and I still went the day after to be bridesmaid. I was just drugged up.

All: (laughing)

M: You'd had loads of pain relief.

Amelia: Yeah

M: To cope with it

Amelia: Yeah. But I think if. I think if it was an arm or summat like that, I think I'd dodge it.

This was further supported when the participants continued to refer to tiredness, rather than reduced function later within the focus group.

Reduced function in relation to fractures was identified, but small bone fractures were not described as something that interfered with daily life, or rather the participants didn't allow them to.

M: How about when you have had a fracture?

Amelia: I don't know.

M: Can you get around as easy and stuff or

Amelia: No not really, but I just figure, a way round and do something different instead of doing what I was planning on doing.

Harry: It depends....

Amelia: It....

Harry: It does depend on what the fracture is as well

M: How so?

Harry: If you break your little toe, you are not going to really notice

Amelia: No you are not going to

Harry: You're just 'oh, my toes red', still walking, keep going (laughing)

Further questioning around fractures and probing revealed more information with regard to coping strategies. It is difficult to ascertain whether participants were being factual or saying what they felt their peers would expect them to say.

Amelia: (referring to fractures) I think people who have had them most cope with them better.

M: Yeah

Amelia: Like people who walk, I don't think they cope with them as well, as, I don't know, than somebody who has had a lot.

M: What do you think?

Harry: That your amount of fractures increases your pain resistance because.....

M: Do you?

Harry: The more pain you have the higher your resistance to it is really.

The need for equipment was discussed least of all in relation to reduced function. Two participants discussed their bath seat; but more from a comfort and enjoyment sense rather than functional improvement. One participant talked about her downstairs bathroom, which functionally enabled her to be more independent, a second participant talked about the need for better bathroom facilities and waiting for the addition of a wet room, as she couldn't safely function without the help of her Mum.

Amelia: I have got a bench to help me get in and out of the bath.....And a chair, like a chair lift to get me in and out.

Lola: I've got a chair lift

Amelia: Which is good

M: You've got a chair lift? (directed at Lola)

Lola: Yeah, for like getting out of the bath

Amelia: Aren't they comfy, you can just sit on them and .....

Lola: Yeah I just sit back on mine, just sit pressing the buttons

Amelia: I do (laughs)

Olivia: Yeah and I've got a shower whats, you just like go in to and you just like sit on a chair. It's not got like one of those things on (mimics the bottom step of a shower), you know to....

Amelia: Yeah, we have got a downstairs toilet thing and we are getting a new wet room thing, to make it easier for me to get in and out of the shower myself.....Yeah once we get the wet room then I can just crawl in.

The third theme to be introduced to the group was pain. This prompted discussion around pain in cold weather and the stiffness associated with it.

Harry: May be we are like partially solar powered, cos if I'm warm I don't hurt and I've got more energy

Amelia: It's true

Lola: Yeah, like when it snows and that I get like right stiff.....It pains

Quite soon the conversation turned round to pain relieving medication, and how general aches and pains and fractures are managed. Initially the need for pain relief was down played, but as the participants became a bit more comfortable with the subject they began to talk more readily.

Amelia: I just have pain killers with me and just if I feel pain I just take one. But then I don't feel pain that much unless it's cold or something.

M: So do you all take pain relief or medication for pain?

Amelia: I only do if I've broke.....

Lola: If I get pain in my legs (touches thighs) I take pain relief

M: Do you all take pain relief if you have a fracture?

Amelia: Yeah

Lola: Yeah

Harry: Yeah.....

Amelia: Yeah, so that then you can move and be treated after you have broke it, if you get what I mean. So as soon as you hear it, you take one, and then you can be treated after.

Discussions around pain soon turned into talking about how they felt when they had a fracture. How the fracture made them feel and how they experienced pain and dealt with it. Three participants talked a bit more in depth about their experience surrounding fractures, commenting on the sound of fractures, how they knew they had sustained a fracture and anecdotes relating to this.

Harry: its weird hearing a fracture isn't it. It's just like 'click' (demonstrates breaking a length of bone with hands)

Amelia: (covers ears) it's horrible, it like goes arrgh!

Lola: I hate hearing cracks; I just don't like cracks at all.

Harry: It's like getting a twig and going like that (demonstrates breaking a twig with hands), a twigs that's just.....

Lola: I just hate that noise.

Amelia: (interrupts) you can't feel it though straight away, can you like and then you're like was that broke? And then you go, 'oh yeah it was'.

Lola: Yeah

M: So do you have to like move it to know it's broken?

Amelia: Yeah

Harry: I can remember when I was younger and I broke one while walking and it was just, I didn't immediately get pain, so this is what happened to my body.....(demonstrates with hands) I was like walking along, and my leg went and started to do this, getting lower and lower to the floor.

All: (laughing)

Me: And then you got pain

Harry: I got to the bus to get back on to school and I was like just on the floor going like 'hello' (demonstrates clinging on to the bus rail)

All: (laughing)

Harry: Please help

Lola: Yeah

When the main theme fear was placed on the table, one of the more severely affected participants was quick to talk about her experience of being handled by other people and the fear she felt surrounding that. She described still being fearful of being handled by some carers she had known for years, and avoiding being handled where possible. When pushed to say why she disliked this handling, she admitted it was because they may cause her to fracture.

Amelia: It's like my carers, even though I have known them for like 4 years I won't, I don't like them touching me still.

M: Do you still let them?

Amelia: I still let them sometimes, but they don't need to. If they don't need to then I won't let them go near me.

Discussions around fear soon moved on to talk about fear of needles and canulation.

Harry: I don't trust junior Doctors any more with cannulas.....

Harry: The vein collapses

Amelia: Oh mine come out

Harry: You know, I have nightmares of it falling out. Is it going to happen this time?

Amelia: Mine fell out when I was doing physio with Davina.

All: (laughing)

When asked if they had always been scared of needles, or had needle phobia, discussion took place as to why they had become fearful, what had caused it and how it made them feel.

Harry: No it's developed. It developed after the 7, constant attempts to do it.....(jokes) 'is this going to work? No, this one? No' Why do people just keep going, someone actually stabbed the same vein twice in a row. What is the point of that?

Olivia: (Laughs)

Harry: That vein didn't work, go away.

Amelia: I know, you just kind of feel like telling them to shut up don't you.

Lola: They couldn't get blood out of mine once and they had to try about 5 times.

Amelia: I ended up with like plasters all over me hand and up here (demonstrates up arm), I nearly passed out.

All: (laughs)

Amelia: And then they goes, 'oh we'll have to try it somewhere else', and I was like 'you have got to be kidding'

Lola: I cried once because they were trying to get blood out of me and it was hurting me hand.

Amelia: Yeah, they did it once and it just kept pouring out of me.

Lola and Olivia: (laugh)

Harry: I'm not scared of blood and I'm not scared of the thing in it, but I am scared of them putting it in! Do you get what I mean?

Lola: Yeah, you're not scared of....

Amelia: (interrupts) yeah, I don't think I moan a right lot me, I don't think I'm that bad.

Placement of the theme 'Being Different' was controversial, with one participant stating 'bit weird!' The group didn't seem comfortable with the title of this theme and what it represented, even though it had been stated and discussed during the one-to-one interviews. The group immediately choose to talk about being isolated from certain activities, rather than the concept of being different from their siblings or peers.

One participant felt she could understand why some small children felt isolated from parties, and reported that she had done the same, although she had been invited to parties she often chose not to go. Other members of the group agreed with her, and several reasons behind their choice were given.

Amelia: I think that, (points to that paper) I can see why the nippers were, because its danger.....some kids' parties are dangerous anyway.

Amelia: Too dangerous. And I don't like kids running about anyway, so I just, just like 'don't leave me here!'

Lola: Because there is like everyone running around and I just don't like it. I feel like I get paranoid that the kids are gunna knock me over.

Discussion around being different or isolation did not produce as much conversation as the other topics, although the group did eventually talk about other people's perception of them, and not being allowed to do things they felt they could.

Harry: Some people do try and stop peo....you from doing things, but...

Amelia: They do

Harry: But you know you can do it. I get asked at school 'if I flick your arm will it snap?'

All: (laughing) [unable to locate who says what] They do me, that was me that.

Amelia: Say you could try it and see what happens

All: (laughing ++++++)

Amelia: Try it and see!

Lola: Someone asked me 'if I touch you, will you break your arm?' and I went no.

Harry: And there's the opposite end 'if I kick your arm as hard as I can, will it break?' It would break if you did that to anyone's arm. (laughs)

Lola and Olivia: (laughing)

Amelia: Let me try it to you.

All: (laughing)

The final item that was brought to the table was 'Being independent'. Immediately this was placed on the table, participants within the group pointed to the sub theme 'over

protection'. This was occurring in their view at home and school, with grandparents, parents and carers over protecting them. One participant described how it had taken several years before he was allowed to go to the toilet on his own at school, and having to sit with an adult at lunchtime rather than his friends. This produced a large amount of frivolity and jokes, and the moderator had to wait a while for the group to settle as a result.

When asked why they felt people over protected them, they all felt it was to prevent them doing something that would lead to a fracture.

Olivia: They....they think it's their responsibility to make sure that you don't do anything.....

Amelia: I hate having over protections though where they are like don't even move or breathe or you'll break.

Lola: (laughs)

Amelia: I hate that, like they'll say to me 'don't do that you'll break' and I'm like 'I won't, I'll be fine'.

Harry: And they sit you down and say 'stay there'

Amelia: Yeah, the....(inaudible) .in school goes to one of my friends 'don't even touch her', I were like 'shut up!' They can still give me a hug or summat like that because I don't care, and they are like 'don't even go near her'. So I just went, I told them to shut up.

The sub theme 'letting go' was also discussed, with participants agreeing this should also be included within the themes, as three of the participants felt they suffered as a result of some family members not letting go. One participant however felt his parents were very good, although incidentally he was the only participant with a parent affected by OI.

Lola: Well my, my Mum she don't like let me do stuff that I want to do, if you know what I mean.

Me: What like?

Lola: Like if I want to go to a sleep over she has to like think it over and until she can say an answer. Because like I wanted to go to my friends sleep over and she said I can't because it's like too difficult, but I want to like make my own decisions about if I want to go to. I know like what my restrictions are. I know what like; I know what not to do and what to do.

Amelia: Yeah I must admit I do as well, because my Mum had to think stuff over as well, before I go and do something. And I keep thinking none of my friends have to do that, so why should I. And then I keep thinking that she needs to, if you get me.....and so I just think oh I'll let you do it, but I keep thinking I want to do that myself.

Towards the end of the interview I asked the group if there were any themes or topics that they felt had not been covered within their focus groups discussion. One participant suggested PE, and a discussion around this topic developed:

Olivia: PE?

Amelia: Ohh, I just sleep for an hour. I just sit there for an hour doing my own thing.

Lola: I have to do extra work because I don't do PE.

Harry: They force me to do homework whilst everyone else is having fun.

Me: So do none of you do PE?

Amelia: No, I just used to get my work out and just play games on the computer.

Olivia: There's a teacher in our school that's like got a son that's in a wheelchair, so she's put it over to the head, and now I am doing like gym stuff. So I like go on the exercise bikes and the rowing machines and everything in the gym.

Me: Brilliant.

Olivia: I didn't for the first 2 years I were like, I were like doing homework and everything.

Me: So you were completely kept out of PE?

Amelia: We just used to play kiddie games and I didn't like that. You know like those skittles that you get for kiddies parties, you got some of them when you were allowed to have friends over to come and play it with us. But now they don't do anything, so I don't do PE or anything.

Harry: One thing I have to do, I got a new head of PE one year, and we had to persuade them, that football is a contact sport (laughs).

Towards the end of the group I ask them to place the themes in order of importance to quality of life in OI. Discussion took place, but the overall outcome was that being safe and careful, was the most important theme; followed by independence, then fear, with pain and reduced function of equal importance and isolation/being different as the least important theme.

#### 6.4.2 *Focus group 2*

Six young people and ten parents were contacted via a letter for possible inclusion within the focus group. Ten agreed to take part, but due to timing of the focus group, other appointments and travel to Sheffield Children Hospital, seven declined to take part for logistical reasons. Focus group 2 took place in December 2011 and included two young people; a male aged 13 years, female aged 17 and one parent (mother), who had two children diagnosed with OI and had OI herself (See Table 6.2).

The participants arrived and gathered for only a short time within a waiting area, but had not formally met only introduced themselves. The focus group took place in a small room away from parents and partners, with the participants seated around a circular table. Drinks and biscuits were made available, and the room was fully accessible, although all participants were ambulant without the use of equipment. Two facilitators were present; one to record the focus group on DVD, set back from the group, the other to moderate the group was again sited more centrally.

The duration of the focus group was 51 minutes. The participants were quite chatty, but not over familiar. All appeared comfortable talking about OI, not seeming to need a

warm up. This group was less humorous than the previous, but the dynamics were different, with slightly older young people and a parent.

This group followed a similar format to the previous group; main themes and sub themes were placed on the table to aid discussion and focus the conversation. The first theme to be placed on the table was being safe and careful, which initially was felt important to older children by the parent in the group. She felt that her children were currently too young (ages 5 and 6) to think about always remaining safe and being careful.

Jenny: A little bit yeah, how I feel sometimes, because obviously at the moment it's more me thinking for them I don't think necessarily both my children think "be safe and careful".

Conversely, one teenager felt she often thought about being careful, and that although she often wanted to take part in some activities, once she had considered the consequences, she decided not to.

Juliette: You always have to think of activities, and sometimes you might want to do it, but then you have to think if you do it and something happens, what are the consequences of what you have risked doing. So like when everyone else did ice skating and roller blading and I couldn't do it, and I know it just made you think, should I have done it and risked it, but then you think it's a condition that could get worse from that

Sam: I would have to say it is always like on my mind, but not like sort of at the front, you know what I mean, sort of I am not always considering everything but naturally after a while you just start....

Jenny: It becomes human nature?

Sam: Yeah

Juliette: Emmm

Sam: You just get used to.....

Jenny: Emmm

Sam: And I think it would feel weird and a bit sort of riskier not to.....and just like go in for something, I don't think I would enjoy it. Because I am used to now always thinking things through and sort of getting everything organised so that hopefully nothing is to go wrong.

The parent participant felt that her need to keep her children safe and be careful about what activities they took part in, had relaxed as a result of the bisphosphonate treatment they had received. She felt previously she would have worried more about what they participated in, but more recently this worry had reduced.

Jenny: And two years ago there is no way I would have done it, because they were having break after break after break after break, but when you do have time where there is sort of, a bit of a gap and things aren't happening all the time, you feel like, you become a little bit more relaxed perhaps then.....You know I want them to have the life that, you know, other children have.

The second theme placed on the table was again reduced function. Participants discussed the issues of tiredness and equipment, but the discussion didn't move on to reduced function relating to fractures until the parent within the group mentioned it. This may have been because both the teenagers within the group had not suffered a bad fracture recently, they may not have remembered a time when their function had been severely affected by a fracture. Conversely they may not have felt reduced function due to fractures had a large effect on their QoL.

Juliette: I think tiredness is quite, yeah, strong one, because you get tired more easily like, if I was to go shopping for the day, I'll have to have more breaks than someone else who hasn't got OI, because I'll just get tired easier.

Jenny: It's just everything is all a bit too much really, especially towards the end of treatment, when they are ready for the next cycle it's just, it does seem to become quite apparent, it's just you know, a lot more of a struggle than what it is.....

It was only the parent in the group that commented on reduced function after fracture, and talked about serious fractures, which within the OI population, usually means lower limb.

Jenny: Yeah, yeah and you know, sort of mostly so. I think definitely reduced function after fracture, especially if it is a serious fracture, erm, that can be, have a big impact definitely.

The third theme to be discussed was pain. General aches and pains, pain relief and pain of fractures were suggested as sub themes which had been extracted from the previous interviews. The majority of the discussion took place around general aches and pains and pain relief. The parent within the group described having to give her two children some pain relief towards the time when their next Bisphosphonate treatment was due. One teenager stated she always carried pain relief with her so she could take it if required.

Juliette: So I have took to carrying, like pain relief with me, everywhere I go.....Just in case, then if any general pain comes, then I can just take it, and then it slows it off.

Comments were made about the effect of Bisphosphonate treatment on pain relief or the perception of pain and the need for pain relief on the run up to their next Bisphosphonate treatment.

Sam: Yeah, but then after that first treatment, everything was like feeling better than normal, and then I got used to it, used to feeling good.....And then I started to feel actual aches and pains.....That I wasn't realising wasn't an ache and pain before, because it was all the time.....

Jenny: It was part of your life, yeah, you just felt that's what it was all about.

Jenny: I have to give Ellie and Tamsin, erm calpol, towards the end of treatment, they do complain a lot about their legs aching.

Fear was discussed amongst the group, but this centred around intervention and needle phobia, and fear of fractures. All participants had experienced some fear of needles or needle phobia in their children.

Juliette: I'm petrified of needles when I have treatment, I'm horrible with it. Like I can't have my Mum there when they put the cannula in, she panics me more.

Jenny: really frightened, but I think, I don't know obviously how old you two were when you started your treatment, but I think they have got an advantage now of being younger, because they are just used to it, and when you are young. I don't know whether you are just, do you know what I mean? They, they have only been this year that they started seeing that lady (psychologist) and talking through their needle therapy. And more Ellie, but obviously Tamsin came along and just joined in, but erm, no, now there is no worry, I mean they are still obviously it's a bit painful, you know, no one likes it.....

I asked one teenager in the group if they felt they were scared of needles themselves or the pain produced by the procedure.

Sam: I think it's a bit of both, because I know that they are gonna put it in and then take it out again, because it has never gone in first time. So you know, I am just waiting for it to happen.

Fear relating to fractures was described by the situation within which they occurred or the potential consequences of sustaining a fracture.

Moderator (M): How about fear of fractures then?

Juliette: When it's icy.....And you, you want to go out, but it's if you slip, what could happen

One participant described a fear of hospitals, rather than a fear of the fracture itself, stating "It's more the fear of hospitals, then pots, then might be having surgery.....". She also felt it was more the consequences of a fracture....

Juliette: Cos it makes you think well if that happens then I'm gunna be behind on college, and everything else is just gunna, it's gunna have to affect my Mum's work and it's just everything that's gunna follow on after.

None of the participants discussed any fear from handling or being handled or moved by another person. This may have been due to the fact that the individuals within this group were mild to moderately effected and as a result were only perhaps handled by others during times of fracture.

Following the first focus group, the main theme entitled 'being different' was now described by the title 'isolation', as participants had appeared uneasy about its previous name. Individuals within this second focus group still discussed feeling different from their peers stating "I think you just get treated different because you have OI".

Juliette: at college they always try to, and like, like I don't know, they just treat you different cos you've got a condition, and with your friends, if you are doing something and you, and you can't do it properly, they'll be straight there like to help you.

The parent within the group felt one of her daughters disliked being treated differently, or being singled out at school.

Jenny: She didn't like that, cos I mean she was sat in this chair, and it supports her spine, but the entire class basically threw themselves round her and like oh my god, what's this new thing. And she hated it, she hated being the centre of attention, err, but she does happily say 'you know I can't do this because I've got brittle bones'.

Another participant felt conflicted about being treated differently....

Sam: And like you almost want them to treat you the same and then make the little changes, not treat you completely differently and allow you to do things the same as everyone else.

Being different or isolation was discussed within the group, with reference to being separated from friends at break times, or teachers having to have their parents' permission for everything that they wanted to do. It was more closely linked with wanting to be independent and not appearing to be different within this focus group.

Sam: I think with break times, you do find that they seem to presume that because you have OI, you can't go outside and that you need to be inside, and sitting down.....and they were like saying, but we have not got your parent's permission to go outside, and its like, why would I need my parent's permission to do what everyone else is doing, you know, it's just a seat but it's outside and not inside, what's the major issue?

All individuals within the group describe themselves or their children striving for independence and having a determination in their approach to life.

Juliette: It makes it feel like they don't think that you can do it. They are taking it away from you, that you can't do it, when I probably could, if given the opportunity to do it.

Juliette: I think it's because I've got OI, I'm more determined to do things. Because I know I can do them, so I want to do them, because it's something I actually can do.

Jenny: I'm blasted with a picture of her, she had got presents for her teachers, three bags, and she's very little and she is determined that she is carrying these to school, all the way from the car. They were getting dragged on the floor, all sorts. Putting them back down, starting again, but she did it.

Overprotection was described by the group. One participant laughed when she stated her husband tells her when she is getting too over protective, ".....like in the playgrounds and stuff. Like, 'for God's sake you have to let them go'."

Juliette: I think my Mum has only just stopped being over protective. Cos she has now realised that I can make my own decisions and I've made them quite good for the last year, but when I go out she's like going, 'who are you with', so that she knows exactly where I am.....She's got to know where they live, so that if anything did happen she's there, she can be there.

The opportunity was taken with this second focus group to discuss the possible format of the potential quality of life measure; how they envisaged the questions or statements reading, the layout of the questionnaire, the possible Likert scale and the recall duration.

Juliette: ....and I think for children it should be easier to understand, like with smiley faces or cartoon characters..... I think it should be more of a question.

Sam: I'd also say like a little box at the bottom of may be each question, where you can put a little comment if you have got one.

When asked about the recall period the parent within the group felt her children would remember a short time before, but not any great length of time. She laughed when she thought about her younger child (age 5), stating she might only remember the day before, but felt her older one (age 6) would recall things better.

Jenny: yeah she would be able to reflect back, a little bit further, but not a month, or even a couple of weeks really, you are talking about the last 5-7 days.

The whole group felt that the questionnaire should remain neutral, not asking negatively phrased questions, or may be should include a balanced amount of both negative and positively worded questions.

Sam: It needs to be neutral.

Juliette: Yeah, like a mixture of both.....if it is all negative, then they are just going to think well, don't they want to know what I can do?

Jenny: Yeah, you know what I can do, but then you think, well actually if this is what I can't do, it just gets back in your head, and you think oh God, you

know, these things I have not thought about for ages and (laughs) can't do that, can't do that

Juliette: You don't think about it because you can't do it, and then you have to sit there and go; oh well now I think about it I can't do that.

The overall feeling from this second focus group was that the questionnaire should include a balance of both positive and negatively phrased questions, so that those completing it do not feel upset about what they may not be able to achieve. They felt it should have a recall period of no more than a week, as younger children and some adolescents would not be able to remember further back. An area for further comments was suggested, but this may make the questionnaire too subjective and more difficult to compare before and after any intervention, for this reason this suggestion was not taken forward during questionnaire development.

Discussion took place, but the overall outcome was that being safe and careful, was the most important theme; followed by independence, then fear, with pain and reduced function of equal importance and isolation/being different as the least important theme. This rating of importance is demonstrated in Table 5.3, where the necessary changes made to the main themes and sub themes are also detailed.

**Table 6.3.** Overview of Main themes and sub themes following Interviews and Focus Groups

Interviews (fig. 5.2. Chapter 5)		Focus Groups	
Main Themes	Sub Themes	Main Themes	Sub Themes
Reduced Function	Reduced function due to fractures	Being safe and careful	Avoidance of activities
	Tiredness/fatigue		Trying to be safe
	Equipment/adaptation		
Pain	General aches & pains	Independence	Pushing for independence
	Pain of fracture		Overprotection
	Pain relief		Letting go
Fear	Fear of fracture	Fear	Fear of activity/handling
	Fear of activity/handling		Needle phobia
	Needle phobia		Fear of fracture
Being safe and careful	Avoidance of activities	Pain	General aches & pains
	Trying to be safe		Pain relief
			Pain of fracture
Independence	Pushing for independence	Reduced Function	Tiredness /fatigue
	Overprotection		Reduced function due to fractures
			Equipment/adaptation
Being different	Isolation from peers	Isolation	Isolation from peers
	Being different		Being different
			Isolation from PE

 Change made to item name or order of sub themes within the main theme category.

 Increased intensity of colour denotes less important theme.

## 6.5 Discussion

The format of the focus groups varied in nature due to the different characteristics of the participants within the groups. Focus group 1, with no parental influence was noisy, fun and had less structure. The adolescents appeared to want to make a good impression with their peers, and therefore joking, laughing and story-telling took place. Previously concerns have been raised that children may be intimidated, adopting themes voiced by other members of the group (Lewis, 1992); this was not the case in focus group 1. The second group had a different dynamic. The one parent present within the group appeared to make it more serious, discussion still took place, but there was less camaraderie and story-telling. With hindsight it may have been beneficial to run separate parent and adolescent focus groups, which may have reduced the serious nature of the second focus group, but this would have lacked the balance of opinion and voices from adolescents and younger children, even though the latter was via proxy. Both focus groups appeared comfortable with the subject matter, and there weren't any periods when conversation was difficult or long silences were apparent.

Christensen (2004) states that children are often more comfortable in a focus group setting; conversation with their peers is very natural for them, whereas one-to-one discussions with adults may be more unfamiliar. However children with OI have often spent a large amount of time with adults within a hospital setting, and as a result are often confident with adults. The younger participants within this research knew the primary researcher as a physiotherapist within the Metabolic Bone Disease Team, so it is unlikely that they were fazed by either the one-to-one interviews or focus groups; the audio or DVD recording conversely was a new concept.

It is important to remember that children's vocabulary and use of language can be very different from that of adults, which if not monitored can lead to misunderstandings (Punch, 2002). Children of 12 years and over have an increased ability to reason abstractly, solve verbal and mental problems and make decisions using deductive logic (Vaughn and Lill, 1990). It is therefore beneficial, when planning to use focus groups with children, to spend time with them, learning about the way the child participants use language (Kortesluoma et al, 2003). The primary researcher facilitating the focus groups works with children of all ages on a daily basis; as a result is aware of children's language and vocabulary, encouraging comfortable flow and moderation.

One member of focus group 1 was a little slower to settle in to the discussion, perhaps finding the outgoing nature of the other three members a bit overwhelming. For this reason this focus group was more heavily facilitated in the initial phases, with the moderator feeling the need to direct questions to involve all participants. Eventually everyone became more involved and comfortable, appearing to become empowered by the topic/process. This individual may have been more comfortable with an interview type setting, but with a period of increased moderation they soon became more at ease.

Porcellato et al (2002) used 12 single sex focus groups from six primary schools in Liverpool, UK. Each focus group included 4-5 children (mean age 7 years), who were preselected, to ensure the involvement of a proportion of chatty children. The

moderator was then given the responsibility of encouraging the shy children to speak out. They chose to use the recording of the children's voices on the tape recorder as an introduction and ice breaker, as several of the participants were inquisitive about it. The DVD recorder acted as an ice breaker in focus group 1; the participants were initially uncomfortable with its presence, but soon found it fun and began joking around.

A child friendly repertoire of patience, warmth, humour and flexibility is suggested as suitable attributes for a focus group facilitator by Kennedy et al (2001). Christensen (2004) stated she was happy to present herself as a friendly adult who was willing to share appropriate personal information and who wants to learn from children by listening to what they think and feel. Her intent was to create a partnership rather than hierarchical relationship. As the participants of both focus groups were familiar with working alongside the primary researcher in her role as a physiotherapist within the team, they were already aware and somewhat at ease with her as a moderator; a non hierarchical approach was adopted.

Both focus groups were relatively small. Vaughan et al (1996) had suggested small same sex groups for focus groups involving children, and with this in mind Porcellato et al (2002) recruited groups of four to five children of the same gender and age for their study to explore children's perspectives of smoking.

The focus groups within this study contained four and three individuals respectively. The intention was to use small focus groups of children with differing severities of OI, including approximately five to six participants. Logistically this proved more difficult than expected. Focus group one was a little easier to recruit to, as the participants were naive to the research and it was therefore not a necessity that they had taken part in the interviews within the item generation phase (Chapter 4). However, focus group two involved participants who had already been interviewed earlier in the study (chapter 4), thus the number of participants meeting the inclusion criteria was 17. As a tertiary centre, patients and their families travel from all areas of the UK; asking families to travel long distances outside of their appointment time would mean extra time away from school and work. Attempting to gain a small group from this 17, who were willing to attend Sheffield Children's Hospital for the focus group alone proved more difficult; a pragmatic approach was adopted and hence only three participants were involved in this second group.

These scheduling issues were also described by Gibson (2007) who felt focus groups with children and young people can prove difficult; working around the school timetable, homework, exams, after school activities and geographical region (distance to travel) in relation to the venue of the focus group, all lead to difficulties within arranging the focus group (Gibson, 2007).

Greenbaum (1988) suggest the use of single sex groups may be more suitable for some topics. They state that younger children's dislike of the opposite sex can hinder the discussion within focus groups. Alternatively they note older teenager's interest in the opposite sex can also have a negative effect on the group. During both validation focus groups there appeared to be no negative effect caused by the nature of the mixed groups, the young people responded and interacted well with each other, without

appearing ill at ease when discussing topics alongside the opposite sex. This may have been due to the fact the topic was quality of life, and not seen as sensitive in nature. There are also mixed views within the literature with regard to friendship groups and the effect this may have on focus group dynamics. Some authors feel that having a prior knowledge of peers can help with the discussion and comfort within the group (Watson and Robertson, 1996). Others disagree; stating that peer pressure in groups of known individuals hindered the smooth running of the focus group (Spethmann, 1992). None of the members of the validation focus groups knew each other prior to taking part, although the members of focus group 1 did meet informally for a short time prior to the group. As a result of this, they had already begun talking and getting to know one another.

The main aim of focus group one was to validate and triangulate the themes extrapolated from the 25 initial interviews and assess whether the group felt any important themes had been missed. Both face and content validity were examined via this focus group method, as the adolescents were used as both representatives of the target population, and as experts within the field of OI, particularly when this disease was examined relative to a child's QoL.

French et al (1994) used focus groups in a similar way during their development of a childhood asthma questionnaire. They used groups of children, with and without asthma, who discussed various aspects of their lives. The themes of greatest importance were used to inform questionnaire items and the overall format. A little later they used further focus groups to modify their questionnaire to other cultures.

The decision of what format would be used to record the interview was a difficult one. Audio recording would have just required the use of one moderator, but concern around missing vital visual data, or confusing participants voices lead to the use of both audio recording and DVD recording of both groups. This necessitated the need for two moderators, as a second was required to visually record the group on DVD. The use of both recording media proved vital during transcription, particularly of focus group 1. This group contained three teenage girls and one teenage boy. Geographically all the girls were from Yorkshire or Lancashire, and often discriminating between their three accents was difficult when using audio recording alone. The use of the DVD recording enabled the researcher to be aware of which young person was speaking at any one time, and therefore improved the reliability of the data; although this resulted in a more lengthy transcription process.

Hennesey and Heary (2005) state that the moderator's role is three fold:

- To make the group comfortable and at ease
- To keep the discussion focused on the topic and keep all participants involved.
- To ensure that an accurate account of the views of the group is captured.

The groups appeared at ease with both recording media, and the use of the DVD recorder within the first focus group in some respects acted as an ice breaker. The participants were initially a little nervous about its use, but the moderator using the DVD recorder reduced any anxiety by introducing humour and encouraging the participants to feel at ease. The group soon forgot about its existence and the focus group was recorded throughout.

Gibson (2012) found that the use of an audio recorder to record interviews or focus groups actually engaged the child participants, as they likened the process to those interviews they had seen on the television, and therefore elicited interest in the process. They found allowing children to play with the recording media and play back what they had recorded, resulted in shared laughs and an enjoyable experience, therefore producing an increased desire to engage in the process.

All six main themes uncovered from the initial 25 interviews were discussed within focus group one (See Table 5.3). However, one theme not discussed during focus group one was 'being different'. The participants touched on the subject when they described being isolated from some activities and at those times when their peers had asked them about their OI. This latter discussion appeared to revolve around fractures, and how easy it was to cause a fracture in someone with OI. But also included discussion with peers around the pain of fractures and whether it was equitable between individuals with and without OI. It is the view of the primary researcher following almost 20 years experience of working with children and young people that children, particularly adolescents, are keen not to be seen as different from their peers. The group appeared uncomfortable with the notion that they may feel different from their friends who didn't experience OI, and this is in contrast to some of the adolescents interviewed. One adolescent, who was previously interviewed, actually described being different from her peers, as she spent most of her waking hours within a wheelchair. When this was brought up within focus group one, one participant stated that she felt that suggestion was weird. I am unsure whether this contradiction was due to the nature of the perceived camaraderie or peer pressure within focus group, or just demonstrated the difference between individuals.

Neither of the focus groups involved any friendship groups and therefore it is unlikely that peer pressure was completely to blame. Spethmann (1992) felt that peer pressure was diminished in the focus groups they ran, when representative groups rather than friendship groups were used. The participants were on the whole unhappy with the term 'being different', but comfortable when describing their isolation from activities and events with their peers. As a result of this discomfort, there was a need to make an alteration to the conceptual framework, enabling it to become a true reflection of the views of the OI population (see Figure 5.1 and Table 5.3 for further information). The participants of focus group 2 appeared comfortable with the theme isolation (previously being different); participants used the terms interchangeably, the parent describing her children's dislike of being treated differently, and the young people talking about their isolation from activities. As a result of this, being different continued to remain a sub theme within the main theme, isolation.

Discussion around being isolated when attending parties and not being able to do all activities that their peers could take part in, demonstrated a link between 'isolation' and 'being safe and careful' within this group. Several of the participants felt they didn't attend parties when they were younger due to a need to keep themselves safe and avoid dangerous, busy areas, where they could be knocked. A connection was also noted between tiredness and fractures, and tiredness and pain within this focus group. One individual (Harry) had struggled to separate tiredness and pain during his

discussions, and felt he rarely had one without the other. These connections have now been updated within the revised conceptual framework (Figure 6.1).

Two new further sub themes were also elicited by focus group one. These were 'letting go', which was in turn closely related to 'over protection', and isolation or difficulties in participating in physical education (PE). These two sub themes have now been added to the conceptual framework (Figure 6.1)(Also see Table 6.3 for more information).

The theme 'pain' and it's relation to fractures produced quite a dramatic effect within the majority of the focus group one participants. They remembered their previous experience of fracture, how it had felt and what it sounded like. This memory of the sound caused some participants to cover their ears, others pulled a face, cringing and shuddering their shoulders. This joint experience and understanding brought the group together, negating much need for facilitation at that time. Pain was also discussed within focus group 2, as they acknowledged the pain they saw in their children and the aches and pains they took pain relief to reduce.

Fear of fracture or fear of the consequence of fractures (hospitalisation, immobilisation etc) was discussed by both groups. Focus group one however, discussed needle phobia, which was not discussed to such an extent by focus group 2. There was a discrepancy noted between the more severely affected participants and their more mildly affected peers, in relation to fear of handling. The main participant to acknowledge this fear of handling and being handled was the most severely affected individual. None of the other participants, in either focus group, commented on fear in relation to handling, but this may have been due to their lack of knowledge and appreciation of the need to be handled, as they had more independent function. This theme may be important to incorporate within the questionnaire as it may demonstrate differences between subgroups and provide some measure of discriminative validity. For this reason the sub theme 'fear of being handled' remained an important aspect when describing QoL in children and young people with severe OI, negating its removal from the conceptual framework.

There was one noticeable difference within the sample chosen to take part in focus group 1. Three members had genetically had a spontaneous mutation leading to their OI, and therefore had no other family member with OI. One participant (Harry) however, had a family history of OI, with his mother also having the diagnosis, and experience of living with the condition. During their discussion about independence and parents/carers not letting go, Harry felt he had not experienced parental over protection, yet the other participants all commented on it in one form or another. Perhaps this first hand experience of OI had led his Mother to view the need to over protect slightly differently to the other parents. This theme may also be important to include within the questionnaire; it was obviously an important issue for a large proportion of the focus group one participants, but may also demonstrate differences between respondents during questionnaire completion.

The aim of focus group 2 was to further validate the previously uncovered items, but to also examine the thoughts and opinions around how the questionnaire should be formatted, what the recall period should be and how best to word the items within the

questionnaire. Again all main themes previously uncovered were considered appropriate and valid for inclusion within the QoL questionnaire. Several sub themes however were not picked up and discussed within this second focus group. These included; reduced function associated with fracture, pain related to fracture and fear of being handled. The lack of any discussion surrounding the first two sub themes may have been due to the composition of the group. The two adolescents within the group were only moderately affected with OI, and neither had sustained a serious long bone fracture for a number of years. This may therefore not have been seen as a high priority to those participants. The parent within the group did not address either of these issues, and yet her children had previously had a number of serious long bone fractures, requiring immobilisation. The lack of discussion around this latter theme may again have been due to the make-up of the focus group. It is often younger children and those who are more severely affected that have to be handled or lifted on a regular basis by others. As this focus group did not involve someone who was severely affected, this may have been the reason behind the exclusion of this topic.

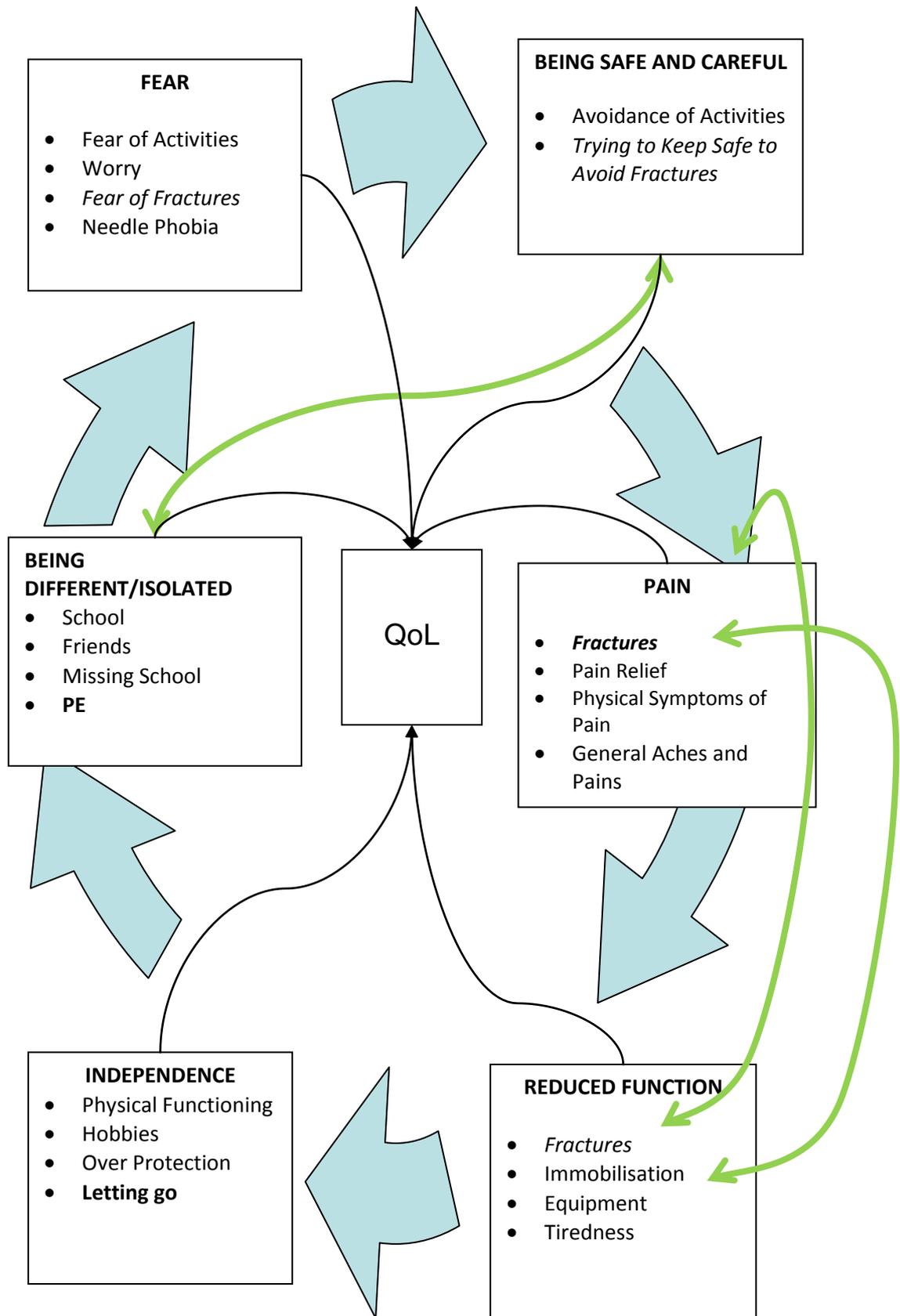


Figure 6.1. Revised conceptual Framework

The revised conceptual framework (Figure 6.1) is now an up-to-date reflection of the concepts relevant to QoL in paediatric OI, and their relationship between one another. For further detail on what changes took place following validation, between the interview and focus group processes refer to Table 6.3. The conceptual framework is cyclic in nature, as this demonstrates the cyclic character of OI and how it affects individuals. It is difficult to separate this circle of potential events, symptoms, attitudes, behaviours and their consequences, which in turn feedback into this cycle to reinforce an altered behavioural pattern and outlook. Further qualitative research to validate this cyclic conceptual framework would be useful to further understand this process and strengthen understanding.

Focus group two was also used to gather information regarding the format of the questionnaire, recall period, types of questions to be included and the scoring system. Walters (2009) suggests that initial literature review and interviews with the target population can be used to inform generation of the dimensions and then the items within a questionnaire. He goes on to state that following this, it is important to consider how the questionnaire will be administered, the choice of recall period, the format of the questions, type of response options and/or scoring system. There is little information available within the literature to describe how best to take the list of previously generated items and turn them into well worded questions. Some suggestions made by Walter's (2009) are:

- Make questions and instructions brief and simple.
- Avoid unclear type faces.
- Avoid questions which may be answered as 'not applicable'.
- Avoid potentially embarrassing questions.
- Consider involving both positive and negatively worded questions.

This transparent approach to questionnaire development is unique. The participants within focus group two discussed several of the suggestions described above. The parent of two younger children felt a recall period of any longer than one week would be too difficult for her children to remember. She felt her younger child (age 5 years) would struggle to remember more than a couple of days. Both adolescent participants felt a month was too long. During the focus group, participants were asked to consider the use of positively or negatively worded questions, and how they felt about answering them. Both adolescents felt the questions should be either neutral, or include a balance of both types of question. No reason is given for this suggestion in Walter's (2009), but a couple of the focus group participants described feeling quite down after answering a negatively worded questionnaire, stating it made them realise what they couldn't achieve rather than identify what they were able to accomplish.

The scoring system was not discussed at length during the focus group, but comments were made about the potential ambiguous nature of some Likert scales. One individual did suggest the use of comment boxes to enable clarification of the chosen answer. This, although a valid suggestion, would provide very subjective open ended data, which would prove difficult to replicate when the questionnaire was repeated at

intervals over a long time period. For this reason, comment boxes are not deemed appropriate for the newly developed measure.

## **6.6 Strengths and Limitations**

A strength of this focus group phase was its ability to offer some validation and triangulation to the previously undertaken interviews. Each of the themes/concepts uncovered from the one-to-one interviews were offered to the focus groups for discussion, allowing them, as a group, to approve or refute each one or provide possible missed concepts. Allowing a naïve group of individuals from the target population to confirm the relevance and suitability of the concepts, strengthens the process and the content validity of the subsequent conceptual framework.

The number of individuals within the second focus group was quite small; alongside the mix of a parent and two adolescents, this may have led to a less productive group. Logistical reasons led to the group being smaller than planned, and the composition including both parent and adolescents could have altered the mechanics. With hindsight, it may have proved more useful to run independent parent and adolescent focus groups, this may have altered the dynamic within the second of the two focus groups, and the young people may have felt more relaxed and able to express their thoughts and opinions.

A further limitation of this phase of the research was the lack of younger children within the focus groups. The initial proposal included a focus group involving younger children, but this was not approved by the local research ethics committee, who were not happy to include the younger children within this phase. The addition of a younger child's focus group would have offered further strength to the conceptual framework.

## **6.7 Conclusion**

Focus group methodology proved useful in validating and further enhancing the content of the previously developed conceptual framework. It also allowed discussion of the format, Likert scale and recall time of the potential QoL questionnaire. This methodology proved both engaging and suitable for young people. The groups soon appeared to feel at ease, with all participants able to express themselves clearly. The experience of the researcher in working with children and young people aided the smooth running of the focus groups.

This distinctive approach of transparent methodology surrounding concept elicitation, validation and the ongoing development of the conceptual framework, to inform item and dimension construction is one of the strengths of this research process. Revisions and updates have been made to the conceptual framework as a result of this validation process. This revised framework can now be used as the basis for the dimensional structure of the OI specific QoL questionnaire.

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## Chapter 7

### Questionnaire and Item Development

The following short chapter discusses and documents the development of the OI specific QoL questionnaire. This phase is often not well reported within the literature; as a result information with regard to how previously uncovered themes and concepts are used to develop items and dimensions within a QoL questionnaire is unknown.

The previously elicited concepts and themes uncovered during the interviews and focus groups led to the development of the conceptual framework (See Figure 6.1. Chapter 6). This framework, alongside the terminology used by the participants, was then used to inform dimension and item development. The subsequent approach taken to develop the QoL instrument is documented below.

#### 7.1 Background

The development of disease specific QoL measures has increased over the last decade. This increase has been driven by the limits placed on paediatric research, by the use of generic self-report and/or parent/proxy measures (Zeller and Modi, 2009). It is often the lack of suitable disease specific tools to measure physical and emotional symptoms that has often been the driving force behind further tool development.

A variety of approaches have been used to develop QoL measures including: adapting adult QoL questionnaires to suit the paediatric population (Landgraf, 2005); expert opinion, alongside discussion and extrapolation from literature (Zeller and Modi, 2009); interviews and focus groups with the target population to elicit themes (Bruce et al, 2010); interviews and/or focus groups with healthy children (Stevens, 2010); or an iterative process involving several previously mentioned techniques to construct a population specific conceptual framework (Hobart et al, 2013).

Further information on questionnaire development has already been documented in Chapter 2. The background information below details previous pieces of research documenting the development of QoL questionnaires.

Previous papers written about QoL measure development are often not explicit about the methods they have used to transform the themes uncovered from interview, focus group or the literature, into dimensions and items for inclusion within the questionnaire. Chaplin et al (2008) describes the use of focus groups with the target population and their parents during the development of their DISABKIDS Smiley questionnaire for 4-7 year olds. They state that statements are elicited from the focus groups which were then reduced to just six items, following a pilot phase. No information is offered as to how these statements were chosen, and how they were transformed into items. This is a common theme across several other questionnaires and QoL measures (Patrick et al, 2002; Ravens-Sieberer et al, 2006; Riley et al, 2004). Some papers, similarly to Chaplin et al (2008), describe initial themes being structured into items, with minimal methodological information on how this was achieved. Newly developed items may then be distributed to experts in a particular field, encouraging assessment of completeness, wording, face and content validity (Bruce et al, 2010).

Bevan et al (2010) combined the two modules of the Child Health and Illness Profile (CHIP) to produce the Healthy Pathways Child Report Scale, which enabled measurement of HRQoL across a wide age range (6-21 years). Within their methodology they report refining and expanding the previously developed conceptual framework from the CHIP, but no information is given with regards to how this took place and whether the target population was involved in the refinement. Many authors (Brod et al, 2014) are not open or transparent about item and dimension development often making large leaps within their methodology making reproduction almost impossible. Others state initial versions are presented to a focus group including parents and children with first-hand experience of the specific disease in question (Parkin, 1997). Corona et al (2011) describes using qualitative methods to elicit concepts, resulting in the documentation of an exhaustive list of new reoccurring topics. These are subsequently validated using medical expert opinion to decide which themes should be included.

Once the dimensions and items are written, the order of the items and their readability needs to be assessed. Reading the questions and answers out loud often uncovers poorly worded or confusing items, allowing revision. Attempts should also be made to group similar items together within a dimension, to aid fluidity and reduce the need for patients to jump topics. Some authors use focus groups or one-to-one interview/discussion with members of the target population to aid the development of the individual items or the response scale (Stevens, 2009). Others develop several variations of the items or questions within their preliminary questionnaire, asking the target population for their opinion on the format, wording and available responses (Carton, 2013).

Once the initial version of the questionnaire is complete, it is important to continue to evaluate and assess the content validity of the scale and the understanding and appropriateness of the items. It is important to demonstrate that the respondents can both understand and interpret the items/questions in a consistent manner (Patrick et al, 2011b). Although this is the final stage of development and alteration prior to psychometric testing, questionnaires should be re-evaluated on a regular basis, as treatment options and patient perspectives change, and this may lead to an alteration in the understanding of the concepts (Basch et al, 2011).

## **7.2 Method**

The combination of both top down (literature and experience) and bottom up (interview and focus group) methodologies used within this piece of work enabled the amalgamation of all the information (themes) uncovered. The diagrammatic representation of the themes uncovered within the semi structured interviews was used to inform the overall concept. As a result information was added to allow further development of the conceptual framework (See figure 5.2. Chapter 5). Supplementary concepts were added to the framework following the focus groups, to further inform the process of questionnaire development and construction of the dimensions within it (see Final conceptual framework. Figure 6.1. Chapter 6).

Themes were explored for connections/links and cross cutting. Initial attempts were made to place the sub themes into three more generic headings; functional, emotional

and impact. This was soon found to be an over simplified view of QoL in paediatric OI. From the final conceptual framework (Figure 6.1. Chapter 6) it can be seen that an OI specific QoL measure is required to meet the needs of the paediatric OI population, as no other generic measure included information on, or the effects of fractures or potential fractures on QoL. This conceptual framework also demonstrates that the theme fractures cross cuts many other themes, further supporting this need for an OI specific measure. This information was felt important to a child with a disease such as OI, where fractures, immobilisation with cast or splints and orthopaedic intervention was common place.

Other generic QoL measures included items relating to avoiding risk, but these tended to be around risk taking behaviour rather than the need to be safe and careful to avoid fractures (e.g. CHIP-CE (Riley et al, 2004; MAPI, 2006). Those children previously interviewed, their parents and health professionals (HPs), all described avoiding fractures by being safe and careful, avoiding crowds and making judgements about the consequences of their actions.

The conceptual framework alongside the item generation and validation was then used to identify dimensions for the QoL questionnaire. Changes that arose within the concepts as the study progressed and the relationship between these themes can be seen more closely in Table 6.3 Chapter 6.

### 7.2.1 *Dimensions and Items*

The main themes previously uncovered were directly placed as dimension headings. These were the most frequently discussed themes from the one-to-one interviews. As previously mentioned (Chapter 6) the original theme 'being different' was replaced with the theme 'isolation', as this appeared more acceptable when discussed within the first of the two focus groups. Several of the individuals in the focus group denied being different to their siblings and peers, but were more comfortable describing the isolation they felt from activities, parties and other social settings.

It was speculated that the master list of suggested QoL issues for children and young people with OI, generated from the one-to-one interviews would be used as potential items for inclusion within the OI specific QoL measure. This list was exhaustive (see appendix 2) and would have lent itself to a very lengthy questionnaire. Therefore items which were reported by all three groups (children, parents and HPs) most frequently were chosen for inclusion. Where possible sub themes and the verbatim comments made by both interviewees and focus group participants were therefore used to construct the items within each specific dimension; aiding the content validity and overall understanding and acceptability of the questionnaire. The choice was made to base the items on a description of frequency rather than severity. This decision was made as the children within the one-to-one interviews and focus groups repeatedly described things related to how often they occurred and rarely in relation to how severe they were.

Items such as avoiding crowds and busy areas, making judgements about activities and sports were moved directly into the dimension entitled being safe and careful. On several occasions two items were used to describe a particular topic. This again was

directed by the information uncovered during the interviews and focus groups, when participants had described similar situations or concepts in differing ways. This could have been due to differences in age or experience across the participant group, severity of the individual or may have been the product of differing use of language and colloquial speech. Where concepts or subjects had been described in two or more separate ways within the interviews or focus groups, it was decided several items would be created. These items/questions may later be reduced following psychometric testing to achieve the most relevant and appropriate version.

Where possible the wording used by the young participants within the interviews and focus groups was used to construct the items. This was felt to improve the overall validity of the QoL measure, but also to make it more relevant to the target population. This increased relevance and therefore comfort would also hopefully aid completion and avoid unanswered ambiguous questions; leading to improved content validity of the final measure (Guyatt and Cook, 1994). It would also encourage missing data to be kept to a minimum.

Some themes were more difficult to construct and format into an unambiguous item. Occasionally it was difficult to grasp the essence of what a child had expressed during the interview and put it into a useful, readable format for an item.

Item construction began towards the completion of theme/concept elicitation. As the themes were uncovered, the verbatim quotes and evidence to support each theme began to become a question or incite an item. Quotes such as “....and then it gets too busy, I’ll go into the library” and “I leave a few minutes early.....before people start pushing out of the classroom” become “I have to be more careful about the things I do” or “I go to quieter areas at school to keep me safe”. Which after careful consideration and revision became; “Do you keep away from busy areas to keep you safe?” and “Do you keep away from crowds to keep you safe?” Some quotes were taken verbatim, documented in the format of a question and placed directly into the questionnaire.

E.g. “I have to take a lot of rest breaks in the day”, became...

“Do you have to take rests in the day?” in the initial version (copy located at the end of this chapter).

We chose to use a categorical response scale for scoring the questionnaire in the format of a Likert scale. A frequency based category was developed as both interviewees and focus group participants discussed concepts, issues or feelings occurring; sometimes; always; often etc. rather than describing an intensity or severity. A five point Likert scale was developed as literature has demonstrated that participants completing a questionnaire can appropriately manage 5-7 response options (Streiner and Norman, 1995). However, Stevens (2010) notes that eight year olds can accurately use a 5 or 7 point scale, but that younger children tend to use more extreme responses. There is little evidence within the literature to suggest what recall period is suitable for children. Previously developed questionnaires vary from present day ‘now’ to several weeks. Discussion that took place within focus group 2 (Chapter 6) suggested that no longer than one week would be appropriate for younger children (age six years), and those older children would manage this recall length with ease.

Following the discussion and subsequent information uncovered within focus group 2 (Chapter 6), it was decided where possible; to positively word the items as negative statements and wording had been described as disheartening and upsetting.

To promote good item format and understanding it was felt important to ask the advice of two primary school teachers, with regard to readability and wording. They were provided with a couple of examples of the items which were proving difficult to create, asking them if they could better construct and reword the item to aid the understanding of younger children. They were consulted on a couple of occasions, and this appeared to improve the readability of those items. The primary researcher discussed the word 'activities', with regards to the younger children and their level of understanding, but they both felt that this term would be well understood by all children of reading age. As expected the term 'over protection' was brought up as a possible concern with regards to understanding; after lengthy discussion it was agreed that a suitable alternative could not be thought of and therefore 'over protection' remained within the questionnaire.

Initial items were tested for reading ability on a small convenient sample of 6 - 8 year olds. These included my children and a couple of their school friends, whose parents had shown an interest in the topic and were keen to help out. This process highlighted items which needed development or rewording.

The children demonstrated no problems reading the overall questionnaire. A couple of items were however difficult for them to understand, and they questioned what the item was trying to ask them. One child (age 7) did question the phrase 'over protect', but this was readily explained by another child (age 8) within the group. The word 'fracture' caused discussion, but they understood the term 'broken bone'. This may be due to the fact the children had no experience of OI, and none of them had ever sustained a fracture or broken bone. Following discussion it was felt that children with OI would have an awareness of this term, but that close monitoring of such items would take place during pilot testing.

Questions such as "*Did you trust people to handle you well?*" and "*Did you worry someone would handle you wrong and cause a fracture?*", became "*Did you worry that someone might move you wrong to cause a broken bone?*" and "*Have you worried about new people handling you?*". After reviewing the first draft questionnaire, one of the primary school teachers suggested the question 'Do the teachers at school allow you as much freedom as you would like?' as an alternative to 'over protection'. Following this advice the question "*Do the teachers at school over protect you?*" became "*Do the teachers at school allow you as much freedom as you would like?*", but this was changed back following discussion with the children, who felt they understood the initial version without any concern. However following discussion with clinical experts and fellow researchers (supervisors), this further question suggested by the primary school teachers to tease out information with regards to over protection and freedom, was then added at a later stage to ensure understanding and coverage of the themes uncovered in the concept elicitation stage.

This process of readability testing did identify concerns with the initial Likert scoring. One child felt the initial version was too complex, and not sequentially how a child

would view their outcome options. As a result of this discussion the Likert scale was reworded, in an attempt to improve understanding and readability. They suggested a differently worded five point Likert scale (see below), which on reflection was far better than the initial (adult) planned version.

#### **Initial Likert Scale**

Always      Almost Always      Sometimes      Almost Never      Never

#### **Likert Scale following changes**

Always      Most of the time      Sometimes      Not Much      Never

This final version is included for reference at the end of this chapter, and is the version used to pilot on 25 individuals aged 6 - 18 years. Previous versions are also available for reference in Appendix 7, ensuring transparency of the changes occurring to the items during this review and development process.

### **7.3 Discussion**

If authors are not transparent about their methodology when developing items and dimensions it is difficult to determine whether the resultant questionnaire is suitable for the target population or specific disease. Moreover, content validity is not ensured.

Bruce et al (2010) describe a similar methodology to the one documented within this thesis in Chapters 4, 5 and 6. They reviewed the literature and ran focus groups to uncover themes to develop their HRQoL measure in paediatric long-term anticoagulation therapy. Once saturation had been reached the exhaustive list of items and their conceptual framework was given to a panel of experts (two Doctors, a nurse, a pharmacist) who then developed the HRQoL measure. No description is provided as to how the measure is developed and therefore the process could not easily be repeated. Our methodology attempted to be more transparent, using the direct wording from the interviews and focus groups, alongside the main themes within the conceptual framework as the basis for the items.

Patrick et al (2011a) states the process between concept elicitation and testing of the instrument is its development. This is an iterative process of drafting, evaluating and revising. They state that selecting the content of an instrument involves comparing interview and/or focus group data, to literature and expert opinion. They go on to state that the language used within the items should be as close as possible to the language of the interview and focus group participants. We chose to replicate this within our methodology and attempted to include the participant language from both the interviews and focus groups. However as the OI specific QoL measure is for child self completion, we tried where possible to use the child's interview quotes alone to populate the instrument, as using health professional or parental quotes would not have promoted high content validity for children.

Corona et al (2011) also describes running a similar methodology to Bruce et al (2010); they used semi-structured interview questions which had been informed by the

literature, to elicit concepts from parents of children with early onset scoliosis. These concepts were then rated by both expert and parental groups with regard to their relevance and subsequent inclusion within the early onset scoliosis questionnaire; they were also asked to provide any possible missing items or concepts. This group do not detail how these revised items become formatted or organised within the instrument and we are left to assume that the list of items are imported directly into the questionnaire. No information is given about the recall period or the potential Likert or appropriate rating scale. Alternatively the methodology used to develop the OI specific QoL measure describes how several of the items were developed and adapted, and how a small group of young children and primary school teachers were used to improve the readability of the items and the suitability of the Likert scale.

Shaikh et al (2009) developed their patient reported outcome measure for children with streptococcal pharyngitis slightly differently. Their initial concepts were gathered from literature reviews followed by an expert panel teleconference to confirm items and discuss completion instructions, format and choice of wording. These concepts were then discussed with 18 school aged children within an interview setting, where they were asked to rate the items. The mean 'importance' of each item was then used to rank them; low ranking items were omitted. Again they provide minimal information on how these items became questions or statements within the measure, negating understanding or reproduction of the process.

Like other groups Brod et al (2014) used literature reviews, telephone interviews with experts and patients, and focus groups to inform the development of their conceptual framework, from which the items for their disease specific instrument was developed. They were not transparent about how the items were worded or rated, and if they had an external help in doing so.

However several groups were more open about their methodology. Edwards et al (2005) demonstrated excellent openness and transparency of their methodology to develop a craniofacial-specific QoL assessment in adolescents. They provided a 13 step method highlighting how concepts were elicited, then transformed into items and later validated using cognitive debriefing. They attempted to stay as close as possible to the wording uncovered from the interviews. Parkin et al (1997) were also transparent about their methodology, allowing repeatability. They generated items for the pool from the literature, peer interviews, parental and family interviews. Item reduction took place with children and parents, who were asked to rank the importance of each item. This reduced set of items comprised the basis for the first version of their questionnaire examining HRQoL in children with spina bifida. Stevens (2010) interviewed over 70 children to elicit concepts and items for her health utility measure for school children. She used the wording uncovered in the interviews as the basis for the QoL measure to ensure good content validity.

These latter groups used appropriate transparent methodology ensuring good face and content validity, as opinion and feedback was sought from a relevant population at several stages during the development process. This was also the aim of the methodology used during the development of the OI specific QoL measure.

## **7.4 Strengths and limitations**

Transparency throughout all stages of questionnaire development has allowed the children's own thematic based quotes to be used as items within the OIQoL, encouraging high content validity and acceptability of the newly developed questionnaire. Its readability, understanding and scoring format was assessed and improved with the help of a small sample of young children, to ensure suitability, comprehension and comfort across the younger age range. This transparent process has not always been documented previously in studies describing the development of QoL instruments or patient reported outcome measures.

Gaining the opinion and assistance of primary school teachers was a useful exercise to assess readability and aid the construction of some items which were more difficult to conceptualise. Working with a small group of younger children to improve the understanding of the Likert scale was also a useful exercise and strengthened the newly developed questionnaire. However using a small purposive sample of the OI population to rank the importance and relevance of the newly constructed items would have improved this process and increased both content validity and appropriateness of the included items.

Gaining further understanding about the nature of the Likert scale would also have proved worthwhile. Using the target population to assess the levels within the Likert scale would have enabled a greater understanding of the intervals between each level, and whether they were close to being equal. This would have offered more validity to the Likert scale, which although is a set of ordered discreet items, having more information with regards to the behaviour of these items, or the nature of the items as perceived by the target population would have been beneficial.

## **7.5 Conclusion**

The process undertaken to develop the disease specific QoL measure for children with Osteogenesis Imperfecta incorporated both top down and bottom up methodology. This enabled the views and opinions of both experts within the field and families to be incorporated alongside previous literature, ensuring content validity. Previous studies have often taken a single approach only, either choosing to review the literature and develop the measure with the help of experts within the particular field, or to make adjustments to an adult based instrument. This can lead to poor validity and the development of a tool which misrepresents the population it is attempting to measure.

The use of a conceptual framework enables transparency and openness during the development, and allows review of the developers thought process and the actions taken during instrument or questionnaire development to be monitored and reproduced. Many authors are not open or transparent about item and dimension development often making large leaps within their methodology making reproduction almost impossible.

Following production of the initial version of a quality of life measure it is important to examine the acceptability, understanding, ease of reading and completion of the

measure on the target population. To do this the measure needs to be piloted on a small sample from the relevant population, and post completion interviews undertaken. The following chapter describes this pre-testing process and any changes made as a result.

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**Version 1. OIQoL**

**Being safe and careful**

Thinking about your last week

Does someone give you extra help to keep you safe?	Always	Most of the time	Sometimes	Not much	Never
Do you keep away from busy areas to keep safe?	Always	Most of the time	Sometimes	Not much	Never
Do you keep away from crowds to keep safe?	Always	Most of the time	Sometimes	Not much	Never
Do you try to keep safe to stop you breaking a bone?	Always	Most of the time	Sometimes	Not much	Never
Do you keep away from some activities to stop you having a broken bone?	Always	Most of the time	Sometimes	Not much	Never
Do you think before playing sports to avoid having a broken bone?	Always	Most of the time	Sometimes	Not much	Never

## Reduced Function

Thinking about your last week....

Have you felt tired in the day?	Always	Most of the time	Sometimes	Not much	Never
Have you felt tired by the end of the day?	Always	Most of the time	Sometimes	Not much	Never
Do you have to take rests in the day?	Always	Most of the time	Sometimes	Not much	Never
Has having a broken bone stopped you doing things?	Always	Most of the time	Sometimes	Not much	Never
Has it been more difficult to move around because of a broken bone?	Always	Most of the time	Sometimes	Not much	Never
Have you had to do things differently because of a broken bone?	Always	Most of the time	Sometimes	Not much	Never
Do you use equipment to help you to move around?	Always	Most of the time	Sometimes	Not much	Never
Do you have to use equipment to help at school or home?	Always	Most of the time	Sometimes	Not much	Never

## Pain

Thinking about your last week....

Have you had pain in your back?	Always	Most of the time	Sometimes	Not much	Never
Have you had pain in your legs or arms?	Always	Most of the time	Sometimes	Not much	Never
Have you had to take medicine for pain?	Always	Most of the time	Sometimes	Not much	Never
Have you had to take medicine because you broke a bone?	Always	Most of the time	Sometimes	Not much	Never
Did you have pain because you had a broken bone?	Always	Most of the time	Sometimes	Not much	Never
Have you missed meeting up with your friends because you had pain?	Always	Most of the time	Sometimes	Not much	Never

## Fear

Thinking about your last week....

Have you been worried about breaking a bone?	Always	Most of the time	Sometimes	Not much	Never
Do you get scared about doing something that might make you break a bone?	Always	Most of the time	Sometimes	Not much	Never
Do you worry about coming into hospital?	Always	Most of the time	Sometimes	Not much	Never
Do you get scared about needles?	Always	Most of the time	Sometimes	Not much	Never
Did you worry that someone might move you wrong and cause a broken bone?	Always	Most of the time	Sometimes	Not much	Never
Have you worried about new people handling you?	Always	Most of the time	Sometimes	Not much	Never

## Isolation

Thinking about your last week....

Did you see your friends outside of school?	Always	Most of the time	Sometimes	Not much	Never
Are you able to do everything your friends do?	Always	Most of the time	Sometimes	Not much	Never
Did you get to do lots of different activities?	Always	Most of the time	Sometimes	Not much	Never
Did you do PE at school?	Always	Most of the time	Sometimes	Not much	Never
Do you feel different because you have to be more careful than your friends?	Always	Most of the time	Sometimes	Not much	Never
Have people treated you differently because you have brittle bones?	Always	Most of the time	Sometimes	Not much	Never

## Independence

Thinking about your last week....

Did you like to do things for yourself?	Always	Most of the time	Sometimes	Not much	Never
Did your family encourage you to do things for yourself?	Always	Most of the time	Sometimes	Not much	Never
Do you have as much freedom as your friends?	Always	Most of the time	Sometimes	Not much	Never
Do your family <b>let you</b> make your own decision about what is safe?	Always	Most of the time	Sometimes	Not much	Never
Do the teachers at school over protect you?	Always	Most of the time	Sometimes	Not much	Never
Do the teachers at school stop you doing things that you think are safe?	Always	Most of the time	Sometimes	Not much	Never
Do your family let you choose your own activities?	Always	Most of the time	Sometimes	Not much	Never

## Chapter 8

### Pilot of pre-testing of the initial questionnaire

The aim of the pilot study was to examine the instrument development process, to assess the patient's understanding of the initial draft instrument and address any need for alterations and revisions. This chapter aims to identify any need for further questionnaire development and make an early assessment of validity and reliability.

#### 8.1 Background

Smith et al (2005) state that best practice guidelines should be followed when developing questionnaires, items and response scales. The questionnaires should be simple and clearly phrased to minimise ambiguity and bias; include easy to follow instructions; incorporate a short time frame, and have mutually exclusive response options.

Patrick et al (2011b) describe the pilot stage taking place following initial instrument development and item crafting, during the concept elicitation process. They go on to describe the need to assess whether the questionnaire captures those aspects that are important to the respondents, and whether the respondents understand how to complete the instrument. The background literature related to the pilot testing of newly developed QoL questionnaire and PRO measures has already been discussed in Chapter 3, the following information describes research studies detailing the pre-testing or pilot testing of newly developed instruments, and how previous authors have undertaken this process.

Smith et al (2005) report several methods which can be used to assess a participants' understanding of the items within a newly developed questionnaire. Techniques such as asking the respondent to rephrase the question as they understand it; or asking respondents to think aloud as they complete items; or after each item, asking the respondent how they arrived at the particular answer that they chose, can be employed. These methods are felt difficult to employ with participants who have dementia (Smith et al, 2005), and therefore would be more difficult to undertake with younger children. Observing children completing the questionnaire is an easier method from which to gain information and feedback about its suitability and ease of completion. This would enable feedback without the children struggling to find the vocabulary to describe what they think the question is asking them. During completion they could be asked what they are thinking, why they have paused on a particular item or why they feel it took them longer to answer some items. This will also encourage feedback and information without the subjects feeling compelled to be positive.

Groenvold (1997) describes using a short 'debriefing form' following questionnaire completion with a group of 14 breast cancer patients. This included questions such as; how long had it taken to fill in the questionnaire; whether they had received assistance from others in completing the questionnaire; whether any items were confusing or difficult to respond to; whether any items had been upsetting; and whether they had any further comments. Within a sample of adult patients this may work well, but with children would be more difficult to achieve. This is a useful method, and less time

consuming than face-to-face interviews, but does not allow any observational data to be recorded and may be open to acquiescence bias, as respondents attempt to be over positive about the questionnaire and over confident about their ability to complete it. Others have used post completion cognitive interviews with the target population to ascertain understanding, readability, comfort and suitability of the newly developed measure, prior to psychometric testing and item reduction (Gorecki et al, 2013).

A semi structured interview guide can be used to keep the cognitive interview on track, encouraging a four stage process (Tourangeau, 1984). The interview should aim to gain insight into:

- The understanding of each question/item,
- The information that the subject can pull from memory,
- The judgement the subject is making about what information is required,
- How the subject forms their response.

Shaikh et al (2009) used post completion interviews with eleven school aged children during their development of the patient reported outcome measure for children with Streptococcal Pharyngitis. They questioned the children about any difficulties in understanding instructions, or understanding the meaning of each item.

Questions can also be asked about the recall period; in our instance, is it possible to think back over the last week about symptoms or problems? Is this time period too long or too short? Observations of respondents having difficulty remembering back over the last week, or doing this with ease should be documented. If respondents do not understand a question, or the question is ambiguous in any way, respondents may choose not to complete it. Questions or items can also be missed if the respondent feels uncomfortable with the subject matter, or feels they do not want to answer due to the nature of the question. Smith et al (2005) reported an acceptable questionnaire would have less than 5% missing data and there would be less than 10% floor or ceiling effects noted on summary scores. As a result of this pre-testing changes and improvements can be made to the newly developed questionnaire.

It is of course not possible to address all the issues or suggestions raised by the subjects, although it is important to demonstrate that the questionnaire is understandable and relevant to the target population. When an item is revised it is important to document this process, being transparent about why and how the changes were made. QoL instrument development does not take place in a linear fashion; the process is iterative, involving ongoing modification and validation.

Several groups have used a pilot or pre testing phase to gain some insight into the acceptability and psychometric properties of the initial version of their newly developed questionnaire. Shaikh et al (2009) during their development of a patient reported outcome measure for children with a streptococcal pharyngitis examined inter-item correlations and Cronbach's alpha for their scale to determine whether the scale reflected the same construct. Inter-item correlations of less than 0.2 and Cronbach's alpha greater than 0.7 was considered to demonstrate good internal consistency.

Brod et al (2014) developed a disease specific measure to assess the impact of growth hormone deficiency treatment in adults. During their validation phase, immediately following cognitive debriefing, they measured validity by using their newly developed tool alongside previously developed well known measures. They examined the level of missing data, floor and ceiling effects, item-to-total and item-to-item correlations to inform item reduction.

Tsakos et al (2012) used psychometric analyses on their SOHO-5 instrument, which involved assessment of internal reliability (Cronbach's alpha, item-total and inter-item correlations), alongside evaluation of content and face validity. The latter were based on patient comprehension of the questions and expert review as to whether the questionnaire covered what had been discussed within the previous item generating focus groups.

Although some psychometric analysis is undertaken in the pilot stage, early item reduction when patient numbers are relatively low, is usually based on the judgement of the investigator. The latter stages when psychometric methods are undertaken with larger patient numbers, allows more scope for item reduction (Fayers and Machin, 2007).

## **8.2 Method**

Twenty five children aged 6-16 years took part in the pilot phase of questionnaire development. The sample was purposive for age and severity of OI. The participants were sampled from those attending a tertiary Metabolic Bone Disease Clinic at the Sheffield Children's Hospital, UK for treatment or active monitoring. Patients were excluded if they had already taken part in phase 1 of the study (Chapters 5 and 6), if they had an unknown diagnosis or did not consent.

Patients were initially approached via post with an invitation letter and reply slip (see appendix 3) detailing the study. Potential participants were made aware that this study was multi-faceted with three phases and that they may be approached for inclusion to other phases of the study. An information sheet (appendix 4) and consent form (see appendix 5) were included in the mail out. Those patients who expressed an interest to take part in the study were given the opportunity to discuss the study further and ask any questions, during their next visit to SCH. A quiet area, away from the hustle and bustle of usual hospital life, was arranged for the visit.

Informed consent was gained from the parent and written assent from the patients under 16 years of age. Young people aged 16-18 years could consent to take part, but consent was also sought from their parent or carer. Consented individuals received a copy of their consent/assent form for their records.

Each of the 25 children and adolescents were asked to attempt to complete the newly developed OI specific QoL questionnaire (OIQoL). Although the questionnaire was developed to be self-completed, parental supervision was allowed and often dependent on reading age and ability of the child.

Completion of the questionnaire was observed by the primary researcher (CH); any help required was recorded, alongside the type and amount of help provided. Notes

were taken by the researcher, identifying and recording questions which were asked, comments that were made, pauses that took place, and any facial expression indicating confusion. Where respondents required additional help this was gained from their parent or carer. If items/questions were deemed particularly difficult questions were directed towards the researcher, and discussion took place. The notes made by the researcher and any reflections made were documented. Completed questionnaires were retained by the researcher, and the answers obtained were input into an Excel spread sheet to aid statistical analysis.

Following completion of the questionnaire participants were asked to provide feedback in the format of a post completion interview. These were semi structured in nature and a schedule was used to guide the interview (see Appendix 6), encouraging the respondent to describe and evaluate their experience of completing the questionnaire. Subjects were asked questions such as:

- What did you think about the questionnaire?
- Was the questionnaire easy to answer?
- Were there any questions that you did not understand?
- Were there any questions that did not make sense?
- Were there any questions that you did not like or didn't want to answer?
- Did any questions upset you?

Respondents were then given the opportunity to suggest any changes and/or improvements to the questionnaire or the individual items within it.

The interviews were audio recorded and transcribed verbatim. The transcripts underwent framework analysis, looking to identify reoccurring themes and therefore issues with any items within the questionnaire, the wording or format of the overall questionnaire. Common problems were examined and documented, allowing changes and improvements to be made to the questionnaire as a result.

SPSS (version 20) was used to examine some simple psychometric properties of the initial version of the questionnaire. Any patterns within missing data were documented; if items were regularly not completed, this may indicate an issue with a respondent's understanding of the item, or comfort around its completion. Floor and ceiling effects were examined for each individual item, although causal items related to symptoms were noted. Cronbach's alpha scores were used to analyse reliability of the questionnaire, examining the internal consistency between items and the overall score for each dimension and the questionnaire as a whole.

### **8.3 Results**

The first twenty five individuals approached to take part in this phase of the study agreed to do so. The participants range from 6 to 16 years and included eleven boys.

There was mixed severity of OI including; eight children with mild disease; twelve children who were moderately affected and five children with severe disease. Seven children required help to complete the questionnaire, and these participants were those younger children aged 6-10 years (see table 8.1). This help included reading the questionnaire, discussing the most appropriate answer, providing examples of activities or situations which had arisen over the last week to support the item in question and in one case, encouraging ongoing completion towards the end of the questionnaire. One parent commented that:

Mum (PS1): I think it's appropriate that somebody is with him so that you can explain some of the questions, because sometimes you might have, you think it's one answer, but when you read the question again, you're doing the wrong answer.....it's just a case of not reading it too quickly.

All twenty five participants managed to complete the whole questionnaire (39 items), and all twenty five agreed to take part in the post completion interview. Interviews ranged from 2 minutes 49 seconds to 7 minutes in length. Each completed questionnaire was coded numerically from the Likert scale (Always = 1, Never = 5) and the scores were input into SPSS to allow statistical analysis. Raw scores were then transformed to a 0-100 scale; taking into account those items which are reversed scored (items Q27, Q28, Q29, Q30, Q33, Q34, Q35, Q36, Q39). To achieve this items which are reversed score were recoded. Item scores were then added together to produce dimension scores, which were subsequently transformed to a 0-100 scaled score.

The mean age of the participants were 14.0 years and ranged from 6 to 16 years, 56% (14/25) were female, 32% (8/25) had mild OI, 48% (12/25) had moderate OI and 20% (5/25) had severe OI, 28% (7/25) had help to complete the questionnaire.

**Table 8.1.** Characteristics of the sample (n=25)

Participant	Age	Severity of OI	Sex	Help Given
PS1	7	Mild	M	Yes
PS2	8	Mild	F	Yes
PS3	10	Mild	F	No
PS4	13	Moderate	F	No
PS5	8	Moderate	F	No
PS6	6	Severe	F	Yes
PS7	10	Moderate	F	No
PS8	14	Moderate	F	No
PS9	8	Moderate	F	No
PS10	8	Moderate	F	No
PS11	10	Moderate	M	No
PS12	16	Mild	F	No
PS13	8	Mild	M	Yes
PS14	9	Moderate	F	Yes
PS15	14	Mild	M	No
PS16	15	Moderate	F	No
PS17	12	Moderate	M	No
PS18	6	Severe	F	Yes
PS19	10	Moderate	M	Yes
PS20	14	Severe	F	No
PS21	8	Moderate	M	No
PS22	15	Mild	M	No
PS23	9	Mild	M	No
PS24	10	Severe	M	No
PS25	11	Severe	M	No

### 8.3.1 *General reflections*

Overall the questionnaire was well received.

Me: What did you think about the questionnaire then?

PS1: They were brilliant.

Me: Was it easy to answer?

PS1: Emm, most of the time (boy, aged 7)

Me: What did you think about the questionnaire?

PS12: Yeah, it was good?

Me: Was it easy to answer?

PS12: Yeah (girl, aged 16)

Some of the younger children found concentrating on its completion more difficult, becoming a little bored towards the latter pages. Those older children appeared able to remain focused throughout and were enthusiastic. Some of the teenagers were

happy for the diversion from the mundane visit for a four hour infusion. A couple of the older participants PS12 and PS16 asked if they could complete their questionnaire away from their parents, as they would be nosy. This was allowed as on both occasions and the parents were happy to do so. One parent showed good insight into her 13 year old daughter when she commented;

Mum (PS4): .....I think some kids might not tell the truth in front of their parents.

Most pauses took place when participants attempted the questions surrounding fractures in the last week (items Q10, Q11, Q12), and those which described pain (items Q18, Q19). Occasionally this was due to participants rushing in and completing the question before considering if the fracture or resultant pain had actually occurred in the last week.

Discussion took place around several items; those previously mentioned relating to fractures and/or resultant pain (items Q10-12, Q18, Q19), but also some later items within the questionnaire. Younger children often had a discussion around items within the isolation category, as parents commented on their chosen answers and this sparked discussion and explanation of their choice.

Mum: .....I think your (points to Son) interpretation of the questions isn't always the same as mine (laughs)....

Me: Or the answer?....

Mum: Or the answer for that matter (laughs)

Older children often discussed items within the independence dimension, as they were pushing for more independence, a reduction in any over protection and to be like their friends. Many children confirmed what equipment should be included in items Q13 and Q14, but were happy to complete the item once they had verified a certain piece of equipment could be included.

One of the eight year old girls was very mature in her approach to completion. She read each question carefully in her head and then thought about the answer before marking it down. She had attended hospital with her Dad, who did not offer any help with questionnaire completion, so her understanding was checked on a couple of occasions, but it appeared to be fine. She was at ease with the topic, although did joke about how long the questionnaire was and how many pages there were to complete.

The youngest child to complete the questionnaire was a 6 year old girl. She had good reading ability and understood what was asked of her. Her Mum had initially asked her to read out the questions, but she was quite self conscious and eventually completed it herself with Mum looking over her shoulder. When she came to the isolation dimension, she did state that some of the items were quite hard, and although she read them with ease, she seemed to take longer deciding on the answer. She appeared a little distracted when she completed the independence dimension (the last dimension in the questionnaire), and when interviewed post completion, she did think the questionnaire was too long, but her Mum felt the length was fine.

Me: What did you think to the questionnaire? You can be honest?

PS6: Erm, I thought it was good.

Me: Did you think it was a bit long?

PS6: Erm, yes (laughs)

Several of the girls (PS2, PS3, PS7, PS8, PS12, PS16, PS20) were very enthusiastic to take part in the study, a couple were even keen to know how the questionnaire had been developed and what other children with OI felt about having the condition (PS, 19, PS20). One young girl aged 6 had attended with her Nana, who one thought would have wanted to stay with her during completion. This was not the case and when help was required, this was offered from the researcher.

There was only one participant (PS9) who stated they felt upset by the questionnaire. She had completed the first four sections with ease, but disliked the dimension entitled 'isolation'.

Me: Were there any questions that you didn't like or you didn't want to answer?

PS9: Yes (girl, age 8)

Me: Which ones didn't you like?

PS9: The ones about my friends and what I can't do.

Me: Why did you not like those?

PS9: (quietly) I felt sad.

She had continued to complete the rest of the questionnaire, and Mum reported she was often a little teary about being different from her friends. This participant was given the option to stop the questionnaire when she became upset, but she and her Mum felt she would like to complete it.

One child (PS24) had difficulty reading the print (font size 12). Although his eyesight was corrected by glasses, the correction was not good enough for him to read the small print. This sparked discussion about his local school being very supportive and providing all his reading material in large print. In this instance his Mum chose to read the questionnaire out loud to him, but this issue may need remedying in the future, and a copy could be made available for children and young people who require a larger print.

### 8.3.2 *Being safe and careful*

This section was completed with ease by all of the participants. One young boy (PS1) asked his Mum about 'crowds', and once she gave an example of a crowd, he confidently answered 'never' on the Likert scale. This demonstrated a discrepancy between 'crowds' and 'busy areas', as he had stated he always avoided busy areas.

A second participant also showed a tendency to prefer the item about busy areas, although he didn't ask any questions, he answered this item much quicker than the item about crowds (PS19).

Some participants discussed the need to leave lessons early to avoid busy areas, which demonstrated good content validity, as this sub theme had arisen several times within the interviews and focus groups in phase 1 of this study (Chapters 5 and 6).

One 9 year old participant (PS14) asked about item Q6, which stated ‘...do you think before playing sports to avoid having a broken bone’. Once we had discussed this and I had given her an example, she answered it with ease.

A further 14 year old boy with mild disease (PS15) asked about what I meant by ‘keeping safe’. He is mildly affected and very active. Once I explained what this meant, he immediately answered ‘never’ on the Likert scale.

### 8.3.3 *Reduced function*

This section proved more complicated to answer for two reasons. Firstly it talked about broken bones; and secondly whether a broken bone had resulted in any reduced function.

In the last week.....

**Item Q10:** Has having a broken bone stopped you doing things?

**Item Q11:** Has it been more difficult to move around because of a broken bone?

**Item Q12:** Have you had to do things differently because of a broken bone?

The time scale for the items continued to be ‘In the last week.....’, but several participants (PS1, PS3, PS4, PS5, PS6, PS8, PS10, PS11, PS17, PS18, PS19, PS21, PS22, PS23, PS24) struggled with this concept, often forgetting to just think about the last week. The above participants rushed into completing these item, potentially immediately thinking about the last time they had sustained a fracture, rather than whether this fracture had occurred in the last week. These items lead to a lot of discussion and reminders of the time scale, often participants had to be encouraged to go back and rethink an item considering only the last week. The primary researcher’s sensitivity to issues arising from these items was improved by previous knowledge of the participants and their recent fracture history.

Me: Was it easy to answer?

PS11: Some of the questions were easy and some of the questions were hard

Me: Which ones were hard?

PS11: Err, like erm, oh I’ve forgotten what they were now

Me: Have a look

PS11: Oh, like, erm, ‘do you find it hard when you erm, like when you move around’, because it’s like from last week, so it’s quite hard to think like, oh I forgot about that and then you have to cross it out and stuff

Three of the participants who correctly answered these items without hesitation or questions, were the older participants (PS12, PS15, PS16). Several others had no issues with these three items, as they all had a current fracture at the time of questionnaire completion (PS7, PS9, PS13, PS14, PS20). For this reason the items were potentially answered with little thought given to the time scale.

This dimension also included items relating to the use of equipment to aid function.

In the last week.....

**Item Q13:** Do you use equipment to help you to move around?

**Item Q14:** Do you have to use equipment to help at school or home?

A few participants asked me to confirm what equipment should be included (PS4, PS5, PS12), and one felt a short list of equipment to aid their memory would be a good idea (PS5). All other participants completed these items with ease, although discussion was often sparked between what equipment the child did use in school; had access to in school and at home; and what they actually chose to use. Parents often thought that children were using prescribed equipment in school, when actually their child had chosen not to use them, but had not made their parents aware of this.

#### 8.3.4 *Pain*

This dimension appeared to be answered well by most participants, although it did include items which talked about fractures within the last week, and these items were where participants had more problems.

In the last week.....

**Item Q18:** Have you had to take medicine because you broke a bone?

**Item Q19:** Did you have pain because you had a broken bone?

Some participants (PS2, PS3, PS6, PS15, PS18, PS24) needed to be reminded again about the time scale around the above two items. Once a discussion had taken place about when they had sustained their last fracture, they were then able to answer the items with ease. These items were problematic for fewer participants than the fracture related items within the previous dimension (reduced function). This may have been due to those discussions about the time scale already taking place during completion of this previous dimension. Again those participants who had sustained a recent fracture had no problems with items Q18 and Q19.

One 10 year old boy made comment about the inclusion of items related to pain in his back and legs (items Q15 and Q16). He felt these symptoms were 'just like him', and again this demonstrates some content validity from the subthemes uncovered within the interviews and focus groups in phase 1 of the study (Chapters 5 and 6).

Two of the participants talked openly during completion about playing or meeting up with their friends (item Q20). One 6 year old girl (PS18) with severe OI described always being able to play with her friends in the garden, but that her friends always altered their play to suit her, and often played with dolls on the floor. The second participant to discuss meeting up with her friends (PS14) stated that she didn't meet them outside of school for two reasons; they did not follow the same culture as her, and her Mum had reduced trust of other parents being able to deal with potential fractures and what may constitute as a risk for her.

### 8.3.5 *Fear*

This dimension was well completed and there were minimal questions and discussion related to items within this section.

This dimension includes items which refer to handling and lifting of children and young people with OI.

In the last week.....

**Item Q26:** Have you worried about new people handling you?

The third participant to complete the questionnaire (PS3) was a 10 year old girl, who was mildly affected with OI. She stated that she didn't want a stranger handling her (referring to item Q26), and I wondered whether she had understood the question, as it is not often necessary for a child with mild OI to be handled or lifted unless they had a fracture. This subject was not pursued during the interview, as discussions around what was socially acceptable handling were not relevant to the research.

Children and young people with severe OI however, are often 'handled' or 'lifted' as they are non ambulatory, and require this additional support to transfer. One 14 year old who was mildly affected (PS15) actually asked why he would need to be handled and this led to a discussion about more severely affected individuals. This was not an issue for any other participants when completing this dimension. All other items within this dimension were answered with ease.

### 8.3.6 *Isolation*

The younger children were not sure what was meant by 'isolation', and had to have this term explained by parents or the researcher (PS1, PS13). This dimension was previously entitled 'being different', as several of the interviewees from phase one (Chapter 5, Item Generation) of the study had described themselves as being different. However, when this was presented as a sub theme to focus group participants, they were uncomfortable with the terminology, and hence the term 'isolation' had been chosen as an alternative.

Some parents commented on the fact that they hadn't realised how their children felt about having OI until they had completed the questionnaire, and referred particularly to this dimension. This again is a strong argument for the need to gain self completion of a patient reported outcome measure, and further demonstrates the possible reduced validity of questionnaires answered by proxy alone.

Item Q32 produced some discussion amongst parents and their children. This item asks; 'Have people treated you differently because you have brittle bones?' One parent questioned how truthful his 13 year old daughter (PS4) had been when she had answered this item. Another teenage girl (PS12) admitted she had experienced some bullying, both at school and in her neighbourhood, as a result of having OI. One 10 year old (PS19) reported that he was occasionally isolated from his friends when they were doing contact sports, but that they often adapted the game to allow him to join in.

**Item Q30:** Did you do PE at school?

This item was found to be the most problematic item within this dimension. PE is an activity that is done in school, and therefore if you complete the questionnaire during your school holidays, your reason for not doing PE is not related to isolation, but to logistics. This was discovered by two participants during their completion (PS9, PS10). This item obviously required change prior to psychometric testing.

**Item Q29:** Did you get to do lots of different activities?

The majority of children completed this item with ease and didn't require any additional help. One of the younger participants (PS6), a 6 year old girl with severe disease, did however disagree with her mother when she completed this item. She stated that she didn't do many things, but her Mum corrected her with quite a list of activities that she took part in each week. This was not an area of concern for the other participants, but I am unsure as to whether she answered this way because of feeling different from her friends, or whether she was just quite young and lacked understanding or the ability to compare herself to her peers or siblings.

**Item Q28:** Are you able to do everything your friends do?

All participants except one (PS20) completed this item with ease. This 14 year old girl attends both mainstream and special school education, due to her severity of OI. She felt it was difficult to answer this question well, as she was more able than many of her friends in special school, but less able than those in her mainstream school.

### 8.3.7 *Independence*

**Item Q37:** Do the teachers at school over protect you?

Three children asked what over protect meant. Two boys aged 7 and 10 (PS1 and PS24) and a 9 year old girl (PS2). One Mum used the analogy of 'being wrapped up in cotton wool'. In one instance (PS23) the description of 'over protect' produced discussion about the teachers at school; although he felt they tried to over protect him, after he had discussed things with them they often agreed to allow him to do those activities that he felt were safe. Once a description had been given all were able to answer the question with ease.

Some of the young people felt they lacked independence as their families insisted they had to be watched whilst completing activities. One teenage girl (PS12) felt her independence was limited by the neighbourhood in which she lived, and not her OI.

### 8.3.8 *Psychometric evaluation*

All items within each dimension were answered by all participants. There was therefore no missing data found across the whole questionnaire.

Most items demonstrated a good spread of data across all response options. Items Q23, Q24, Q25, Q30 and Q34 had one response item which recorded zero, but this was not at the floor or ceiling, or persistently the same response option. Floor and ceiling effects were noted in several items (table 8.3), but this was possibly due to the items being related to symptoms (causal items), poorly worded items or items which were more relevant to a subgroup of patients within the sample.

**Table 8.2** Reliability Statistics (n=25)

Dimension	N of items	Cronbach's alpha	Mean score (1-5)	Median score (0-100)	SD (0-100)	Minimum score	Maximum score
Being safe and careful	6	0.87	2.0	16.7	23.1	1.6	2.5
Reduced function	8	0.65	3.6	65.6	17.8	2.4	4.2
Pain	6	0.61	3.9	66.7	18.3	3.3	4.4
Fear	6	0.70	3.6	70.8	21.8	2.9	4.1
Isolation	6	0.50	3.0	45.8	19.7	2.9	3.2
Independence	7	0.46	2.7	39.3	17.7	1.9	3.6

Cronbach's alpha demonstrated adequate internal consistency for the complete 39-item questionnaire (0.79), but reduced scores for dimensions; Pain (0.61); Isolation (0.50); and independence (0.46). No improvement in Cronbach's alpha score would be gained from eliminating any item within the being safe and careful dimension, and only minimal improvement would be gained in dimensions; reduced function; fear; isolation and independence if items were removed. However, it is suggested that internal consistency reliability of the pain dimension would improve with the elimination of item Q15.

Some items demonstrated poor correlation within their dimension, with low item-to-total correlation (ITC < 0.30), although this was not the case for the dimensions 'being safe and careful' and 'fear', where all items correlated well within the dimension (see tables 8.4 and 8.7). The tiredness items (Q.7, Q.8, Q.9) within the reduced function dimension correlated poorly with the other items (ITC 0.04, 0.17, 0.06 respectively) (see table 8.5). Back pain (item Q.15) correlated poorly within the pain dimension (ITC -0.17), but the other items within this dimension demonstrated good correlation (see table 8.6). Many items within the dimension entitled independence demonstrated poor correlation, the only item demonstrating good correlation referred to the overprotection provided by school teachers (Q.37) (see table 8.9).

Some item-item correlations within each dimension were high; items Q10 and Q12 ( $r = 0.83$ ), Q11 and Q12 ( $r = 0.82$ ), Q21 and Q22 ( $r = 0.80$ ), but the highest item-item correlation was found between items Q18 and Q19 ( $r = 0.91$ ). These latter items were related to fear of fracture, and being scared of activities which may lead to fracture, the value greater than 0.90 gives rise to concerns regarding redundancy of one of these items.

**Table 8.3.** Percentage items responses to the 39 OIQoL item

Item	Question	Always (%)	Most of the time (%)	Sometimes (%)	Not much (%)	Never (%)
Q1	Does someone give you extra help to keep you safe?	44	32	12	8	4
Q2	Do you keep away from busy areas to keep safe?	44	28	12	8	8
Q3	Do you keep away from crowds to keep safe?	20	36	20	12	12
Q4	Do you try to keep safe to stop you breaking a bone?	56	24	16	4	4
Q5	Do you keep away from some activities to stop you having a broken bone?	48	28	8	12	4
Q6	Do you think before playing sports to avoid having a broken bone?	60	12	16	0	12
Q7	Have you felt tired in the day?	4	20	40	28	8
Q8	Have you felt tired by the end of the day?	24	36	24	8	8
Q9	Do you have to take rests in the day?	8	12	12	28	40
Q10	Has having a broken bone stopped you doing things?	8	4	12	12	64
Q11	Has it been more difficult to move around because of a broken bone?	12	4	12	8	64
Q12	Have you had to do things differently because of a broken bone?	4	8	20	12	56
Q13	Do you use equipment to help you to move around?	8	8	24	12	48
Q14	Do you have to use equipment to help at school or home?	24	16	4	12	44
Q15	Have you had pain in your back?	8	20	24	16	32
Q16	Have you had pain in your legs or arms?	4	28	36	8	24
Q17	Have you had to take medicine for pain?	8	12	20	8	52
Q18	Have you had to take medicine because you broke a bone?	4	4	12	4	76
Q19	Did you have pain because you had a broken bone?	4	8	16	4	68

Q20	Have you missed meeting up with your friends because you had pain?	8	4	12	16	60
Q21	Have you been worried about breaking a bone?	12	4	12	28	44
Q22	Do you get scared about doing something that might make you break a bone?	16	4	24	32	24
Q23	Do you worry about coming into hospital?	16	0	28	20	36
Q24	Do you get scared about needles?	36	0	20	24	36
Q25	Did you worry that someone might move you wrong and cause a broken bone?	12	0	12	32	44
Q26	Have you worried about new people handling you?	4	4	24	20	48
Q27	Did you see your friends outside of school?	20	16	16	16	32
Q28	Are you able to do everything your friends do?	8	16	40	20	16
Q29	Did you get to do lots of different activities?	12	36	16	12	24
Q30	Did you do PE at school?	32	20	12	0	36
Q31	Do you feel different because you have to be more careful than your friends?	28	4	32	8	28
Q32	Have people treated you differently because you have brittle bones?	36	4	20	20	20
Q33	Did you like to do things for yourself?	56	16	16	8	4
Q34	Did your family encourage you to do things for yourself?	56	20	16	0	8
Q35	Do you have as much freedom as your friends?	16	28	16	20	20
Q36	Do your family let you make your own decision about what is safe?	28	24	8	20	20
Q37	Do the teachers at school over protect you?	12	24	16	16	32
Q38	Do the teachers at school stop you doing things that you think are safe?	16	12	20	12	40
Q39	Do your family let you choose your own activities?	28	28	28	12	4

**Table 8.4.** Table to demonstrate item-item correlation, item-total correlation and Cronbach's alpha scores for being safe and careful dimension.

	Q1 Does someone give you extra help to keep you safe?	Q2 Do you keep away from busy areas to keep safe?	Q3 Do you keep away from crowds to keep safe?	Q4 Do you try to keep safe to stop you breaking a bone?	Q5 Do you keep away from some activities to stop you having a broken bone?	Q6 Do you think before playing sports to avoid having a broken bone?	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q1 Does someone give you extra help to keep you safe?	1.00						0.45	0.87
Q2 Do you keep away from busy areas to keep safe?	0.71	1.00					0.66	0.83
Q3 Do you keep away from crowds to keep safe?	0.41	0.47	1.00				0.73	0.82
Q4 Do you try to keep safe to stop you breaking a bone?	0.27	0.56	0.64	1.00			0.72	0.83
Q5 Do you keep away from some activities to stop you having a broken bone?	0.03	0.19	0.60	0.60	1.00		0.55	0.85
Q6 Do you think before playing sports to avoid having a broken bone?	0.34	0.64	0.68	0.65	0.75	1.00	0.82	0.80

**Table 8.5.** Table to demonstrate item-item correlation, item-total correlation and Cronbach's alpha for Reduced Function scores dimension.

	Q7 Have you felt tired in the day?	Q8 Have you felt tired by the end of the day?	Q9 Do you have to take rests in the day?	Q10 Has having a broken bone stopped you doing things?	Q11 Has it been more difficult to move around because of a broken bone?	Q12 Have you had to do things differently because of a broken bone?	Q13 Do you use equipment help you to move around?	Q14 Do you have to use equipment to help at school or home?	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q7 Have you felt tired in the day?	1.00								0.04	0.67
Q8 Have you felt tired by the end of the day?	0.40	1.00							0.17	0.65
Q9 Do you have to take rests in the day?	0.22	0.24	1.00						0.06	0.68
Q10 Has having a broken bone stopped you doing things?	0.07	0.11	0.02	1.00					0.60	0.54
Q11 Has it been more difficult to move around because of a broken bone?	-0.04	0.13	-0.10	0.66	1.00				0.59	0.54
Q12 Have you had to do things differently because of a broken bone?	-0.08	-0.02	-0.12	0.83	0.82	1.00			0.56	0.56
Q13 Do you use equipment help you to move around?	-0.14	0.12	0.03	0.26	0.39	0.34	1.00		0.48	0.58
Q14 Do you have to use equipment to help at school or home?	-0.18	-0.13	0.03	0.21	0.24	0.18	0.58	1.00	0.26	0.64

**Table 8.6.** Table to demonstrate item-item correlation, item-total correlation and Cronbach's alpha scores for the Pain dimension

	Q15 Have you had pain in your back?	Q16 Have you had pain in your legs or arms?	Q17Have you had to take medicine for pain?	Q18 Have you had to take medicine because you broke a bone?	Q19 Did you have pain because you had a broken bone?	Q20 Have you missed meeting up with your friends because you had pain?	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q15 Have you had pain in your back?	1.00						-0.15	0.74
Q16 Have you had pain in your legs or arms?	0.62	1.00					0.30	0.56
Q17Have you had to take medicine for pain?	-0.09	0.33	1.00				0.68	0.37
Q18 Have you had to take medicine because you broke a bone?	-0.41	-0.04	0.66	1.00			0.51	0.48
Q19 Did you have pain because you had a broken bone?	-0.44	0.02	0.65	0.91	1.00		0.55	0.46
Q20 Have you missed meeting up with your friends because you had pain?	-0.23	-0.10	0.34	0.36	0.48	1.00	0.26	0.58

**Table 8.7.** Table to demonstrate item-item correlation, item-total correlation and Cronbach's alpha scores for Fear dimension

	Q21 Have you been worried about breaking a bone?	Q22 Do you get scared about doing something that might make you break a bone?	Q23 Do you worry about coming into hospital?	Q24 Do you get scared about needles?	Q25 Did you worry that someone might move you wrong and cause a broken bone?	Q26 Have you worried about new people handling you?	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q21 Have you been worried about breaking a bone?	1.00						0.72	0.57
Q22 Do you get scared about doing something that might make you break a bone?	0.80	1.00					0.57	0.62
Q23 Do you worry about coming into hospital?	0.23	0.18	1.00				0.30	0.71
Q24 Do you get scared about needles?	0.24	0.06	0.66	1.00			0.34	0.70
Q25 Did you worry that someone might move you wrong and cause a broken bone?	0.63	0.50	-0.14	0.02	1.00		0.40	0.67
Q26 Have you worried about new people handling you?	0.33	0.34	-0.07	0.14	0.42	1.00	0.33	0.69

**Table 8.8.** Table to demonstrate item-item correlation, item-total correlation and Cronbach's alpha scores for Isolation dimension.

	Q27 Did you see your friends outside of school?	Q28 Are you able to do everything your friends do?	Q29 Did you get to do lots of different activities?	Q30 Did you do PE at school?	Q31 Do you feel different because you have to be more careful than your friends?	Q32 Have people treated you differently because you have brittle bones?	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q27 Did you see your friends outside of school?	1.00						0.38	0.32
Q28 Are you able to do everything your friends do?	0.09	1.00					-0.03	0.52
Q29 Did you get to do lots of different activities?	0.38	0.41	1.00				0.51	0.25
Q30 Did you do PE at school?	0.24	0.22	0.61	1.00			0.39	0.30
Q31 Do you feel different because you have to be more careful than your friends?	0.17	-0.58	0.09	-0.01	1.00		0.07	0.50
Q32 Have people treated you differently because you have brittle bones?	0.12	-0.21	-0.18	0.01	0.39	1.00	0.07	0.50

**Table 8.9** Table to demonstrate item-item correlation, item-total correlation and Cronbach's alpha scores for the Independence dimension.

	Q33 Did you like to do things for yourself?	Q34 Did your family encourage you to do things for yourself?	Q35 Do you have as much freedom as your friends?	Q36 Do your family let you make your own decision about what is safe?	Q37 Do the teachers at school over protect you?	Q38 Do the teachers at school stop you doing things that you think are safe?	Q39 Do your family let you choose your own activities?	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q33 Did you like to do things for yourself?	1.00							0.21	0.53
Q34 Did your family encourage you to do things for yourself?	-0.07	1.00						0.23	0.52
Q35 Do you have as much freedom as your friends?	0.25	-0.02	1.00					0.29	0.50
Q36 Do your family let you make your own decision about what is safe?	0.12	0.36	0.47	1.00				0.30	0.49
Q37 Do the teachers at school over protect you?	0.26	0.17	0.20	0.14	1.00			0.55	0.37
Q38 Do the teachers at school stop you doing things that you think are safe?	0.12	0.02	-0.23	-0.17	0.47	1.00		0.06	0.59
Q39 Do your family let you choose your own activities?	-0.06	0.28	0.28	0.09	0.40	-0.01	1.00	0.31	0.49

**Table 8.10** Change made following pilot

<b>Dimension</b>	<b>Item Number</b>	<b>Change Made</b>
All	All except PE related item	New item stem “In the last week....” To be incorporated into all items.
Isolation	30	New wording of item to cover the event of school holidays. Now reads “In a normal school week do you do PE?”
Isolation	Items 27 - 32	Dimension now placed at the end of the overall questionnaire. Items now numbered 34 - 39
Independence	Items 33 - 39	This dimension was previously the 6 <sup>th</sup> , but became the 5 <sup>th</sup> once changes were made to PE related item

## **8.4 Discussion**

The need to pilot the initial version of the questionnaire proved imperative.

Several changes were made to the questionnaire as a result of this pilot phase (See table 8.10). The most major change took place within the wording of the items, and the question stem. Many children and young people found the instruction ‘In the last week’ appearing only once, at the beginning of each dimension quite difficult. Each dimension has at least six items and having to remember that each item refers only to the last week proved difficult for several respondents, and this was more noticeable for those younger children. It was therefore decided that each item would begin ‘In the last week....’

Smith and colleagues (2005) found that the time frame of one week was suitable for their population; it was short enough to remember, but long enough to be meaningful. All of our respondents were capable of remembering what had happened and what they had taken part in over the last week. The issue within the format of the newly developed questionnaire (OIQoL), was not that of the time frame, but the format of how often children were reminded of that time frame within each dimension. Children often rushed into the question, particularly those relating to fractures, without reminding themselves of the time frame, and needed to be facilitated to think again and consider just the last week.

The fact that the primary researcher was also a physiotherapist within the Metabolic Bone Disease team enabled increased sensitivity as to when fractures had taken place; allowing the researcher to prompt participants who may have answered incorrectly to re-read the question and re-consider the time frame.

This rushing in was also experienced by a few of the older respondents, who had to be reminded about the time scale for the questions related to fractures within the last week. They commented within the post completion interviews, that they had found those items more difficult to answer. As a result of this the question stem within all items except one (see discussion below), was altered to state:

Item 10: In the last week has having a broken bone stopped you doing things?

Item 11: In the last week has it been more difficult to move around because of a broken bone?

Item 12: In the last week have you had to do things differently because of a broken bone?

One question within the isolation dimension (Q. 30) asked:

Thinking about your last week...  
Did you do PE at school?

This question initially appeared to be fine, but when given to a respondent during their school holidays, this was not the case. PE is an activity which is undertaken during school time, and therefore during holiday from school it is unlikely that the respondent had participated in PE. For this reason this question was altered, becoming 'In a normal school week do you do PE?' This altered the overall question stem for this item, and the stem... 'In the last week...' was no longer appropriate. This is the only item within the questionnaire that now lacks this repeated question stem. As a result this item no longer flowed well in its current position (Q30) and was considered for replacement and resultant reformatting of the questionnaire. Following discussion with the research team, it was decided this item should now be placed at the end of the isolation dimension. To improve readability and aid completion, the isolation dimension was placed at the end of the questionnaire, allowing all other items to follow the question stem 'In the last week...' enhancing flow throughout the questionnaire.

Some of the younger participants required assistance with the meaning of a couple of items. One item (Q2) asking about busy areas was easily completed by all respondents; conversely the similar item (Q3) asking about crowds required some additional input with one of the younger children. Discrepancy was highlighted between these two items, as one participant reported he always stayed away from busy areas to keep safe, but never avoided crowds. Both these items demonstrated good internal consistency, if either item was removed from the scale the Cronbach's alpha score would drop slightly. For these reason neither item was removed from the questionnaire at this stage. Both demonstrated good content validity during the development of the conceptual framework and item generation phase (Chapter 5). Further psychometric evaluation will inform which, if any of the items requires removal.

Some discrepancy was uncovered between the younger children (PS1, PS13) and their older counterparts. These two younger children were not sure about the meaning of the word isolation, which was used as a dimensional heading, and this terminology had to be explained by their parents. This dimensional heading had already undergone change following the validation focus group with young people (See Chapter 6). In the event of the younger children regularly not understanding the term isolation, it may be necessary to rethink this dimension heading, once further information has been gained when the questionnaire is assessed with a larger sample.

Differences in understanding were noted between mildly effected and more severely effected individuals with regards to some items. One teenager aged 14 (PS15) had difficulty understanding the need for him to consider activities prior to taking part in order to keep safe. This participant was very mildly effected and active, taking part in sporting activities both in and outside of school. He questioned why individuals with OI would have to think about keeping safe, and obviously did not feel he needed to.

Cano and Hobart (2011) state that health measurement can be described in two ways; measuring health outcomes as the extent to which certain universal needs are met, or viewing health outcomes as being constructed from individual evaluations of what is personally important. This can lead to flaws in health measurement of a population where disease severity is very varied. If individuals see their health outcome as a perception of their life circumstance, and this is dependent on the psychological makeup of the individual, then one cannot assume that each individual will value different circumstances in the same way. In this instance, the respondent with mild disease did not view his need to keep safe in the same way as the participants who suggested the items during the one-to-one interviews or those that validated the items during the focus groups. This may have been due to difference in severity of disease, but may also be due to differences in psychological make up.

Consideration as to whether it is necessary to remove this item, or alter it to make it comprehensible to all participants is required. This individual was the only one in the sample that made comment about this item, and all other participants completed it without question. It may be that this teenager was so mildly affected that he had never before considered the need to remain safe. It may be that he did not want to appear weak in any way and wanted to portraint a tougher, more socially acceptable veneer. At this stage in questionnaire development it was decided to retain this item within the tool, and monitor it psychometrically during the next stage of instrument development. This more mildly effected individual had also questioned why someone would need to handle him, as item Q26 had asked. This again is an issue related to the severity of OI, with several more severely effected individuals commenting about their fear in being handled, particularly if they did not know the capabilities of the adult who was planning to assist in their transfers. Parents of very young children also reported their other family members being fearful of handling their new baby, and expressing concerns of poor handling leading to fractures, often avoiding handling as a result. No other mildly affected individuals within the sample reported any concerns with either of these two items, and possibly had more understanding of the varying severities of the disease and the effects this may have. For these reasons, this item was also not removed, as the content validity of the questionnaire may have been reduced as a

result. If this item did not test well in the psychometric evaluation on a larger sample, then it may need to be removed at that point.

Eiser and Morse (2001) expressed concern that the removal of items at this early stage, especially if only proving an issue to a small sample of respondents, could lead to reduce validity of the overall questionnaire.

Cano and Hobart (2011), within their two key messages, warn that psychometric statistics, when considered in isolation, can be misleading. They confirm that establishing a clinically meaningful content validity from the onset; developing a conceptual framework to ensure the questionnaire measures the concepts relevant to the target population, is a vital step in questionnaire development.

The items Q13 and Q14 sparked discussion between some respondents and their parents/carers, and consequently with the research team. These items asked participants to consider the equipment they had used within the last week. Most of the respondents were happy to complete these items without discussion with parents, and several completed the item, stating that they had not often or had never used equipment. Those participants who were being observed by both the researcher and their parent/carer were often then questioned as to why they had answered more negatively with regard to equipment. Some parents stated 'What about your cushion?', and were then informed by their son/daughter that although they had been given a piece of equipment to use within the school environment, they had opted not to do so. This was obviously not something that had been discussed before, and parents were under the illusion that their child was using the equipment at school, when this was not actually the case. This posed uncertainty around the ability of parents/carers to act as reliable and accurate proxy respondents, and reinforced the need to gain self completion of the QoL questionnaire. This has been repeatedly reported in children with chronic or life long conditions, when attempting to gain understanding of whether children are prepared to undergo treatments, and their appreciation of the expected outcome or success (Ingerski et al, 2010; Varni et al, 2008).

The discrepancies between children's self report and their parents' proxy report have been described within the literature (Upton et al, 2008), and were previously often regarded as measurement error (Eiser and Varni, 2013). It is important to consider that if discrepancies do occur between children and their parents/carers, then who is right?

The US Food and Drug administration (FDA, 2009) states that paediatric patient self reported HRQOL is a form of patient reported outcome measure (PRO), and should therefore be reported directly by the patient, without the need for interpretation from parents, carers or clinicians. Eiser and Varni (2013) conclude that both opinions are important, and both respondents add useful information to the measure of HRQOL. However, they go on to state that ultimately, it is the child who knows best his or her thoughts, feelings of pain, emotional upset, fatigue or internal symptoms.

It is also noted within the literature, that parental proxy report of their child's quality of life, can be dependent on their own state of well being; those mothers that are more anxious, rate their child's HRQOL lower than those mothers that are less distressed (Janike et al, 2007). It is also important to make note, that some children will attempt to

protect their parents from distressing information, and this will contribute to the differing opinion of parents compared to their children (Metcalf et al, 2008). Eiser and Varni (2013) conclude that parents are not in a position to monitor their children in many of their social and functional interactions. This is more apparent for school aged children and especially older adolescents, who are often not in an easily, regularly observable environment.

All participants had completed all areas of the questionnaire; there was therefore no missing data from the 25 participants who undertook the questionnaire. Moreover, this may have occurred as participants were observed when completing the questionnaire. Smith et al (2005) states the usual criterion for missing data is 5%, although in their study evaluating HRQOL in people with dementia their missing data was particularly high, they had to raise their criterion to 30%, which then allowed elimination of the most extreme items and a sufficient number of items for further psychometric testing. There was good coverage of response options for all items within the questionnaire; with only an occasional zero score which was not at the floor or ceiling. This demonstrated a good use of all the available Likert levels for all items within the questionnaire. No participant commented on the need for additional or fewer Likert response options during the post completion interviews. Vincent et al (2007) undertook post completion interviews during their construction and validation of a QoL questionnaire for neuromuscular disease. They found that participants preferred a seven point Likert rather than a five.

Floor and ceiling effects were noted for items which were either causal in nature (related to symptoms of OI), or affected only a small minority of more severely affected individuals. Items Q10, Q11, Q12, Q18 and Q19 are all related to fractures and therefore a high number of participants responding 'never' occurred as only a small sample of participants within this pilot had sustained a fracture within the last week. This automatically led to a ceiling effect on items related to fracture. Items Q4, Q5 and Q6 are related to staying safe and reducing risk to avoid sustaining a fracture, these items are again likely to be causal in nature, related to OI and the need to stay fracture free. Only two items demonstrated very high item-item correlation (Q18 and Q19); these items related to pain resulting from a fracture, and the need to take medication due to fracture pain. It is easy to understand why these two items correlated highly; additional assessment of potential redundancy will be required during further psychometric testing on a larger cohort.

Although some items within the OI specific QOL measure did not correlate sufficiently well with others in their dimension ( $ITC > 0.3$ ), they were not removed at this stage. As missing data was not an issue, it was felt there was no concern regarding comfort or relevance of the items. As the items were developed through direct patient interview, informing the conceptual framework, it was felt removal of such items with high relevance to the patient group, would not ensure continued high content validity. Early removal of items on psychometric grounds, which demonstrate high relevance to the participant group, can produce a strong statistical measure which has low content validity, particularly when the psychometric analysis was based on small numbers ( $n=25$ ). Eiser and Morse (2001) state:

“The practice of excluding certain items on the basis of statistical criteria can lead to some bias. Items that may be important to individuals are excluded while items that fulfil psychometric requirements may be included, even if they would not be endorsed by any single individual.” (pp 90).

Content validity of the questionnaire was further supported by the comments made by one 10 year old respondent, who felt some of the items within the pain dimension were ‘just like him’. These items related to the pain he experience in his back and limbs, a reoccurring theme which was reported within the one-to-one interviews and the focus groups.

## **8.5 Strengths and Limitations**

Observed pre-testing of the questionnaire with the addition of post completion interviews, allowed pauses to be monitored, and questions to be asked. This first hand feedback from the target population with regards to understanding, readability and relevance proved invaluable, enabling changes to be made to the initial version of the OIQoL questionnaire and an obvious strength to the overall process of PRO measure development.

Although the methodology had an obvious strength, it also had its limitations. The participants having previous knowledge of the principle researcher as their physiotherapist may have affected the post completion interviews. It may have led to more ‘yes’ saying, with participants providing more positive feedback during the interview, not wanting to disappoint or upset the interviewer.

The interviewer being present and taking notes during questionnaire completion will also have had an effect on the lack of any missing data. Participants will have felt compelled to complete the questionnaire, as they were being observed doing so. A true measure of the amount of missing data will have to be calculated during further testing, where participants will not be observed throughout completion.

Those items/questions that ask about pain related to fracture may have led to the floor and ceiling effects; anyone who hasn’t sustained a fracture in the last week will immediately fall at the extreme end of the range (i.e. Never); therefore providing an immediate ceiling effect for those items. Choosing not to make changes to these items at this stage, prior to any psychometric evaluation, was in hindsight a poor decision, which led to flaws within the questionnaire being moved forward into the next stage of testing. These questions will need revision or removal prior to testing on a larger multi-site sample.

## **8.6 Conclusion**

The pilot phase of the study enabled changes and modifications to be made to the overall questionnaire. These modifications were mainly surrounding the format of the items in relation to the time scale. During the pilot, problems arose when the time scale ‘In the last week...’ was written only once at the beginning of each dimension. Children and young people with OI seemed to have no problem recalling what had

happened within the last week, but needed to be reminded of this time scale on a more regular basis. The addition of 'In the last week' to the item stem will hopefully encourage children and young people to be more mindful when answering the questionnaire. The addition of this new item stem will aim to reduce the possibility that children will rush into items, especially those related to fractures, and encourage them to think whether the fracture had occurred within the last week.

Changes to item Q30 'Did you do PE at school?', were made as those children who had attempted to use the questionnaire during the school holidays, were at a loss as to how to answer this item. Due to the occurrence of school holidays, it was impossible for this item to follow the newly identified item stem 'In the last week...'. Item 30 was therefore altered to read; 'In a normal school week do you do PE', and was therefore placed at the end of the questionnaire to avoid further confusion.

Some items initially proved difficult to understand to a couple of children who were mildly affected. It was difficult to decide whether this was an individual problem, because the participant(s) was a very active and able young person, or whether this would be a reoccurring theme in a larger sample. The same applied to the understanding of a couple of items with the younger participants. In this instance parental help, promoted better understanding and allowed informed completion. This highlighted the need for occasional additional help with some of the younger participants.

The issue of proxy completion was again highlighted, and the potential discrepancy between the thoughts of children and their parents in relation to their QoL during questionnaire completion was acknowledged. Further work around identifying and understanding this discrepancy would be both interesting and useful. It is again acknowledged that there may have been a missed opportunity to develop both child and parental questionnaires simultaneously, and perhaps this would be an area for future research.

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**Version 2. OIQoL.**

**Being safe and careful**

<i>In the last week did</i> someone give you extra help to keep you safe?	Always	Most of the time	Sometimes	Not much	Never
<i>In the last week did</i> you keep away from busy areas to keep safe?	Always	Most of the time	Sometimes	Not much	Never
<i>In the last week did</i> you keep away from crowds to keep safe?	Always	Most of the time	Sometimes	Not much	Never
<i>In the last week did</i> you try to keep safe to stop you breaking a bone?	Always	Most of the time	Sometimes	Not much	Never
<i>In the last week did</i> you keep away from some activities to stop you having a broken bone?	Always	Most of the time	Sometimes	Not much	Never
<i>In the last week did</i> you think before playing sports to avoid having a broken bone?	Always	Most of the time	Sometimes	Not much	Never

## Reduced Function

<i><u>In the last week</u></i> have you felt tired in the day?	Always	Most of the time	Sometimes	Not much	Never
<i><u>In the last week</u></i> have you felt tired by the end of the day?	Always	Most of the time	Sometimes	Not much	Never
<i><u>In the last week did</u></i> you have to take rests in the day?	Always	Most of the time	Sometimes	Not much	Never
<i><u>In the last week</u></i> has having a broken bone stopped you doing things?	Always	Most of the time	Sometimes	Not much	Never
<i><u>In the last week</u></i> has it been more difficult to move around because of a broken bone?	Always	Most of the time	Sometimes	Not much	Never
<i><u>In the last week</u></i> have you had to do things differently because of a broken bone?	Always	Most of the time	Sometimes	Not much	Never
<i><u>In the last week did</u></i> you use equipment to help you to move around?	Always	Most of the time	Sometimes	Not much	Never
<i><u>In the last week did</u></i> you have to use equipment to help at school or home?	Always	Most of the time	Sometimes	Not much	Never

## Pain

<i><u>In the last week</u></i> have you had pain in your back?	Always	Most of the time	Sometimes	Not much	Never
<i><u>In the last week</u></i> have you had pain in your legs or arms?	Always	Most of the time	Sometimes	Not much	Never
<i><u>In the last week</u></i> have you had to take medicine for pain?	Always	Most of the time	Sometimes	Not much	Never
<i><u>In the last week</u></i> have you had to take medicine because you broke a bone?	Always	Most of the time	Sometimes	Not much	Never
<i><u>In the last week did</u></i> you have pain because you had a broken bone?	Always	Most of the time	Sometimes	Not much	Never
<i><u>In the last week</u></i> have you missed meeting up with your friends because you had pain?	Always	Most of the time	Sometimes	Not much	Never

## Fear

<i><u>In the last week</u></i> have you been worried about breaking a bone?	Always	Most of the time	Sometimes	Not much	Never
<i><u>In the last week did</u></i> you get scared about doing something that might make you break a bone?	Always	Most of the time	Sometimes	Not much	Never
<i><u>In the last week did</u></i> you worry about coming into hospital?	Always	Most of the time	Sometimes	Not much	Never
<i><u>In the last week did</u></i> you get scared about needles?	Always	Most of the time	Sometimes	Not much	Never
<i><u>In the last week did</u></i> you worry that someone might move you wrong and cause a broken bone?	Always	Most of the time	Sometimes	Not much	Never
<i><u>In the last week</u></i> have you worried about new people handling you?	Always	Most of the time	Sometimes	Not much	Never

## Independence

<i><u>In the last week</u></i> did you like to do things for yourself?	Always	Most of the time	Sometimes	Not much	Never
<i><u>In the last week</u></i> did your family encourage you to do things for yourself?	Always	Most of the time	Sometimes	Not much	Never
<i><u>In the last week did</u></i> you have as much freedom as your friends?	Always	Most of the time	Sometimes	Not much	Never
<i><u>In the last week did</u></i> your family <b>let you</b> make your own decision about what is safe?	Always	Most of the time	Sometimes	Not much	Never
<i><u>In the last week did</u></i> the teachers at school over protect you?	Always	Most of the time	Sometimes	Not much	Never
<i><u>In the last week did</u></i> the teachers at school stop you doing things that you think are safe?	Always	Most of the time	Sometimes	Not much	Never
<i><u>In the last week did</u></i> your family let you choose your own activities?	Always	Most of the time	Sometimes	Not much	Never

## Isolation

Important to note that this dimension was the penultimate one prior to the pilot, but the order was altered due to the format of the last question.

<i><u>In the last week did</u> you see your friends outside of school?</i>	Always	Most of the time	Sometimes	Not much	Never
<i><u>In the last week were</u> you able to do everything your friends do?</i>	Always	Most of the time	Sometimes	Not much	Never
<i><u>In the last week did</u> you get to do lots of different activities?</i>	Always	Most of the time	Sometimes	Not much	Never
<i><u>In the last week did</u> you feel different because you have to be more careful than your friends?</i>	Always	Most of the time	Sometimes	Not much	Never
<i><u>In the last week</u> have people treated you differently because you have brittle bones?</i>	Always	Most of the time	Sometimes	Not much	Never
<i><u>In a normal school week do you do PE?</u></i>	Always	Most of the time	Sometimes	Not much	Never

## **Chapter 9**

### **Psychometric Evaluation (Field testing)**

#### **9.1 Aim**

The aim of this chapter is to describe the field testing stage of the newly developed disease specific QoL measure for children with OI (OIQoL). The relevant background literature related to the methodological process of psychometric evaluation has already been discussed in Chapter 3. This chapter will highlight some research papers where psychometric evaluations of newly developed questionnaires and PRO measures have taken place. It will also explain why the methods used were chosen, the limitations of these methods and the ideas for further research and testing.

#### **9.2 Background**

The process of QoL questionnaire development is an iterative one; items are generated, concepts uncovered, questionnaires are developed and piloted or pre-tested, and the final version is field tested on a larger sample of the chosen population. At any stage changes may be made to the questionnaire, items may be eliminated in response to the ongoing development and testing. These changes will require further testing and potential further changes may arise, hence the process is both fluid and cyclic.

##### *9.2.1 Acceptability*

Full forms of missing data within a multiple page questionnaire, may be a sign that the instrument is too lengthy and that the burden placed on the individual completing the questionnaire is too high. The amount of items that are eliminated due to missing data needs to be examined closely, and an incremental percentage approach can be used to identify this. Smith et al (2005) chose to eliminate items that had greater than 30% missing data, which left them with over 30 items within their questionnaire. They noted that if they reduced the percentage of missing data to greater than 25%, this would leave only seven items. A questionnaire with so few items may have reduced reliability and content validity, and therefore not reflect those themes which are important to the patient population.

Gorecki et al (2009) examined floor and ceiling effects within their PU-QOL, a patient reported outcome measure for patients with pressure ulcers. They choose a value of <15% as adequate for the proportion of the sample at the floor or the ceiling, based on information from McHorney et al (1995).

##### *9.2.2 Psychometrics*

Having an understanding of the properties that a questionnaire should adhere to is only part of the overall picture. It is necessary to statistically demonstrate these psychometric properties and offer evidence of the newly developed questionnaires' robustness. There are several methods described in the literature to provide this statistical evidence, but which is the best or 'gold standard' approach is not clear. The

literature appears to fall into two camps; classical test theory (+/- factor analysis) and the new psychometric methods such as, item response theory or Rasch theory, with some review papers unsure of which method is the most appropriate, if any, to demonstrate the overall validity and reliability (Cano and Hobart, 2011).

Raven-Sieberer et al (2010) whilst examining the psychometric properties of the newly developed Kidscreen-10 used several statistical methods. They used interclass correlation coefficients (ICC) to examine test-retest following a two week delay in questionnaire re-completion, stating an ICC>0.7 would demonstrate an acceptable level of reliability. Pearson's correlation was used to assess the criterion validity of the newly developed Kidscreen-10 alongside similar 'gold standard' questionnaire, with values of above 0.7 considered acceptable.

Weiss et al (2013) tested an anglicised translated version of an Italian rheumatological QoL scale on their paediatric cohort. They used the PedsQL to examine convergent and discriminant validity, and assessed known groups validity using correlations with disease activity or state, as described by an experienced rheumatologist. They examined internal consistency reliability using Cronbach's alpha and test-retest using intra class correlation coefficient. They used both confirmatory and exploratory factor analysis to ascertain whether the two factor model obtained for the Italian version of the questionnaire also fit their data, and latterly to examine the model without any pre-assumptions to uncover the number of theoretical dimensions required.

Wiklander et al (2013) during their development of the HIV stigma scale, field tested their questionnaire on 58 children to examine percentage of missing data, floor and ceiling effects, internal consistency (Cronbach's alpha) and criterion validity by assessing correlations with other HRQoL measures, alongside principle component analysis to inform factor structure. They quoted Field (2009) when suggesting that a sample of 50 individuals would be satisfactory for factor analysis, and used a Kaiser-Meyer-Olkin test for sample adequacy, alongside a Bartlett's test for sphericity to ensure the sample of 50 was suitable for factor loadings. As a result of this they concluded a three factor solution was suitable.

Gorecki et al (2013) during their development and validation of the PROM for patients with pressure ulcers, used both traditional psychometrics, as advised by the FDA criteria (2009), alongside new psychometric methods; Rasch measurement theory. They stated that to use Rasch methodology a sample size of 250 subjects would be required, but described this latter measurement as a formal method for evaluating a scale against a sophisticated mathematical measurement model. Their first psychometric evaluation produced a 10-point scale, but the subsequent Rasch analysis found limitations in these scales, which required modification. Particularly the 4-point item scoring system, which didn't work for several items resulting in a change to a 3-point system.

### 9.2.3 *Approach chosen*

The statistical methodology chosen to examine the psychometric properties of the newly developed OIQoL was dictated by the size of the available participant sample, the time available in which to complete this phase of the research, as it took place

within a PhD and the level of understanding of the primary researcher. As a result of this traditional methodology was chosen, to provide an introduction to the psychometric properties of the new questionnaire, enabling some consideration of item reduction or revision based on acceptability and responsiveness. Items were deemed redundant if they were correlated highly with another similar item ( $r > 0.90$ ), if they incurred a high level of missing data ( $>10\%$ ), or demonstrated high levels of floor or ceiling effects; excluding those causal items affected by disease symptoms. Preliminary information was gained with regards to reliability and validity of the questionnaire as a whole and the items within each dimension.

The decision not to include any factor analysis (confirmatory or exploratory) was taken after lengthy discussion with the research team, and was again decided due to time and sample size constraints and the lack of statistical ability and experience of the principle researcher. The need to examine the questionnaire further, with regards to its overall structure and the number and type of dimensions included is acknowledged. The need for further research and psychometric analysis on a larger sample is required.

The choice to use traditional psychometric analysis in favour of more modern techniques (Rasch analysis and item response theory) was also chosen because of the relatively small sample size and the limited knowledge and experience of the primary researcher.

### 9.3 Method

The methodology for the final phase of this study involved a larger sample of participants recruited from patients known to the Metabolic Bone Disease Team at Sheffield Children’s Hospital. Ninety five children and adolescents with a medically confirmed diagnosis of OI were asked to complete the newly developed OI specific QoL questionnaire on three separate occasions (see chapter 8 for version 2 of the OIQoL). These were; at baseline, in out patient clinic or as an inpatient on the ward (time point 1); at one week later (postal assessment – time point 2); and approximately three months later at follow up clinic or via post (time point 3).

**Table 9.1** Inclusion and Exclusion Criteria

Recruitment	Inclusion	Exclusion
SCH patients	Age 6-18 years. Medical diagnosis of OI. Attending SCH for out patient review or inpatient treatment. Ability to understand English. Consent/assent from patient and/or parent/carer.	Unknown diagnosis. Non consent.

Patients were approached via post with an invitation letter and reply slip (see Appendix 3) which gave details of the study. This was the final stage of this study; potential

participants were made aware that there have been previous stages to this multi faceted study, and the fact that some participants may have already taken part in previous phases was acknowledged. An information sheet and consent form (see Appendix 4 and 5) were included in the mail out. Two weeks following the receipt of the letter, potential participants were contacted by telephone to answer any questions they or their parent/carer may have and to discuss possible inclusion. Patients who expressed an interest in taking part within the study or those who asked for further information were offered a suitable date to attend SCH.

Potential participants were asked to travel to SCH to discuss the study further and to consent those individuals who agreed to participate. Where possible this was arranged to coincide with a routine appointment for out patient review or inpatient stay. These appointments occur on a regular basis (3-6 monthly) and patients can travel from far and wide. For the principle researcher to travel to individual homes was logistically impossible within the realms of this study.

Prior to inclusion within this study, all participants were given the opportunity to meet with the lead researcher to discuss the study and ask any questions they had. This took place away from the clinic setting, which allowed any sensitive questions or information to be comfortably addressed. All participants who agreed to take part within the study were required to provide consent. Young people of 14 years and over were deemed competent to agree assent, but consent was still gained from their parent/carer prior to inclusion. Younger children who were able to understand the research study agreed to assent and wrote their name on an assent form.

Consented individuals were asked to complete both the newly developed OI specific QoL measure (OIQoL – see Chapter 8 for version 2), the PedsQL (see appendix 8) and EQ5D (see appendix 9), during a routine visit to SCH; the latter two questionnaires are generic measures of QoL. Following completion of these baseline questionnaires (OIQoL, PedsQL and EQ5D), participating individuals were asked to complete a second copy of the questionnaires a week later, alongside a global rating of health question (see Appendix 10). They were provided with an envelope which contained the second copy of the OIQoL, PedsQL, EQ5D, global rating of health question, and a stamped addressed envelope for return purposes.

Three months later participating individuals were again asked to complete a third and final copy of the OIQoL, PedsQL and EQ5D, and second copy of the global rating of health question. Those individuals who were returning to SCH for a routine out patient appointment or inpatient admission were provided with the questionnaires during this visit. Those patients who are reviewed at SCH less frequently, received their third and final copy of the questionnaires via post, and were provided with a stamped addressed envelope for its return.

Once returned the coded questionnaires were initially input into an Excel spreadsheet. Data was input and then rechecked for accuracy. Any missing data was denoted 999.

- Time point one; OIQoL-baseline, PedsQL-baseline, EQ5D-baseline
- Time point two; OIQoL-one week, PedsQL-one week, EQ5D-one week, global rating of health-one week.

- Time point three; OIQoL- three month, PedsQL-three month, EQ5D-three month, global rating of health- three month.

The majority of items within the newly developed OIQoL are scored incrementally, where 'always' scores 1, and 'never' scores 5. However a few items are reverse scored (items Q27, 28, 29, 30, 33, 34, 35, 36, 39), where 'always' scores 5 and 'never' scores 1. This enables an overall high score to represent better reported QoL.

### 9.3.1 *Acceptability and data quality*

Raw scores were then transformed to a 0-100 scale, taking into account those items which are reversed scored (items Q27, Q28, Q29, Q30, Q33, Q34, Q35, Q36, Q39). To achieve this items which are reversed score were recoded.

Using a fictional Being safe and careful dimension with scores Q1=3, Q2=3, Q3=3, Q4=3, Q5=3 and Q6=3, the following paragraph describes how the data was transformed. No recoding was required for this dimension as a higher score means less concern regarding being safe and careful and therefore higher QoL. Raw scale scores were computed by summing the items in the same scale; for the being safe and careful dimension this involves adding up the responses to the six items (Q1 to Q6). The raw score is then transformed to a 0-100 scale using the following formula:

Transformed Scale Score = [(Actual raw score-lowest possible raw score)/Possible raw score range]\*100.

Therefore, for the being safe and careful dimension the transformed scale score is:

$$T\_score = ((raw\_score - 6) / 24) * 100 = 50.$$

See Appendix 11 for SPSS syntax example for the being safe and careful dimension. Baseline scores were examined to identify characteristics of age, sex, and the severity of disease within the cohort. The data was examined for the distribution of item responses; the frequency and position of missing data was examined, alongside the proportion of respondents at the floor and ceiling. The percentage of item-level missing data was deemed appropriate if less than 10%. Percentages at the floor and ceiling were deemed suitable if <50%, with a 5 point Likert scale expected percentage at each point if the data spread was even would be 20%. Where large proportions of the cohort scored at the floor or ceiling, these items were examined as their link to symptoms or the effects of treatment may highlight causal items. Those items which are not necessarily causal in nature, which demonstrate large floor or ceiling effects will be examined for potential revision or elimination.

### 9.3.2 *Scaling assumptions*

Ideally the items within the questionnaire should be seen to measure a common underlying construct; they should therefore demonstrate similar mean scores and standard deviations. Correlations between the items will be explored, ideally items within the same dimension should correlated more closely. Items which correlated very closely with one another may be a sign of redundancy. Alternatively, causal items (Fayers and Machin, 2007) may be closely related to symptoms of disease or treatment

and may therefore not correlate well with one another, but clinically remain well sited within a particular dimension.

### 9.3.3 *Internal consistency reliability*

Cronbach's alpha statistics for each dimension and for the scale as a whole will be examined. Values of greater than or equal to 0.7 demonstrate adequate internal consistency. Item to total correlation of 0.4 to 0.6 indicates that the items are moderately correlated, values of <0.3 indicate poor correlation.

### 9.3.4 *Known Groups validity*

Correlation methods will be used to examine the relationships between the items within the newly developed OIQoL and the total score for the dimension within which it is sited. Correlations between known groups, such as severity of disease or treatments received will also be examined to further inform construct validity of the newly developed OIQoL.

The PedsQL is a generic paediatric QoL questionnaire, and therefore there is an expectation that the newly developed OIQoL will positively correlate with some items or dimensions within the scale. This would demonstrate a level of criterion validity, although as the PedsQL is not deemed the 'gold' standard QoL questionnaire for the OI population (Chapter 4), this may not be the case.

### 9.3.5 *Test-retest reliability*

Those respondents who reported 'no change' in their global rating of health at time point two will be selected to examine the reliability of the test-retest at one week. Correlations will be used to examine scale stability; a correlation of >0.7 will indicate reliable scale stability between time point one and time point two (a duration of one week). The intra-class coefficient (ICC) will also be explored for agreement between dimension scores; a value of >0.7 will identify good agreement between test and retest dimension scores. Responsiveness at item level will also be examined with respect to the treatment that individuals received, mean differences between treatment groups will be explored.

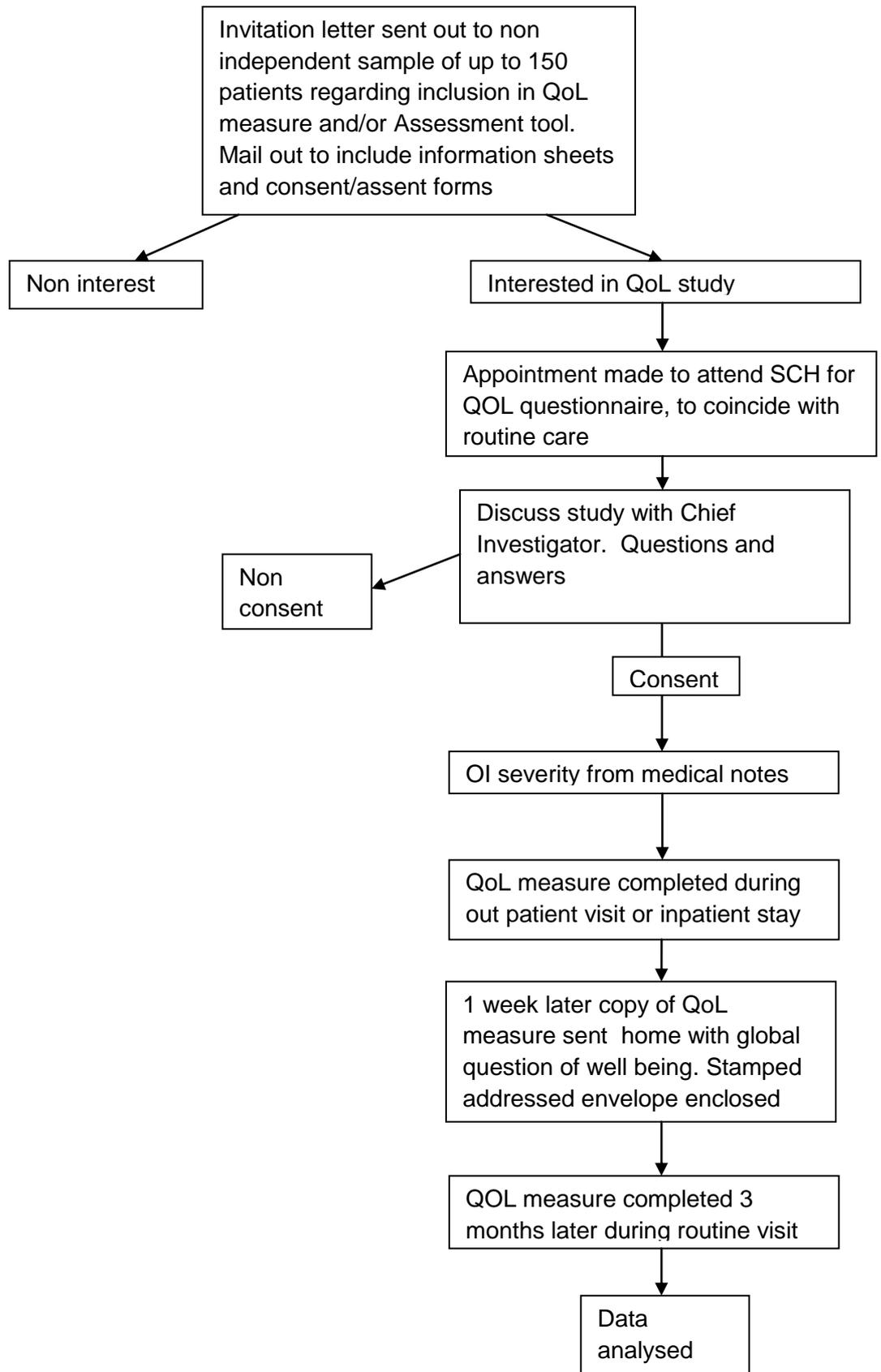
### 9.3.6 *Time point three (3 months follow up)*

Those respondents who again reported 'no change' in their global rating of health at time point three will be selected to examine the reliability of the test-retest at three months. Correlations will be used to examine scale stability, alongside intra-class coefficient, as was planned at test-retest at one week. Again, item level responsiveness will be explored and mean differences between treatment groups investigated.

### 9.3.7 *Item reduction strategy*

Items will be considered for potential removal using the item removal strategy of:

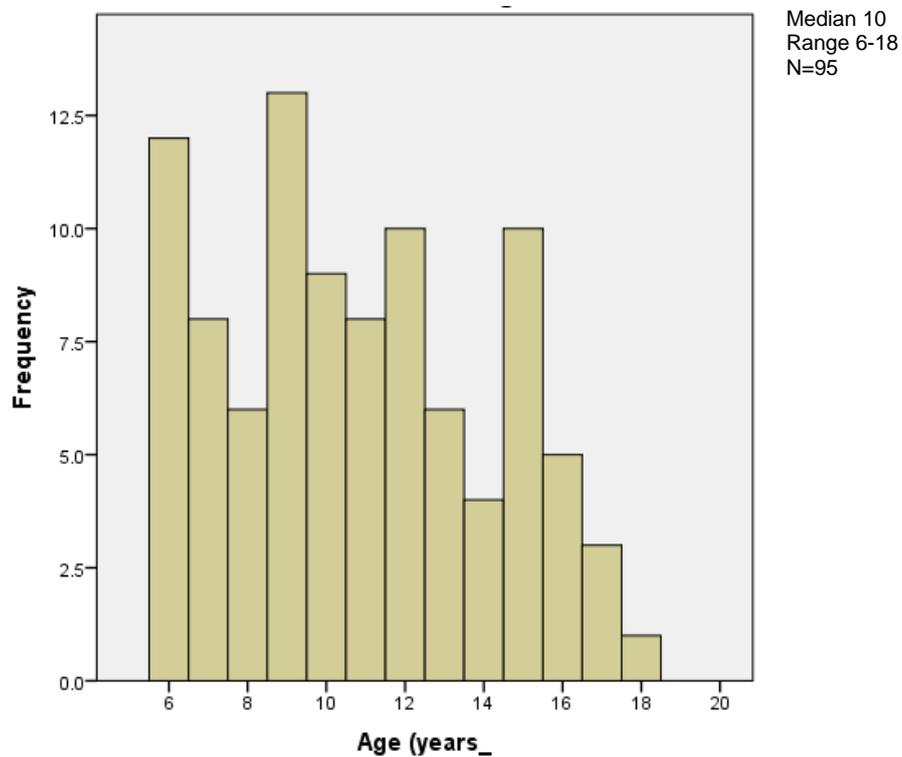
- Cronbach's alpha  $<0.70$ , demonstrating reduced internal consistency within a particular dimension or scale.
- Item-total correlation values  $<0.30$ , highlighting an items' poor fit within the dimension or scale.
- Item-item correlation  $>0.90$ , highlighting high correlation between items which may be indicative of redundancy of one or more items.
- Floor and ceiling effects  $>50\%$
- Item removal will only take place if the content validity of the questionnaire will not be unduly affected as a result. This latter consideration will involve the judgement of the primary researcher alongside the concepts elicited and conceptual framework uncovered in the early sections of questionnaire development (Chapters 5 and 6).



**Figure 9.1.** Flowchart psychometric evaluation; reliability, validity, responsiveness.

## 9.4 Results

Almost all of the individuals that were approached to take part in this phase of the research agreed to do so. Ninety eight individuals were initially approached, two declined to take part, one became distressed about another aspect of their treatment/care and it was therefore felt inappropriate to re-approach for consent. One individual chose to delay her inclusion and consent for three months, as she was about to take her GCSE exams, but was still keen to participate. The participants ranged from 6 to 18 years and included 41 boys (43%). 59% of participants were of primary school age, 37% were in secondary school, and the latter 4% were 17-18 years of age. There was mixed severity of OI including; 41 children with mild disease, 37 who were moderately affected and 17 children with severe disease.



**Figure 9.2.** Histogram to demonstrate the age range of participants within the sample.

Participants were asked to complete the questionnaires at baseline, one week and 12 weeks follow up; 95 participants completed the questionnaires at baseline, 76 individuals returned completed questionnaires at one week follow up, with 73 individuals completing and returning the 3 month follow up. Nineteen children therefore failed to return the one week follow up questionnaires, an initially loss of 20%, with an overall loss of twenty two participants at 3 months (23%).

### 9.4.1 Missing data

All children managed to complete the full questionnaire, with only a small amount of missing data. Of those 95 individuals who completed the questionnaires at baseline, only occasional items were not completed. Seven items (items Q6, Q24, Q34, Q35, Q37, Q38 and Q39) recorded 1% missing data, with only two items (items Q30 and Q36) missing 2%. See Table 9.3 for further details at an individual item level; table 9.2 highlights baseline and missing data for each dimension.

**Table 9.2.** Summary descriptive statistics for baseline OIQoL dimension scores based on transformed data (0-100) n=95

	Valid N	No. Missing	Mean	Median	SD	Min	Max
OI Being safe and careful dimension (0-100)	94	1	34.2	29.2	25.6	0.0	100.0
OI PROM Reduced function dimension (0-100)	95	0	61.4	62.5	20.3	12.5	100.0
OI PROM Pain dimension (0-100)	95	0	74.3	79.2	20.7	16.7	100.0
OI PROM Fear dimension (0-100)	94	1	73.8	79.2	21.6	12.5	100.0
OI PROM Independence dimension (0-100)	93	2	68.0	67.9	15.6	28.6	100.0
OI PROM Isolation dimension (0-100)	93	2	56.5	54.2	19.6	8.3	100.0

Table 9.3. demonstrates a small amount of item level missing data, mean and median scores for each individual item.

Table 9.3. Summary descriptive statistics for baseline OIQoL item level score based on raw data n=95

Item	Question	N	Missing	Mean	Median	SD
1	In the last week did someone give you extra help to keep you safe?	95	0	2.44	2	1.34
2	In the last week did you keep away from busy areas to keep safe?	95	0	2.52	2	1.33
3	In the last week did you keep away from crowds to keep safe?	95	0	2.53	3	1.40
4	In the last week did you try to keep safe to stop you breaking a bone?	95	0	1.93	1	1.27
5	In the last week did you keep away from some activities to stop you having a broken bone?	95	0	2.53	2	1.43
6	In the last week did you think before playing sports to avoid having a broken bone?	94	1	2.28	2	1.48
7	In the last week have you felt tired in the day?	95	0	2.53	2	1.12
8	In the last week have you felt tired by the end of the day?	95	0	2.39	1	1.28
9	In the last week did you have to take rests in the day?	95	0	3.46	3	1.17
10	In the last week has having a broken bone stopped you doing things?	95	0	3.99	5	1.48
11	In the last week has it been more difficult to move around because of a broken bone?	95	0	4.21	5	1.32
12	In the last week have you had to do things differently because of a broken bone?	95	0	4.13	5	1.38
13	In the last week did you use equipment to help you to move around?	95	0	3.60	4	1.58
14	In the last week did you have to use equipment to help at school or home?	95	0	3.36	4	1.69
15	In the last week have you had pain in your back?	95	0	3.49	3	1.25
16	In the last week have you had pain in your legs or arms?	95	0	3.42	3	1.27
17	In the last week have you had to take medicine for pain?	95	0	3.84	4	1.34
18	In the last week have you had to take medicine because you broke a bone?	95	0	4.58	5	1.04
19	In the last week did you have pain because you had a broken bone?	95	0	4.32	5	1.27
20	In the last week have you missed meeting up with your friends because you had pain?	95	0	4.17	5	1.26
21	In the last week have you been worried about breaking a bone?	95	0	3.68	4	1.32
22	In the last week did you get scared about doing something that might make you break a bone?	95	0	3.84	4	1.27
23	In the last week did you worry about coming into hospital?	95	0	4.04	4	1.22
24	In the last week did you get scared about needles?	94	1	3.72	5	1.58
25	In the last week did you worry that someone might move you wrong and cause a broken bone?	95	0	4.23	5	1.16
26	In the last week have you worried about new people handling you?	95	0	4.17	5	1.17
27	In the last week did you like to do things for yourself?	95	0	1.83	2	1.00
28	In the last week did your family encourage you to do things for yourself?	95	0	2.18	2	1.3
29	In the last week did you have as much freedom as your friends?	95	0	2.59	2	1.31
30	In the last week did your family <b>let you</b> make your own decision about what is safe?	93	2	2.67	3	1.37
31	In the last week did the teachers at school over protect you?	95	0	3.48	4	1.37
32	In the last week did the teachers at school stop you doing things that you think are safe?	95	0	3.98	4	1.23
33	In the last week did your family let you choose your own activities?	95	0	2.20	2	1.22
34	In the last week did you see your friends outside of school?	94	1	2.90	3	1.49
35	In the last week were you able to do everything your friends do?	94	1	2.80	3	1.24
36	In the last week did you get to do lots of different activities?	93	2	2.56	3	1.34
37	In the last week did you feel different because you have to be more careful than your friends?	94	1	2.99	3	1.43
38	In the last week have people treated you differently because you have brittle bones?	94	1	3.12	3	1.38
39	In a normal school week do you do PE?	94	1	2.34	2	1.59

**Table 9.4.** Raw items responses to the 39 OIQoL item

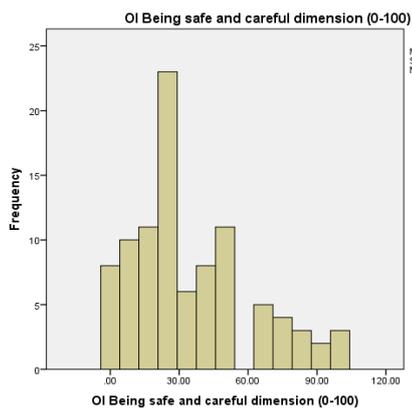
Item	Question	n	% missing data	Always (%)	Most of the time (%)	Sometimes (%)	Not much (%)	Never (%)
Q1	In the last week did someone give you extra help to keep you safe?	95	0.0	33.7	20.0	25.3	10.5	10.5
Q2	In the last week did you keep away from busy areas to keep safe?	95	0.0	29.5	24.2	22.1	13.7	10.5
Q3	In the last week did you keep away from crowds to keep safe?	95	0.0	34.7	14.7	26.3	11.6	12.6
Q4	In the last week did you try to keep safe to stop you breaking a bone?	95	0.0	54.7	18.9	13.7	4.2	8.4
Q5	In the last week did you keep away from some activities to stop you having a broken bone?	95	0.0	32.6	23.3	17.9	11.6	14.7
Q6	In the last week did you think before playing sports to avoid having a broken bone?	94	1.0	48.4	10.5	17.9	8.4	13.7
Q7	In the last week have you felt tired in the day?	95	0.0	20.0	30.5	32.6	10.5	6.3
Q8	In the last week have you felt tired by the end of the day?	95	0.0	31.6	28.4	16.8	15.8	7.4
Q9	In the last week did you have to take rests in the day?	95	0.0	6.3	10.5	40.0	16.8	26.3
Q10	In the last week has having a broken bone stopped you doing things?	95	0.0	13.7	6.3	8.4	10.5	61.1
Q11	In the last week has it been more difficult to move around because of a broken bone?	95	0.0	8.4	7.4	5.3	12.6	66.3
Q12	In the last week have you had to do things differently because of a broken bone?	95	0.0	10.5	5.3	9.5	10.5	64.2
Q13	In the last week did you use equipment to help you to move around?	95	0.0	16.8	11.6	15.8	6.3	49.5
Q14	In the last week did you have to use equipment to help at school or home?	95	0.0	25.3	10.5	10.5	10.5	43.2
Q15	In the last week have you had pain in your back?	95	0.0	6.3	15.8	30.5	16.8	30.5
Q16	In the last week have you had pain in your legs or arms?	95	0.0	7.4	18.9	24.2	23.2	26.3
Q17	In the last week have you had to take medicine for pain?	95	0.0	8.4	9.5	18.9	15.8	47.4
Q18	In the last week have you had to take medicine because you broke a bone?	95	0.0	3.2	5.3	6.3	1.1	84.2
Q19	In the last week did you have pain because you had a broken bone?	95	0.0	7.4	6.3	6.3	7.4	72.6

Q20	In the last week have you missed meeting up with your friends because you had pain?	95	0.0	7.4	4.2	14.7	11.6	62.1
Q21	In the last week have you been worried about breaking a bone?	95	0.0	11.6	6.3	18.9	28.4	34.7
Q22	In the last week did you get scared about doing something that might make you break a bone?	95	0.0	6.3	10.5	18.9	21.1	43.2
Q23	In the last week did you worry about coming into hospital?	95	0.0	7.4	4.2	14.7	24.2	49.5
Q24	In the last week did you get scared about needles?	94	1.0	17.9	7.4	9.5	13.7	50.5
Q25	In the last week did you worry that someone might move you wrong and cause a broken bone?	95	0.0	5.3	5.3	10.5	18.9	60.0
Q26	In the last week have you worried about new people handling you?	95	0.0	4.2	7.4	13.7	16.8	57.9
Q27	In the last week did you like to do things for yourself?	95	0.0	48.4	28.4	16.8	4.2	2.1
Q28	In the last week did your family encourage you to do things for yourself?	95	0.0	43.2	21.1	18.9	8.4	8.4
Q29	In the last week did you have as much freedom as your friends?	95	0.0	25.3	27.4	21.1	15.8	10.5
Q30	In the last week did your family <b>let you</b> make your own decision about what is safe?	93	2.2	27.4	17.9	25.3	14.7	12.6
Q31	In the last week did the teachers at school over protect you?	95	0.0	12.6	11.6	21.1	24.2	30.5
Q32	In the last week did the teachers at school stop you doing things that you think are safe?	95	0.0	4.2	11.6	15.8	18.9	49.5
Q33	In the last week did your family let you choose your own activities?	95	0.0	36.8	28.4	18.9	9.5	6.3
Q34	In the last week did you see your friends outside of school?	94	1.0	25.3	15.8	23.2	12.6	22.1
Q35	In the last week were you able to do everything your friends do?	94	1.0	17.9	23.2	29.5	17.9	10.5
Q36	In the last week did you get to do lots of different activities?	93	2.2	30.5	17.9	22.1	18.9	8.4
Q37	In the last week did you feel different because you have to be more careful than your friends?	94	1.0	24.2	8.4	29.5	17.9	18.9
Q38	In the last week have people treated you differently because you have brittle bones?	94	1.0	16.8	18.9	16.8	28.4	17.9
Q39	In a normal school week do you do PE?	94	1.0	45.3	21.1	7.4	4.2	21.1

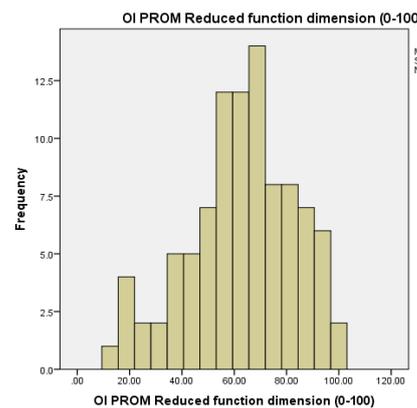
Table 9.4 demonstrates the amount of missing data and the percentage of individuals at the floor and ceiling for each item. This table reiterates the low level of missing data for all items within the OIQoL questionnaire and therefore offering evidence to support the acceptability and comfort of the questionnaire.

### 9.4.2 Floor and ceiling effects

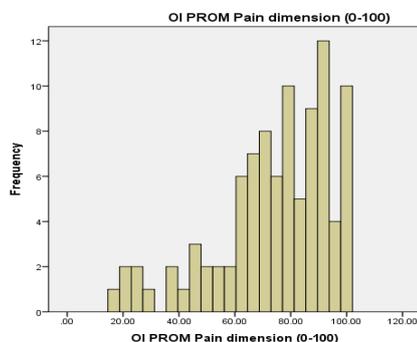
Some items which demonstrated ceiling effects were causal items, related to either symptoms such as fractures or pain (items; Q10-14, Q15-20, Q21, Q22, Q25), or items which are important to more minority groups within the OI population, hence enabling a large amount of the participants to score at the higher end of the scale (Q25-26, Q31-32). Mild floor effects are seen in items Q1-6, which are causal items and closely related to fractures or preventing fractures. Some items (Q10, Q11, Q12, Q18, Q19, Q20) were poorly constructed, asking individuals two questions simultaneously, which promoted ceiling effects.



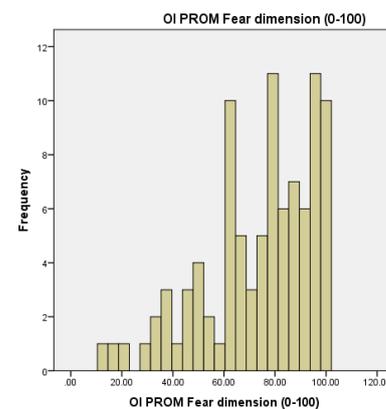
Median 29.17  
Range 0-100  
N=94



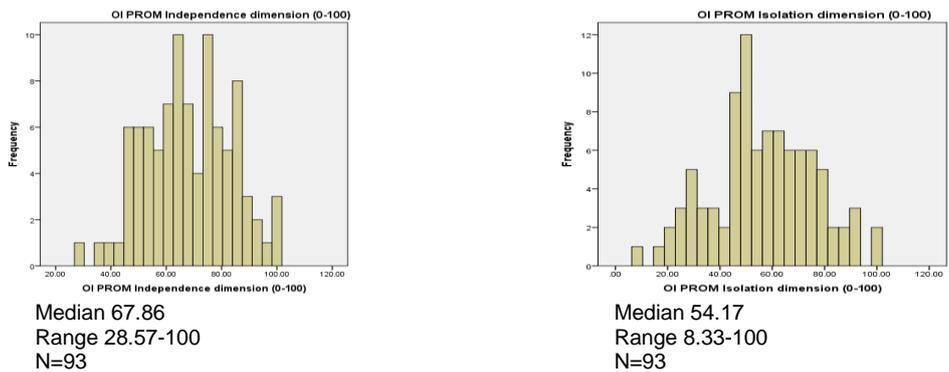
Median 62.50  
Range 12.50-100  
N=95



Median 79.17  
Range 16.67-100  
N=95



Median 79.17  
Range 12.50-100  
N=94



**Figure 9.3.** Histograms of data spread by dimension

The above histograms demonstrate the spread of the dimension scores for the transformed data; for each dimension it can be seen that there is a relative even spread of scores across the item totals, with some dimensions skewed to the right (pain and fear) and the being safe and careful dimension skewed a little towards the left. Those dimensions which are skewed to the right demonstrate higher QoL scores, which in relation to the pain and fear dimensions highlight more individuals reporting less pain and less fear. This may be due to the larger numbers of more mild-moderately affected participants, the relatively small sample size, or a mild ceiling effect due to the inclusion of causal items or those items which were poorly constructed. The skewed data for the being safe and careful dimension demonstrates a tendency for the sample to report more frequent efforts to stay safe and careful, and a resultant reduced QoL. Items which have floor or ceiling effects greater than 50% need further investigation, some may be causal in nature, others such as handling in the more severely effected individuals effect only a small minority of the OI population. Some floor or ceiling effects may be due to the nature of the question, poorly worded items which involve two topics such as pain and fractures automatically place some individuals at the ceiling (Items Q10, Q11, Q12, Q18, Q19).

#### 9.4.3 Correlation

The table in Appendix 12 demonstrates the item-item correlation for the 39 items within the OIQoL. Most items have low (<0.3) to moderate (0.4 – 0.6) correlation with other items within the questionnaire. Items Q1-Q6 correlate well with one another and this can be further seen in table 9.5; being safe and careful is the dimension with the most correlated items across the questionnaire, and therefore the dimension with the highest internal consistency. From the table (Appendix 12) it can be seen that a few items correlate quite highly with one another. Items Q2 and Q3 are well correlated and ask about an individuals' wariness of busy areas and crowds ( $r = 0.72$ ), it is therefore commonsense that these items may correlate with one another. If the correlation had been higher, it may have highlighted some redundancy and potentially identified an item for elimination. Items Q10 and Q11, Q10 and Q12, and Q11 and Q12 all exhibit higher correlation ( $r = 0.73$ ,  $r = 0.75$  and  $r = 0.86$  respectively). They are questions

relating to fractures preventing activity (Q10), fractures making function more difficult (Q11), and having to do things differently because of fractures (Q12); it therefore makes sense for these items to be highly correlated. The highest correlation (Q11 and Q12,  $r = 0,86$ ) may give rise for some concern regarding redundancy, and may lead to elimination of one of these items, should any other psychometric tests, such as Cronbach's alpha, reinforce this concern. Items Q12 and Q19 are also quite highly correlated ( $r = 0.71$ ) and also relate to items describing fractures and the pain reported in the event of a fracture. Items Q18 and Q19 both relate to pain following fracture and the need for pain relief in the event of a fracture. Both these correlations are again obvious, but not high enough to warrant concern with regard to redundancy. The only other correlations which warrants highlighting is that between items Q29 and Q35 ( $r = 0.60$ ) which is again a sensible notion; they are questions relating to having as much freedom as your friends and being able to do everything your friends can do.

Table 9.5 presents Pearson's correlations for each dimension within the OIQoL. No one dimension correlates particularly highly with any other; most correlations are low to moderate

**Table 9.5.** Correlations between each of the six dimensions of the OIQoL.

		OIQoL Being safe and careful dimension (0-100)	OIQoL Reduced function dimension (0-100)	OIQoL Pain dimension (0-100)	OIQoL Independence dimension (0- 100)	OIQoL Isolation dimension (0-100)	OIQoL Fear dimension (0-100)
OIQoL Being safe and careful dimension (0-100)	Pearson Correlation	1					
	Sig. (2- tailed)						
	N	94					
OIQoL Reduced function dimension (0- 100)	Pearson Correlation	0.44**	1				
	Sig. (2- tailed)	0.00					
	N	94	95				
OIQoL Pain dimension (0- 100)	Pearson Correlation	0.29**	0.61**	1			
	Sig. (2- tailed)	0.01	0.00				
	N	94	95	95			
OIQoL Independence dimension (0- 100)	Pearson Correlation	0.06	0.16	0.29**	1		
	Sig. (2- tailed)	0.56	0.13	0.01			
	N	92	93	93	93		
OIQoL Isolation dimension (0- 100)	Pearson Correlation	0.32**	0.36**	0.33**	0.37**	1	
	Sig. (2- tailed)	0.00	0.00	0.00	0.00		
	N	92	93	93	91	93	
OIQoL Fear dimension (0- 100)	Pearson Correlation	0.28**	0.40**	0.31**	0.24*	0.32**	1
	Sig. (2- tailed)	0.01	0.00	0.00	0.02	0.00	
	N	94	94	94	92	92	94

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\* . Correlation is significant at the 0.05 level (2-tailed).

#### 9.4.4 Correlations between other questionnaires

**Table 9.6.** Correlation between the 6 dimensions of OIQoL dimensions and EQ5D

		OIQoL Being safe and careful dimension (0-100)	OIQoL Reduced function dimension (0-100)	OIQoL Pain dimension (0-100)	OIQoL Fear dimension (0-100)	OIQoL Independence dimension (0- 100)	OIQoL Isolation dimension (0-100)
EQ-5D Overall Utility (VAS)	Pearson Correlation	0.11	0.34**	0.40**	0.19	0.17	0.34**
	Sig. (2- tailed)	0.32	0.00	0.00	0.07	0.11	0.00
	N	92	93	93	92	91	91
EQ-5D Overall Utility (Tariff)	Pearson Correlation	0.04	0.30**	0.21*	-0.07	0.04	0.12
	Sig. (2- tailed)	0.72	0.00	0.04	0.51	0.70	0.24
	N	93	94	94	93	92	92

Correlation is significant at the 0.01 level (2-tailed).\*\* Correlation is significant at the 0.05 level (2-tailed).\*

**Table 9.7.** Correlations between 6 dimensions of OIQoL and dimensions in PedsQL

		OIQoL Being safe and careful dimension (0-100)	OIQoL Reduced function dimension (0-100)	OIQoL Pain dimension (0-100)	OIQoL Fear dimension (0-100)	OIQoL Independence dimension (0-100)	OIQoL Isolation dimension (0-100)
PedsQL Physical Functioning (0-100)	Pearson Correlation	0.39**	0.63**	0.52**	0.45**	0.22*	0.57**
	Sig. (2- tailed)	0.00	0.00	0.00	0.00	0.04	0.00
	N	93	94	94	93	92	92
PedsQL Emotional Functioning (0-100)	Pearson Correlation	0.28**	0.35**	0.31**	0.45**	0.11	0.39**
	Sig. (2- tailed)	0.01	0.00	0.00	0.00	0.32	0.00
	N	93	94	94	93	92	92
PedsQL Social Functioning (0-100)	Pearson Correlation	0.28**	0.35**	0.35**	0.39**	0.17	0.61**
	Sig. (2- tailed)	0.01	0.00	0.00	0.00	0.11	0.00
	N	93	94	94	93	92	92
PedsQL School Functioning (0-100)	Pearson Correlation	-0.01	0.17	0.08	0.29**	0.01	0.27**
	Sig. (2- tailed)	0.93	0.10	0.48	0.00	0.91	0.01
	N	93	94	94	93	92	92

Correlation is significant at the 0.01 level (2-tailed).\*\* Correlation is significant at the 0.05 level (2-tailed).\*

The above tables (9.6 and 9.7) demonstrate the relatively low correlations between the six dimensions within the OIQoL and the EQ5D and the low to moderate correlation

between the OIQoL and the PedsQL. However it is useful to make note of the higher correlations between the reduced function dimension of the OIQoL and the physical function dimension of the PedsQL, alongside the isolation dimension of the OIQoL and the social functioning dimension of the PedsQL.

#### 9.4.5 *Known Groups Validity*

It was hypothesised that those individuals with more severe disease would report lower QoL scores than those children with milder disease. Table 9.9 demonstrates that this was not the case across all dimensions. However reduced function did show a difference between groups in both the original questionnaire (RF dimension 8 items) and within the revised version following potential item elimination (RF dimension 6 items). A difference was also noted between groups for the physical functioning dimension (PF) of the PedsQL, although this was not significant (see Table 9.9).

Tables 9.8 a-f demonstrates significant differences between OI severities for items Q1, Q12, Q13 and Q22. Items Q1, Q12 and Q13 all demonstrate significantly lower scores reported by those individuals with more severe disease. Item Q1 shows a noticeable increment in reported extra help from those with severe disease (mean 1.6) to those with mild disease (mean 2.7). Items Q12 and Q13 show the same significant trend in relation to moving differently due to fracture and using equipment, with milder affected individuals reporting higher mean scores. Item Q22 however shows a different trend, which although still significant, demonstrates those individuals with moderate disease reporting a lower score in relation to fear of activities which may lead to fracture, hence they report more fear than their peers with more mild or severe disease. Items Q10, Q11 and Q14 have almost significant differences between severity groups, but do not reach the threshold of 0.05.

**Table 9.8.a** Table to demonstrate item level score differences between OI severity groups at baseline on raw data (Items Q1-6)

Item	Question		N	Mean	SD	Confidence Interval		Sig.
						Lower	Upper	
1	In the last week did someone give you extra help to keep you safe?	mild	41	2.7	1.3	2.3	3.1	0.02
		mod	37	2.5	1.4	2.1	3.0	
		severe	17	1.6	1.1	1.1	2.2	
		Total	95	2.4	1.3	2.2	2.7	
2	In the last week did you keep away from busy areas to keep safe?	mild	41	2.8	1.5	2.3	3.2	0.22
		mod	37	2.4	1.1	2.1	2.8	
		severe	17	2.1	1.4	1.4	2.8	
		Total	95	2.5	1.3	2.2	2.8	
3	In the last week did you keep away from crowds to keep safe?	mild	41	2.6	1.5	2.2	3.1	0.32
		mod	37	2.6	1.3	2.2	3.1	
		severe	17	2.1	1.4	1.3	2.8	
		Total	95	2.5	1.4	2.2	2.8	
4	In the last week did you try to keep safe to stop you breaking a bone?	mild	41	2.0	1.4	1.5	2.4	0.48
		mod	37	2.0	1.2	1.6	2.4	
		severe	17	1.6	1.0	1.1	2.1	
		Total	95	1.9	1.3	1.7	2.2	
5	In the last week did you keep away from some activities to stop you having a broken bone?	mild	41	2.4	1.5	2.0	2.9	0.73
		mod	37	2.5	1.3	2.1	3.0	
		severe	17	2.8	1.6	2.0	3.6	
		Total	95	2.5	1.4	2.2	2.8	
6	In the last week did you think before playing sports to avoid having a broken bone?	mild	40	2.4	1.4	1.9	2.9	0.12
		mod	37	1.9	1.4	1.5	2.4	
		severe	17	2.8	1.7	1.9	3.6	
		Total	94	2.3	1.5	2.0	2.6	

**Table 9.8.b** Table to demonstrate item level score differences between OI severity groups at baseline on raw data (Items Q7-14)

Item	Question		N	Mean	SD	Confidence Interval		Sig.
						Lower	Upper	
7	In the last week have you felt tired in the day?	mild	41	2.6	1.2	2.2	3.0	0.89
		mod	37	2.5	1.1	2.1	2.8	
		severe	17	2.5	.9	2.1	3.0	
		Total	95	2.5	1.1	2.3	2.8	
8	In the last week have you felt tired by the end of the day?	mild	41	2.6	1.4	2.2	3.1	0.31
		mod	37	2.2	1.2	1.8	2.6	
		severe	17	2.4	1.1	1.8	2.9	
		Total	95	2.4	1.3	2.1	2.7	
9	In the last week did you have to take rests in the day?	mild	41	3.5	1.2	3.1	3.9	0.82
		mod	37	3.4	1.3	3.0	3.8	
		severe	17	3.6	.9	3.1	4.1	
		Total	95	3.5	1.2	3.2	3.7	
10	In the last week has having a broken bone stopped you doing things?	mild	41	4.3	1.4	3.9	4.7	0.07
		mod	37	3.9	1.5	3.4	4.4	
		severe	17	3.4	1.6	2.5	4.2	
		Total	95	4.0	1.5	3.7	4.3	
11	In the last week has it been more difficult to move around because of a broken bone?	mild	41	4.6	1.1	4.2	4.9	0.07
		mod	37	4.0	1.4	3.5	4.5	
		severe	17	3.8	1.6	3.0	4.6	
		Total	95	4.2	1.3	3.9	4.5	
12	In the last week have you had to do things differently because of a broken bone?	mild	41	4.5	1.0	4.2	4.9	0.04
		mod	37	3.9	1.5	3.4	4.4	
		severe	17	3.7	1.7	2.8	4.6	
		Total	95	4.1	1.4	3.8	4.4	
13	In the last week did you use equipment to help you to move around?	mild	41	4.2	1.3	3.8	4.6	0.00
		mod	37	3.5	1.6	3.0	4.1	
		severe	17	2.4	1.5	1.6	3.1	
		Total	95	3.6	1.6	3.3	3.9	
14	In the last week did you have to use equipment to help at school or home?	mild	41	3.7	1.7	3.1	4.2	0.08
		mod	37	3.4	1.6	2.8	3.9	
		severe	17	2.6	1.5	1.8	3.4	
		Total	95	3.4	1.7	3.0	3.7	

**Table 9.8.c** Table to demonstrate item level score differences between OI severity groups at baseline on raw data (Items Q15-20)

Item	Question		N	Mean	SD	Confidence Interval		Sig.
						Lower	Upper	
15	In the last week have you had pain in your back?	mild	41	3.4	1.4	3.0	3.9	0.27
		mod	37	3.4	1.2	3.0	3.8	
		severe	17	3.9	1.0	3.4	4.4	
		Total	95	3.5	1.3	3.2	3.8	
16	In the last week have you had pain in your legs or arms?	mild	41	3.5	1.3	3.1	3.9	0.81
		mod	37	3.3	1.2	2.9	3.7	
		severe	17	3.4	1.3	2.8	4.1	
		Total	95	3.4	1.3	3.2	3.7	
17	In the last week have you had to take medicine for pain?	mild	41	3.9	1.4	3.4	4.3	0.83
		mod	37	3.8	1.3	3.3	4.2	
		severe	17	4.0	1.3	3.3	4.7	
		Total	95	3.8	1.3	3.6	4.1	
18	In the last week have you had to take medicine because you broke a bone?	mild	41	4.7	.8	4.4	5.0	0.29
		mod	37	4.6	1.0	4.3	4.9	
		severe	17	4.2	1.4	3.5	5.0	
		Total	95	4.6	1.0	4.4	4.8	
19	In the last week did you have pain because you had a broken bone?	mild	41	4.4	1.2	4.0	4.8	0.66
		mod	37	4.4	1.3	3.9	4.8	
		severe	17	4.1	1.5	3.3	4.8	
		Total	95	4.3	1.3	4.1	4.6	
20	In the last week have you missed meeting up with your friends because you had pain?	mild	41	4.3	1.1	4.0	4.6	0.62
		mod	37	4.1	1.3	3.7	4.6	
		severe	17	3.9	1.6	3.1	4.8	
		Total	95	4.2	1.3	3.9	4.4	

**Table 9.8.d** Table to demonstrate item level score differences between OI severity groups at baseline on raw data (Items Q21-26)

Item	Question		N	Mean	SD	Confidence Interval		Sig.
						Lower	Upper	
21	In the last week have you been worried about breaking a bone?	mild	41	3.8	1.3	3.3	4.2	0.87
		mod	37	3.6	1.3	3.1	4.0	
		severe	17	3.7	1.4	3.0	4.4	
		Total	95	3.7	1.3	3.4	4.0	
22	In the last week did you get scared about doing something that might make you break a bone?	mild	41	4.1	1.1	3.8	4.5	0.02
		mod	37	3.4	1.4	2.9	3.8	
		severe	17	4.2	1.1	3.6	4.8	
		Total	95	3.8	1.3	3.6	4.1	
23	In the last week did you worry about coming into hospital?	mild	41	4.0	1.2	3.6	4.4	0.96
		mod	37	4.0	1.3	3.6	4.5	
		severe	17	4.1	1.1	3.5	4.7	
		Total	95	4.0	1.2	3.8	4.3	
24	In the last week did you get scared about needles?	mild	40	3.7	1.5	3.2	4.2	0.99
		mod	37	3.7	1.6	3.2	4.2	
		severe	17	3.8	1.7	2.9	4.6	
		Total	94	3.7	1.6	3.4	4.0	
25	In the last week did you worry that someone might move you wrong and cause a broken bone?	mild	41	4.4	1.1	4.1	4.7	0.16
		mod	37	3.9	1.4	3.5	4.4	
		severe	17	4.5	.8	4.1	4.9	
		Total	95	4.2	1.2	4.0	4.5	
26	In the last week have you worried about new people handling you?	mild	41	4.3	1.1	4.0	4.7	0.55
		mod	37	4.0	1.2	3.6	4.4	
		severe	17	4.1	1.3	3.5	4.8	
		Total	95	4.2	1.2	3.9	4.4	

**Table 9.8.e** Table to demonstrate item level score differences between OI severity groups at baseline on raw data (Items Q27-33)

Item	Question		N	Mean	SD	Confidence Interval		Sig.
						Lower	Upper	
27	In the last week did you like to do things for yourself?	mild	41	2.0	1.2	1.7	2.4	0.23
		mod	37	1.7	.9	1.4	2.0	
		severe	17	1.6	.6	1.3	1.9	
		Total	95	1.8	1.0	1.6	2.0	
28	In the last week did your family encourage you to do things for yourself?	mild	41	2.3	1.3	1.9	2.7	0.12
		mod	37	2.4	1.3	1.9	2.8	
		severe	17	1.6	1.1	1.0	2.2	
		Total	95	2.2	1.3	1.9	2.4	
29	In the last week did you have as much freedom as your friends?	mild	41	2.3	1.2	2.0	2.7	0.12
		mod	37	2.6	1.3	2.2	3.0	
		severe	17	3.1	1.5	2.4	3.9	
		Total	95	2.6	1.3	2.3	2.9	
30	In the last week did your family <b>let you</b> make your own decision about what is safe?	mild	41	2.8	1.4	2.3	3.2	0.78
		mod	36	2.6	1.3	2.2	3.0	
		severe	16	2.6	1.5	1.8	3.3	
		Total	93	2.7	1.4	2.4	2.9	
31	In the last week did the teachers at school over protect you?	mild	41	3.8	1.2	3.4	4.2	0.09
		mod	37	3.4	1.5	2.9	3.9	
		severe	17	2.9	1.3	2.3	3.6	
		Total	95	3.5	1.4	3.2	3.8	
32	In the last week did the teachers at school stop you doing things that you think are safe?	mild	41	4.2	1.0	3.8	4.5	0.10
		mod	37	4.0	1.3	3.6	4.4	
		severe	17	3.4	1.5	2.7	4.2	
		Total	95	4.0	1.2	3.7	4.2	
33	In the last week did your family let you choose your own activities?	mild	41	2.2	1.2	1.8	2.6	0.99
		mod	37	2.2	1.2	1.8	2.6	
		severe	17	2.2	1.3	1.6	2.9	
		Total	95	2.2	1.2	2.0	2.4	

**Table 9.8.f** Table to demonstrate item level score differences between OI severity groups at baseline on raw data (Items Q34-39)

Item	Question		N	Mean	SD	Confidence Interval		Sig.
						Lower	Upper	
34	In the last week did you see your friends outside of school?	mild	41	2.9	1.5	2.4	3.4	0.96
		mod	36	2.9	1.5	2.4	3.4	
		severe	17	3.0	1.5	2.3	3.7	
		Total	94	2.9	1.5	2.6	3.2	
35	In the last week were you able to do everything your friends do?	mild	41	2.8	1.3	2.4	3.2	0.86
		mod	36	2.8	1.3	2.3	3.2	
		severe	17	2.9	1.1	2.4	3.5	
		Total	94	2.8	1.2	2.5	3.1	
36	In the last week did you get to do lots of different activities?	mild	41	2.3	1.4	1.9	2.8	0.36
		mod	35	2.7	1.3	2.2	3.1	
		severe	17	2.8	1.3	2.2	3.5	
		Total	93	2.6	1.3	2.3	2.8	
37	In the last week did you feel different because you have to be more careful than your friends?	mild	41	2.9	1.5	2.4	3.4	0.74
		mod	36	2.9	1.4	2.5	3.4	
		severe	17	3.2	1.3	2.6	3.9	
		Total	94	3.0	1.4	2.7	3.3	
38	In the last week have people treated you differently because you have brittle bones?	mild	41	3.0	1.4	2.6	3.5	0.92
		mod	36	3.2	1.4	2.7	3.6	
		severe	17	3.2	1.3	2.5	3.8	
		Total	94	3.1	1.4	2.8	3.4	
39	In a normal school week do you do PE?	mild	41	2.2	1.5	1.7	2.7	0.59
		mod	36	2.6	1.7	2.0	3.1	
		severe	17	2.2	1.6	1.4	3.0	
		Total	94	2.3	1.6	2.0	2.7	

**Table 9.9.** Table to demonstrate dimension score differences between OI severity groups at baseline.

		Mild	Moderate	Severe	p value
OIQoL Being safe and careful (0-100)	N	40	37	17	0.53
	Mean	37.2	33.5	28.9	
	SD	28.4	23.6	23.5	
OIQoL Reduced function dimension (0-100)	N	41	37	17	0.00
	Mean	68.7	58.3	50.9	
	SD	20.1	19.1	17.5	
OIQoL Pain dimension (0-100)	N	41	37	17	0.84
	Mean	75.7	73.1	73.3	
	SD	19.4	20.6	24.7	
OIQoL Fear dimension (0-100)	N	40	37	17	0.30
	Mean	76.7	69.5	76.5	
	SD	18.8	24.3	21.5	
OIQoL Independence dimension (0-100)	N	41	36	16	0.76
	Mean	69.1	68	65.6	
	SD	14.9	15.1	18.8	
OIQoL Isolation dimension (0-100)	N	41	35	17	0.92
	Mean	57.4	55.7	55.9	
	SD	21.1	20.2	15.5	
EQ-5D Overall Utility (VAS)	N	41	37	15	0.94
	Mean	71.6	69.9	71.4	
	SD	22.4	23	17.8	
EQ-5D Overall Utility (Tariff)	N	41	37	16	0.17
	Mean	0.9	0.9	0.9	
	SD	0.04	0.06	0.06	
PedsQL Physical Functioning (0-100)	N	41	37	16	0.07
	Mean	55.2	48.7	39.6	
	SD	26.5	21.3	16	
PedsQL Emotional Functioning (0-100)	N	41	37	16	0.65
	Mean	67.7	65.9	71.6	
	SD	23.2	17.1	18.3	
PedsQL Social Functioning (0-100)	N	41	37	16	0.65
	Mean	69.5	65.5	66.9	
	SD	20.9	18.3	15.2	
PedsQL School Functioning (0-100)	N	41	37	16	0.56
	Mean	64	59.6	63.8	
	SD	17.9	22.8	11.6	
PedsQL psychosocial health summary score (0-100)	N	41	37	15	0.57
	Mean	67.1	63.7	67.3	
	SD	17.1	15.7	9.4	
PedsQL Total scale score (0-100)	N	41	37	16	0.48
	Mean	64.1	59.9	60.5	
	SD	18.3	15.1	9.3	

Tables 9.10.a Table to demonstrate item level score differences between treatment groups (Pamidronate, Risedronate, Zoledronate, Nil) at baseline on raw data (items Q1-6).

		N	Mean	Std. Deviation	95% Confidence Interval for Mean		Sig
					Lower Bound	Upper Bound	
<b>Q1</b> In the last week did someone give you extra help to keep you safe?	NIL	14	2.57	1.34	1.80	3.35	0.06
	PAM	62	2.61	1.32	2.28	2.95	
	RISE	15	2.00	1.31	1.27	2.73	
	ZOL	4	1.00	0.00	1.00	1.00	
	Total	95	2.44	1.33	2.17	2.71	
<b>Q2</b> In the last week did you keep away from busy areas to keep safe?	NIL	14	2.79	1.12	2.14	3.43	0.71
	PAM	62	2.53	1.34	2.19	2.87	
	RISE	15	2.27	1.39	1.50	3.03	
	ZOL	4	2.25	1.89	-0.76	5.26	
	Total	95	2.52	1.33	2.25	2.79	
<b>Q3</b> In the last week did you keep away from crowds to keep safe?	NIL	14	2.79	1.37	2.00	3.58	0.40
	PAM	62	2.61	1.41	2.26	2.97	
	RISE	15	2.00	1.25	1.31	2.69	
	ZOL	4	2.25	1.89	-0.76	5.26	
	Total	95	2.53	1.40	2.24	2.81	
<b>Q4</b> In the last week did you try to keep safe to stop you breaking a bone?	NIL	14	2.21	1.48	1.36	3.07	0.78
	PAM	62	1.90	1.24	1.59	2.22	
	RISE	15	1.73	1.28	1.02	2.44	
	ZOL	4	2.00	1.41	-0.25	4.25	
	Total	95	1.93	1.27	1.67	2.19	
<b>Q5</b> In the last week did you keep away from some activities to stop you having a broken bone?	NIL	14	2.64	1.50	1.78	3.51	0.52
	PAM	62	2.48	1.42	2.12	2.85	
	RISE	15	2.33	1.50	1.50	3.16	
	ZOL	4	3.50	1.00	1.91	5.09	
	Total	95	2.53	1.43	2.24	2.82	
<b>Q6</b> In the last week did you think before playing sports to avoid having a broken bone?	NIL	13	2.62	1.45	1.74	3.49	0.11
	PAM	62	2.27	1.52	1.89	2.66	
	RISE	15	1.67	1.05	1.09	2.25	
	ZOL	4	3.50	1.91	0.45	6.55	
	Total	94	2.28	1.48	1.97	2.58	

Tables 9.10.b Table to demonstrate item level score differences between treatment groups (Pamidronate, Risedronate, Zoledronate, Nil) at baseline on raw data (items Q7-14).

		N	Mean	Std. Deviation	95% Confidence Interval for Mean		Sig
					Lower Bound	Upper Bound	
<b>Q7</b> In the last week have you felt tired in the day?	NIL	14	3.07	1.38	2.27	3.87	0.24
	PAM	62	2.40	1.06	2.13	2.67	
	RISE	15	2.47	0.99	1.92	3.02	
	ZOL	4	2.75	1.26	0.75	4.75	
	Total	95	2.53	1.12	2.30	2.75	
<b>Q8</b> In the last week have you felt tired by the end of the day?	NIL	14	2.79	1.31	2.03	3.54	0.39
	PAM	62	2.26	1.30	1.93	2.59	
	RISE	15	2.67	1.23	1.98	3.35	
	ZOL	4	2.00	0.82	0.70	3.30	
	Total	95	2.39	1.28	2.13	2.65	
<b>Q9</b> In the last week did you have to take rests in the day?	NIL	14	3.79	1.05	3.18	4.39	0.49
	PAM	62	3.48	1.10	3.21	3.76	
	RISE	15	3.20	1.47	2.38	4.02	
	ZOL	4	3.00	1.63	0.40	5.60	
	Total	95	3.46	1.17	3.22	3.70	
<b>Q10</b> In the last week has having a broken bone stopped you doing things?	NIL	14	4.07	1.59	3.15	4.99	0.75
	PAM	62	4.02	1.49	3.64	4.39	
	RISE	15	3.67	1.54	2.81	4.52	
	ZOL	4	4.50	1.00	2.91	6.09	
	Total	95	3.99	1.48	3.69	4.29	
<b>Q11</b> In the last week has it been more difficult to move around because of a broken bone?	NIL	14	4.43	1.28	3.69	5.17	0.22
	PAM	62	4.32	1.25	4.00	4.64	
	RISE	15	3.80	1.37	3.04	4.56	
	ZOL	4	3.25	2.06	-0.03	6.53	
	Total	95	4.21	1.32	3.94	4.48	
<b>Q12</b> In the last week have you had to do things differently because of a broken bone?	NIL	14	4.50	0.94	3.96	5.04	0.05
	PAM	62	4.27	1.26	3.96	4.59	
	RISE	15	3.33	1.84	2.32	4.35	
	ZOL	4	3.50	1.73	0.74	6.26	
	Total	95	4.13	1.38	3.85	4.41	
<b>Q13</b> In the last week did you use equipment help you to move around?	NIL	14	4.43	1.16	3.76	5.10	0.04
	PAM	62	3.53	1.57	3.13	3.93	
	RISE	15	3.53	1.77	2.55	4.51	
	ZOL	4	2.00	1.15	0.16	3.84	
	Total	95	3.60	1.58	3.28	3.92	
<b>Q14</b> In the last week did you have to use equipment to help at school or home?	NIL	14	4.29	1.20	3.59	4.98	0.04
	PAM	62	3.16	1.70	2.73	3.59	
	RISE	15	3.67	1.76	2.69	4.64	
	ZOL	4	2.00	1.41	-0.25	4.25	
	Total	95	3.36	1.69	3.01	3.70	

Tables 9.10.c Table to demonstrate item level score differences between treatment groups (Pamidronate, Risedronate, Zoledronate, Nil) at baseline on raw data (items Q15-20).

		N	Mean	Std. Deviation	95% Confidence Interval for Mean		Sig
					Lower Bound	Upper Bound	
<b>Q15</b> In the last week have you had pain in your back?	NIL	14	4.00	0.96	3.45	4.55	0.27
	PAM	62	3.32	1.26	3.00	3.64	
	RISE	15	3.73	1.28	3.02	4.44	
	ZOL	4	3.50	1.73	0.74	6.26	
	Total	95	3.49	1.25	3.24	3.75	
<b>Q16</b> In the last week have you had pain in your legs or arms?	NIL	14	3.64	1.22	2.94	4.34	0.90
	PAM	62	3.40	1.31	3.07	3.74	
	RISE	15	3.33	1.11	2.72	3.95	
	ZOL	4	3.25	1.71	0.53	5.97	
	Total	95	3.42	1.27	3.16	3.68	
<b>Q17</b> In the last week have you had to take medicine for pain?	NIL	14	4.29	1.14	3.63	4.94	0.62
	PAM	62	3.77	1.31	3.44	4.11	
	RISE	15	3.73	1.53	2.88	4.58	
	ZOL	4	3.75	1.89	0.74	6.76	
	Total	95	3.84	1.34	3.57	4.11	
<b>Q18</b> In the last week have you had to take medicine because you broke a bone?	NIL	14	4.86	0.53	4.55	5.17	0.22
	PAM	62	4.60	1.00	4.34	4.85	
	RISE	15	4.13	1.51	3.30	4.97	
	ZOL	4	5.00	0.00	5.00	5.00	
	Total	95	4.58	1.04	4.37	4.79	
<b>Q19</b> In the last week did you have pain because you had a broken bone?	NIL	14	4.64	0.74	4.21	5.07	0.37
	PAM	62	4.37	1.23	4.06	4.68	
	RISE	15	3.87	1.60	2.98	4.75	
	ZOL	4	4.00	2.00	0.82	7.18	
	Total	95	4.32	1.27	4.06	4.58	
<b>Q20</b> In the last week have you missed meeting up with your friends because you had pain?	NIL	14	4.21	1.12	3.57	4.86	0.96
	PAM	62	4.19	1.24	3.88	4.51	
	RISE	15	4.00	1.51	3.16	4.84	
	ZOL	4	4.25	1.50	1.86	6.64	
	Total	95	4.17	1.26	3.91	4.43	

Tables 9.10.d Table to demonstrate item level score differences between treatment groups (Pamidronate, Risedronate, Zoledronate, Nil) at baseline on raw data (items Q21-26).

		N	Mean	Std. Deviation	95% Confidence Interval for Mean		Sig
					Lower Bound	Upper Bound	
<b>Q21</b> In the last week have you been worried about breaking a bone?	NIL	14	3.36	1.39	2.55	4.16	0.34
	PAM	62	3.85	1.30	3.52	4.19	
	RISE	15	3.27	1.28	2.56	3.98	
	ZOL	4	3.75	1.50	1.36	6.14	
	Total	95	3.68	1.32	3.41	3.95	
<b>Q22</b> In the last week did you get scared about doing something that might make you break a bone?	NIL	14	3.79	1.42	2.96	4.61	0.27
	PAM	62	3.98	1.18	3.68	4.28	
	RISE	15	3.27	1.39	2.50	4.03	
	ZOL	4	4.00	1.41	1.75	6.25	
	Total	95	3.84	1.27	3.58	4.10	
<b>Q23</b> In the last week did you worry about coming into hospital?	NIL	14	4.50	0.65	4.12	4.88	0.24
	PAM	62	3.95	1.35	3.61	4.29	
	RISE	15	3.80	1.08	3.20	4.40	
	ZOL	4	4.75	0.50	3.95	5.55	
	Total	95	4.04	1.22	3.79	4.29	
<b>Q24</b> In the last week did you get scared about needles?	NIL	13	3.62	1.50	2.71	4.52	0.88
	PAM	62	3.79	1.60	3.38	4.20	
	RISE	15	3.47	1.55	2.61	4.33	
	ZOL	4	4.00	2.00	0.82	7.18	
	Total	94	3.72	1.58	3.40	4.05	
<b>Q25</b> In the last week did you worry that someone might move you wrong and cause a broken bone?	NIL	14	3.86	1.35	3.08	4.64	0.11
	PAM	62	4.42	0.93	4.18	4.66	
	RISE	15	3.73	1.67	2.81	4.66	
	ZOL	4	4.50	1.00	2.91	6.09	
	Total	95	4.23	1.16	3.99	4.47	
<b>Q26</b> In the last week have you worried about new people handling you?	NIL	14	4.21	1.19	3.53	4.90	0.08
	PAM	62	4.34	1.02	4.08	4.60	
	RISE	15	3.47	1.36	2.72	4.22	
	ZOL	4	4.00	2.00	0.82	7.18	
	Total	95	4.17	1.17	3.93	4.41	

Tables 9.10.e Table to demonstrate item level score differences between treatment groups (Pamidronate, Risedronate, Zoledronate, Nil) at baseline on raw data (items Q27-33).

		N	Mean	Std. Deviation	95% Confidence Interval for Mean		Sig
					Lower Bound	Upper Bound	
<b>Q27</b> In the last week did you like to do things for yourself?	NIL	14	1.79	1.19	1.10	2.47	0.96
	PAM	62	1.85	0.99	1.60	2.11	
	RISE	15	1.73	0.80	1.29	2.18	
	ZOL	4	2.00	1.41	-0.25	4.25	
	Total	95	1.83	1.00	1.63	2.03	
<b>Q28</b> In the last week did your family encourage you to do things for yourself?	NIL	14	2.29	1.14	1.63	2.94	0.41
	PAM	62	2.29	1.41	1.93	2.65	
	RISE	15	1.80	1.01	1.24	2.36	
	ZOL	4	1.50	1.00	-0.09	3.09	
	Total	95	2.18	1.30	1.91	2.44	
<b>Q29</b> In the last week did you have as much freedom as your friends?	NIL	14	2.43	1.40	1.62	3.24	0.40
	PAM	62	2.71	1.31	2.38	3.04	
	RISE	15	2.13	1.19	1.48	2.79	
	ZOL	4	3.00	1.41	0.75	5.25	
	Total	95	2.59	1.31	2.32	2.86	
Q30 In the last week did your family let you make your own decision about what is safe?	NIL	14	2.86	1.41	2.05	3.67	0.54
	PAM	60	2.65	1.40	2.29	3.01	
	RISE	15	2.80	1.32	2.07	3.53	
	ZOL	4	1.75	0.96	0.23	3.27	
	Total	93	2.67	1.37	2.38	2.95	
<b>Q31</b> In the last week did the teachers at school over protect you?	NIL	14	3.07	1.38	2.27	3.87	0.39
	PAM	62	3.45	1.43	3.09	3.82	
	RISE	15	3.87	1.06	3.28	4.45	
	ZOL	4	4.00	1.15	2.16	5.84	
	Total	95	3.48	1.37	3.21	3.76	
<b>Q32</b> In the last week did the teachers at school stop you doing things that you think are safe?	NIL	14	4.36	0.84	3.87	4.84	0.40
	PAM	62	3.82	1.36	3.48	4.17	
	RISE	15	4.20	0.94	3.68	4.72	
	ZOL	4	4.25	0.96	2.73	5.77	
	Total	95	3.98	1.23	3.73	4.23	
<b>Q33</b> In the last week did your family let you choose your own activities?	NIL	14	2.36	1.28	1.62	3.09	0.56
	PAM	62	2.26	1.28	1.93	2.58	
	RISE	15	2.00	1.00	1.45	2.55	
	ZOL	4	1.50	0.58	0.58	2.42	
	Total	95	2.20	1.22	1.95	2.45	

Tables 9.10.f Table to demonstrate item level score differences between treatment groups (Pamidronate, Risedronate, Zoledronate, Nil) at baseline on raw data (items Q34-39).

		N	Mean	Std. Deviation	95% Confidence Interval for Mean		Sig
					Lower Bound	Upper Bound	
<b>Q34</b> In the last week did you see your friends outside of school?	NIL	14	3.36	1.55	2.46	4.25	0.01
	PAM	62	2.77	1.43	2.41	3.14	
	RISE	14	2.43	1.40	1.62	3.24	
	ZOL	4	5.00	0.00	5.00	5.00	
	Total	94	2.90	1.49	2.60	3.21	
<b>Q35</b> In the last week were you able to do everything your friends do?	NIL	14	2.36	1.15	1.69	3.02	0.28
	PAM	62	2.94	1.33	2.60	3.27	
	RISE	14	2.50	0.85	2.01	2.99	
	ZOL	4	3.25	0.96	1.73	4.77	
	Total	94	2.80	1.24	2.54	3.05	
<b>Q36</b> In the last week did you get to do lots of different activities?	NIL	14	2.21	1.05	1.61	2.82	0.70
	PAM	61	2.59	1.38	2.24	2.94	
	RISE	14	2.64	1.34	1.87	3.41	
	ZOL	4	3.00	1.83	0.09	5.91	
	Total	93	2.56	1.34	2.28	2.83	
<b>Q37</b> In the last week did you feel different because you have to be more careful than your friends?	NIL	14	2.29	1.38	1.49	3.08	0.18
	PAM	62	3.08	1.43	2.72	3.44	
	RISE	14	3.07	1.21	2.37	3.77	
	ZOL	4	3.75	1.89	0.74	6.76	
	Total	94	2.99	1.43	2.70	3.28	
<b>Q38</b> In the last week have people treated you differently because you have brittle bones?	NIL	14	3.07	1.33	2.30	3.84	0.07
	PAM	62	2.94	1.40	2.58	3.29	
	RISE	14	4.00	1.04	3.40	4.60	
	ZOL	4	3.00	1.41	0.75	5.25	
	Total	94	3.12	1.37	2.84	3.40	
<b>Q39</b> In a normal school week do you do PE?	NIL	14	2.36	1.65	1.41	3.31	0.37
	PAM	62	2.19	1.49	1.81	2.57	
	RISE	14	2.64	1.86	1.57	3.72	
	ZOL	4	3.50	1.91	0.45	6.55	
	Total	94	2.34	1.59	2.01	2.67	

Tables 9.10. a-f demonstrate significant differences between treatment groups (Pamidronate, Risedronate, Zoledronate, Nil (no treatment)) for items Q12, Q13, Q14, and Q34. Item Q12 demonstrates significantly lower scores for individuals on Zoledronate, with individuals on no treatment (Nil) reporting the highest score and therefore better QoL. Items Q13 and Q14 demonstrate significantly lower scores for individuals on Zoledronate, again with individuals on no treatment reporting the highest score. However, item Q34 demonstrates a different picture, with those individuals on

Zoledronate reporting a higher score (i.e. answering 'never' to the item; in the last week did you see your friends outside of school) and therefore lower QoL. For this item (Q34) individuals on Risedronate reported significantly worse QoL.

As it is anecdotally reported by patients that they feel better immediately following Pamidronate and that this feeling gradually wears off over the next three months, when prior to their next treatment they report beginning to feel achy and experience pain. This change in reported symptoms following a three month cycle is not reported by individuals who take Zoledronate, Risedronate or no treatment, as their treatment has less reported up and downs, is taken weekly in the case of Risedronate and six monthly in the case of Zoledronate. Therefore it was considered that there may be a noticeable difference between those individuals treated with Pamidronate and the patients receiving other treatment options (tables 9.11 and 9.12).

Again items Q13 and Q14 (Table 9.11) demonstrate a significant difference between treatments; with those receiving Pamidronate reporting a lower score (lower QoL). Item Q23 also demonstrates a significant difference with those individuals on Pamidronate reporting a lower score, which may have been due to their need to be admitted to hospital for an intravenous infusion. However, item Q37 demonstrated a significant difference between treatments with those patients not receiving Pamidronate reporting a lower score (lower QoL).

From table 9.12 it can be seen that items Q10, Q11, Q12, Q13, Q18 and Q19 all demonstrate significant difference between treatment options, with those individuals receiving Pamidronate gaining lower scores at the three month follow up, this may support the notion that individuals receiving Pamidronate report a return of some symptoms and a resultant reduction in QoL.

Table 9.11. Table to demonstrate item level score differences between Pamidronate and other treatment options (Rise, Zol, Nil) with hypothesised known groups at one week retest (raw data).

Any drug treatment effects (yes or no)	Pamidronate			Risedronate, Zoledronate, Nil			Mean diff	Confidence Interval		Sig. (2-tailed)
	N	Mean	SD	N	Mean	SD		Lower	Upper	
Q1 In the last week did someone give you extra help to keep you safe?	81	2.42	1.34	14	2.57	1.34	-0.15	-0.97	0.67	0.70
Q2 In the last week did you keep away from busy areas to keep safe?	81	2.47	1.36	14	2.47	1.12	-0.32	-1.02	0.38	0.36
Q3 In the last week did you keep away from crowds to keep safe?	81	2.48	1.41	14	2.79	1.37	-0.30	-1.14	0.53	0.45
Q4 In the last week did you try to keep safe to stop you breaking a bone?	81	1.88	1.24	13	2.21	1.48	-0.34	-1.22	0.55	0.43
Q5 In the last week did you keep away from some activities to stop you having a broken bone?	81	2.51	1.42	14	2.64	1.50	-0.14	-1.04	0.77	0.75
Q6 In the last week you think before playing sports to avoid having a broken bone?	81	2.22	1.49	13	2.62	1.45	-0.39	-1.31	0.53	0.38
Q7 In the last week have you felt tired in the day?	81	2.43	1.05	14	3.07	1.39	-0.64	-1.46	0.19	0.12
Q8 In the last week have you felt tired by the end of the day?	81	2.32	1.27	14	2.79	1.31	-0.47	-1.26	0.33	0.24
Q9 In the last week did you have to take rests in the day?	81	3.41	1.19	14	3.79	1.05	-0.38	-1.03	0.27	0.24
Q10 In the last week has having a broken bone stopped you doing things?	81	3.98	1.47	14	4.07	1.59	-0.10	-1.06	0.87	0.84
Q11 In the last week has it been more difficult to move around because of a broken bone?	81	4.17	1.33	14	4.43	1.28	-0.26	-1.04	0.53	0.50
Q12 In the last week have you had to do things differently because of a broken bone?	81	4.06	1.43	14	4.50	0.94	-0.44	-1.05	0.18	0.15

Q13 In the last week did you use equipment help you to move around?	81	3.46	1.61	14	4.43	1.16	-0.97	-1.71	-0.23	0.01
Q14 In the last week did you have to use equipment to help at school or home?	81	3.20	1.71	14	4.29	1.20	-1.09	-1.86	-0.32	0.01
Q15 In the last week have you had pain in your back?	81	3.41	1.28	14	4.00	0.96	-0.59	-1.20	0.02	0.06
Q16 In the last week have you had pain in your legs or arms?	81	3.38	1.28	14	3.64	1.22	-0.26	-1.00	0.48	0.47
Q17 In the last week have you had to take medicine for pain?	81	3.77	1.36	14	4.29	1.14	-0.52	-1.23	0.19	0.14
Q18 In the last week have you had to take medicine because you broke a bone?	81	4.53	1.10	14	4.86	0.54	-0.33	-0.71	0.06	0.09
Q19 In the last week did you have pain because you had a broken bone?	81	4.26	1.34	14	4.64	0.75	-0.38	-0.89	0.12	0.13
Q20 In the last week have you missed meeting up with your friends because you had pain?	81	4.16	1.29	14	4.21	1.12	-0.05	-0.75	0.64	0.87
Q21 In the last week have you been worried about breaking a bone?	81	3.74	1.31	14	3.36	1.39	0.38	-0.46	1.23	0.35
Q22 In the last week did you get scared about doing something that might make you break a bone?	81	3.85	1.25	14	3.79	1.42	0.07	-0.79	0.92	0.87
Q23 In the last week did you worry about coming into hospital?	81	3.96	1.28	14	4.50	0.65	-0.54	-0.99	-0.08	0.02
Q24 In the last week did you get scared about needles?	81	3.74	1.60	13	3.62	1.50	0.13	-0.83	1.08	0.79
Q25 In the last week did you worry that someone might move you wrong and cause a broken bone?	81	4.30	1.12	14	3.86	1.35	0.44	-0.37	1.25	0.27

Q26 In the last week have you worried about new people handling you?	81	4.16	1.18	14	4.21	1.19	-0.05	-0.78	0.67	0.88
Q27 In the last week did you like to do things for yourself?	81	1.84	0.97	14	1.79	1.19	0.05	-0.66	0.76	0.87
Q28 In the last week did your family encourage you to do things for yourself?	81	2.16	1.34	14	2.29	1.14	-0.13	-0.83	0.58	0.72
Q29 In the last week did you have as much freedom as your friends?	81	2.62	1.30	14	2.43	1.40	0.19	-0.66	1.03	0.64
Q30 In the last week did your family let you make your own decision about what is safe?	79	2.63	1.37	14	2.86	1.41	-0.22	-1.08	0.63	0.59
Q31 In the last week did the teachers at school over protect you?	81	3.56	1.36	14	3.07	1.39	0.48	-0.36	1.33	0.24
Q32 In the last week did the teachers at school stop you doing things that you think are safe?	81	3.91	1.28	14	4.36	0.84	-0.44	-0.99	0.11	0.11
Q33 In the last week did your family let you choose your own activities?	81	2.17	1.21	14	2.36	1.28	-0.18	-0.96	0.59	0.62
Q34 In the last week did you see your friends outside of school?	80	2.83	1.47	14	3.36	1.55	-0.53	-1.47	0.41	0.25
Q35 In the last week were you able to do everything your friends do?	80	2.88	1.25	14	2.36	1.15	0.52	-0.19	1.23	0.14
Q36 In the last week did you get to do lots of different activities?	79	2.62	1.38	14	2.21	1.05	0.41	-0.26	1.07	0.22
Q37 In the last week did you feel different because you have to be more careful than your friends?	80	3.11	1.41	14	2.29	1.38	0.83	-0.02	1.67	0.05
Q38 In the last week have people treated you differently because you have brittle bones?	80	3.13	1.39	14	3.07	1.33	0.54	-0.76	0.87	0.89
Q39 In a normal school week do you do PE?	80	2.34	1.59	14	2.36	1.65	-0.02	-1.02	0.98	0.97

Table 9.12. Table to demonstrate item level score differences between Pamidronate and other treatment options (Rise, Zol, Nil) with hypothesised known groups at three months (raw data).

Any drug treatment effects (yes or no)	Pamidronate			Risedronate, Zoledronate, Nil			Mean diff	Confidence Interval		Sig. (2-tailed)
	N	Mean	SD	N	Mean	SD		Lower	Upper	
Q1 In the last week did someone give you extra help to keep you safe?	64	2.84	1.32	9	3.11	1.69	-0.27	-1.59	1.05	0.66
Q2 In the last week did you keep away from busy areas to keep safe?	64	2.59	1.37	9	2.22	1.48	0.37	-0.79	1.54	0.49
Q3 In the last week did you keep away from crowds to keep safe?	64	2.77	1.33	9	2.33	1.41	0.43	-0.68	1.54	0.41
Q4 In the last week did you try to keep safe to stop you breaking a bone?	64	2.13	1.36	9	2.44	1.67	-0.32	-1.62	0.98	0.60
Q5 In the last week did you keep away from some activities to stop you having a broken bone?	64	2.59	1.44	9	1.89	1.27	0.70	-0.31	1.72	0.15
Q6 In the last week did you think before playing sports to avoid having a broken bone?	64	2.41	1.49	9	1.89	1.17	0.52	-0.42	1.46	0.25
Q7 In the last week have you felt tired in the day?	64	2.77	1.11	9	2.78	1.56	-0.01	-1.23	1.20	0.98
Q8 In the last week have you felt tired by the end of the day?	64	2.25	1.21	9	2.33	1.50	-0.08	-1.26	1.09	0.88
Q9 In the last week did you have to take rests in the day?	64	3.38	1.25	9	3.11	1.62	0.26	-1.00	1.52	0.65
Q10 In the last week has having a broken bone stopped you doing things?	64	4.34	1.26	9	5.00	0.00	-0.66	-0.97	-0.34	0.00
Q11 In the last week has it been more difficult to move around because of a broken bone?	64	4.47	1.19	9	5.00	0.00	-0.53	-0.83	-0.23	0.00
Q12 In the last week have you had to do things differently because of a broken bone?	64	4.39	1.20	9	5.00	0.00	-0.61	-0.91	-0.31	0.00

Q13 In the last week did you use equipment help you to move around?	64	3.64	1.52	9	4.67	0.71	-1.03	-1.66	-0.40	0.00
Q14 In the last week did you have to use equipment to help at school or home?	64	3.31	1.64	9	3.33	1.87	-0.02	-1.49	1.45	0.98
Q15 In the last week have you had pain in your back?	64	3.33	1.39	9	2.67	1.32	0.66	-0.39	1.71	0.19
Q16 In the last week have you had pain in your legs or arms?	64	3.20	1.26	9	2.78	1.09	0.43	-0.45	1.30	0.31
Q17 In the last week have you had to take medicine for pain?	64	3.70	1.38	9	3.78	1.09	-0.07	-0.95	0.80	0.86
Q18 In the last week have you had to take medicine because you broke a bone?	64	4.55	1.11	9	5.00	0.00	-0.45	-0.73	-0.18	0.00
Q19 In the last week did you have pain because you had a broken bone?	64	4.48	1.20	9	5.00	0.00	-0.52	-0.81	-0.22	0.00
Q20 In the last week have you missed meeting up with your friends because you had pain?	64	4.38	1.08	9	4.44	1.01	-0.07	-0.87	0.73	0.85
Q21 In the last week have you been worried about breaking a bone?	64	3.56	1.40	9	3.22	1.48	0.34	-0.83	1.51	0.53
Q22 In the last week did you get scared about doing something that might make you break a bone?	64	3.69	1.33	9	3.33	1.50	0.35	-0.82	1.53	0.52
Q23 In the last week did you worry about coming into hospital?	64	4.06	1.40	9	3.78	1.48	0.28	-0.88	1.45	0.60
Q24 In the last week did you get scared about needles?	64	4.09	1.44	9	3.00	1.94	1.09	-0.42	2.60	0.14
Q25 In the last week did you worry that someone might move you wrong and cause a broken bone?	64	4.19	1.22	9	3.67	1.41	0.52	-0.59	1.63	0.32
Q26 Have you worried about new people handling you?	64	4.33	1.16	9	3.67	1.66	0.66	-0.63	1.95	0.28

Q27 In the last week did you like to do things for yourself?	64	1.72	0.81	9	2.56	1.42	-0.84	-1.94	0.27	0.12
Q28 In the last week did your family encourage you to do things for yourself?	64	2.17	1.23	9	2.11	1.27	0.06	-0.94	1.06	0.90
Q29 In the last week did you have as much freedom as your friends?	64	2.59	1.22	9	2.22	1.48	0.37	-0.79	1.53	0.49
Q30 In the last week did your family let you make your own decision about what is safe?	64	2.28	1.08	9	2.44	1.24	-0.16	-1.13	0.81	0.71
Q31 In the last week did the teachers at school over protect you?	64	3.80	1.30	9	4.00	1.41	-0.20	-1.31	0.91	0.69
Q32 In the last week did the teachers at school stop you doing things that you think are safe?	64	4.19	1.02	9	4.22	1.30	-0.03	-1.05	0.98	0.94
Q33 In the last week did your family let you choose your own activities?	64	2.14	1.13	9	1.89	0.93	0.25	-0.49	1.00	0.47
Q34 In the last week did you see your friends outside of school?	64	2.88	1.35	9	2.89	1.36	-0.01	-1.09	1.06	0.98
Q35 In the last week were you able to do everything your friends do?	64	2.88	1.27	9	2.89	1.27	-0.01	-1.02	0.99	0.98
Q36 In the last week did you get to do lots of different activities?	64	2.45	1.13	9	2.67	1.22	-0.21	-1.18	0.75	0.63
Q37 In the last week did you feel different because you have to be more careful than your friends?	64	3.31	1.22	9	2.44	1.51	0.87	-0.31	2.05	0.13
Q38 In the last week have people treated you differently because you have brittle bones?	64	3.17	1.23	9	3.00	1.73	0.17	-1.18	1.52	0.78
Q39 In a normal school week do you do PE?	64	2.56	1.51	9	2.78	1.56	-0.22	-1.45	1.02	0.71

#### 9.4.6 Internal Consistency of the OIQoL

Cronbach's alpha for the complete 39 item OIQoL is 0.86. This is a score which is well above the 0.70 level required to demonstrate internal consistency as stated by Fayers and Machin (2007). They also suggested for comparisons between individuals a higher Cronbach's alpha score of 0.80 would be more appropriate.

#### 9.4.7 Examining each dimension

**Table 9.13.** Baseline statistics and Cronbach's alpha scores for each of the dimensions in the OIQoL

	Number of items	Valid N	No. Missing	Cronbach's alpha	Mean	Median	Standard Deviation
OIQoL Being safe and careful dimension (0-100)	6	94	1	0.84	34.2	29.2	25.6
OIQoL Reduced function dimension (0-100)	8	95	0	0.72	61.4	62.5	20.3
OIQoL Pain dimension (0-100)	6	95	0	0.75	74.3	79.2	20.7
OIQoL Fear dimension (0-100)	6	94	1	0.76	73.8	79.2	21.6
OIQoL Independence dimension (0-100)	7	93	2	0.49	68	67.9	15.6
OIQoL Isolation dimension (0-100)	6	93	2	0.56	56.5	54.2	19.6

Table 9.13 presents Cronbach's alpha scores for each dimension within the OIQoL. It can be seen from this table that the first four dimensions have Cronbach's alpha scores of above 0.70, the suggested level of requirement for a questionnaire with reasonable internal consistency. However the latter two dimensions (Independence and Isolation) have much lower Cronbach's alpha scores, indicating some items may not demonstrate good fit with the concept or construct of these dimensions, and suggesting there are problems regarding the internal consistency, highlighting the need to explore these dimensions more closely.

### *Being safe and careful.*

The being safe and careful dimension contains six items, all which have Cronbach's alpha score above the threshold of 0.70. No improvement would be made to the internal consistency of this dimension if items were removed, and all item-total correlations are moderate indicating all items correlate well with the construct of this dimension (Table 9.14).

**Table 9.14.** Item-total statistics for 6 item dimension 'Being safe and careful' (n=94)

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q1 In the last week did someone give you extra help to keep you safe?	11.8	28.0	0.57	0.39	0.82
Q2 In the last week did you keep away from busy areas to keep safe?	11.7	27.1	0.65	0.58	0.81
Q3 In the last week did you keep away from crowds to keep safe?	11.7	27.0	0.62	0.55	0.81
Q4 In the last week did you try to keep safe to stop you breaking a bone?	12.3	26.3	0.76	0.60	0.79
Q5 In the last week did you keep away from some activities to stop you having a broken bone?	11.7	27.4	0.56	0.43	0.82
Q6 In the last week did you think before playing sports to avoid having a broken bone?	11.9	27.2	0.55	0.41	0.83

### *Reduced function*

The reduced function dimension has 8 items, and Cronbach's alpha is 0.72. No improvement would be made in this value by deleting any items, however items Q7-9 which discuss aspects of tiredness, have very low item-total correlations <0.3 and are therefore not well correlated with the dimension (Table 9.15). Removing Q7+8 increases Cronbach's alpha to 0.74, but Q9 still continues to have a low item-total correlation (Table 9.16). However, choosing to eliminate item Q9 and leaving either item Q7 or Q8 has a less positive effect on Cronbach's alpha and leaves a poorer item-total correlation (Table 9.17). It would be tempting statistically to remove all three items, but this would not provide good content validity as tiredness was described as an important theme within the focus groups.

**Table 9.15.** Item-total statistics for 8 item dimension 'Reduced function' (n=95)

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q7 In the last week have you felt tired in the day?	25.1	37.3	0.26	0.38	0.72
Q8 In the last week have you felt tired by the end of the day?	25.3	36.2	0.27	0.33	0.72
Q9 In the last week did you have to take rests in the day?	24.2	36.5	0.29	0.34	0.72
Q10 In the last week has having a broken bone stopped you doing things?	23.7	32.2	0.45	0.64	0.69
Q11 In the last week has it been more difficult to move around because of a broken bone?	23.5	31.3	0.61	0.78	0.66
Q12 In the last week have you had to do things differently because of a broken bone?	23.5	32.0	0.52	0.78	0.67
Q13 In the last week did you use equipment to help you to move around?	24.1	30.4	0.52	0.41	0.67
Q14 In the last week did you have to use equipment to help at school or home?	24.3	31.6	0.4	0.38	0.7

*Removal of items 7+8:*

**Table 9.16.** Reliability Statistics following removal of items Q7 and Q8.

Cronbach's Alpha	N of Items
0.74	6

**Table 9.17.** Item-total statistics for dimension 'Reduced function', following removal of items Q7 and Q8 (n=95)

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q9 In the last week did you have to take rests in the day?	19.3	29.8	0.13	0.14	0.78
Q10 In the last week has having a broken bone stopped you doing things?	18.8	22.9	0.54	0.63	0.68
Q11 In the last week has it been more difficult to move around because of a broken bone?	18.5	22.4	0.70	0.78	0.64
Q12 In the last week have you had to do things differently because of a broken bone?	18.6	22.6	0.63	0.77	0.66
Q13 In the last week did you use equipment to help you to move around?	19.2	22.3	0.54	0.40	0.69
Q14 In the last week did you have to use equipment to help at school or home?	19.4	23.9	0.37	0.33	0.74

*Pain*

**Table 9.18.** Item-total statistics for 6 item dimension 'Pain' (n=95)

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q15 In the last week have you had pain in your back?	20.3	19.4	0.34	0.29	0.75
Q16 In the last week have you had pain in your legs or arms?	20.4	17.5	0.53	0.35	0.70
Q17 In the last week have you had to take medicine for pain?	20.0	16.9	0.54	0.38	0.70
Q18 In the last week have you had to take medicine because you broke a bone?	19.2	19.4	0.46	0.63	0.72
Q19 In the last week did you have pain because you had a broken bone?	19.5	17.3	0.54	0.66	0.70
Q20 In the last week have you missed meeting up with your friends because you had pain?	19.7	17.5	0.53	0.31	0.70

The pain dimension includes six items with a Cronbach's alpha score of 0.75. Table 9.18 demonstrates there is no improvement made by removing an item. The item-total correlation for item Q15 is quite low, but is over the recommended 0.3. Back pain is a theme which was discussed throughout the interview and focus group stages of concept elicitation and alongside the experience of the principle researcher, this is a complaint often described by patients. For this reason and because of the initially low sample size, this item will not be removed at this stage.

### *Fear*

Cronbach's alpha for the six items within the fear dimension is 0.76 (see Table 9.13). Removal of item Q24 would increase the Cronbach's alpha to 0.79, and as this item also demonstrates very poor correlation to other items within this dimension, with an ITC score of 0.28 (Table 9.19), its removal would improve the dimension's internal consistency (Table 9.20).

**Table 9.19.** Item-total statistics for 6 item dimension 'Fear' (n=94)

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q21 In the last week have you been worried about breaking a bone?	20.0	19.0	0.56	0.50	0.70
Q22 In the last week did you get scared about doing something that might make you break a bone?	19.9	17.9	0.70	0.60	0.67
Q23 In the last week did you worry about coming into hospital?	19.7	21.0	0.40	0.26	0.75
Q24 In the last week did you get scared about needles?	20.0	20.6	0.28	0.22	0.79
Q25 In the last week did you worry that someone might move you wrong and cause a broken bone?	19.5	19.2	0.65	0.59	0.69
Q26 In the last week have you worried about new people handling you?	19.6	20.3	0.50	0.37	0.72

Removal of item Q24 increased Cronbach's alpha to 0.79, but removing this item also highlighted the low ITC score for item Q23 (0.26), which is outside the suggested range of  $ITC > 0.3$ . However if this item was also provisionally removed, Cronbach's alpha score for the dimension would increased to 0.84 as a result, yet content validity in

relation to item elicitation would decrease, as these items were discussed at length in focus group 1.

**Table 9.20.** Item-total statistics for the 5 item dimension 'Fear' following removal of item Q24 (n=94)

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q21 In the last week have you been worried about breaking a bone?	16.3	12.8	0.62	0.49	0.73
Q22 In the last week did you get scared about doing something that might make you break a bone?	16.1	12.3	0.73	0.55	0.69
Q23 In the last week did you worry about coming into hospital?	15.9	16.3	0.26	0.11	0.84
Q25 In the last week did you worry that someone might move you wrong and cause a broken bone?	15.7	13.1	0.71	0.57	0.70
Q26 In the last week have you worried about new people handling you?	15.8	14.3	0.54	0.35	0.75

### *Independence*

**Table 9.21.** Item-total statistics for the 7 item dimension 'Independence' (n=93)

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q27 In the last week did you like to do things for yourself?	21.9	16.9	0.14	0.10	0.48
Q28 In the last week did your family encourage you to do things for yourself?	22.3	14.7	0.26	0.17	0.43
Q29 In the last week did you have as much freedom as your friends?	22.7	13.8	0.36	0.19	0.38
Q30 In the last week did your family let you make your own decision about what is safe?	22.7	13.3	0.39	0.40	0.36
Q31 In the last week did the teachers at school over protect you?	22.5	17.3	-0.01	0.20	0.56
Q32 In the last week did the teachers at school stop you doing things that you think are safe?	22.0	16.2	0.15	0.20	0.48
Q33 In the last week did your family let you choose your own activities?	22.3	14.2	0.37	0.34	0.38

The independence dimension has an unsatisfactory Cronbach's alpha score of 0.49; removal of any one item does not increase the Cronbach's alpha score by any significant amount. The ITC scores are all quite low, demonstrating the items have very little correlation within the dimension at all (table 9.21). A similar pattern is seen in the final dimension 'isolation'.

### *Isolation*

Overall Cronbach's alpha for the isolation dimension is 0.55 which is below the suggested accepted level of 0.70. ITC scores for the items within this dimension are very low, with only two items (Q35+36) showing moderate correlation (table 9.22). For this reason we chose to examine the latter two dimensions as a singular dimension and look for any correlations between items.

**Table 9.22.** Item-total statistics for the 6 item dimension 'Isolation' (n=93)

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q34 Did you see your friends outside of school?	16.4	16.8	0.27	0.20	0.52
Q35 Are you able to do everything your friends do?	16.3	15.2	0.57	0.44	0.39
Q36 Did you get to do lots of different activities?	16.1	15.8	0.44	0.29	0.44
Q37 Do you feel different because you have to be more careful than your friends?	16.6	16.6	0.31	0.32	0.50
Q38 Have people treated you differently because you have brittle bones?	16.4	17.0	0.29	0.37	0.50
Q39 Did you do PE at school?	15.9	19.6	0.00	0.17	0.65

**Table 9.23.** Reliability Statistics following the combination of dimensions independence and isolation.

Cronbach's Alpha	N of Items
0.64	13

Combining these two dimensions produced a dimension with thirteen items, with a Cronbach's alpha of 0.64 (Table 9.23), but this may be due to the effect of the increased number of items reducing the variability. It is easy to see that a couple of item have negative ITC demonstrating that they correlate poorly with this new combined dimension and are not measuring a similar construct (Items Q31 and Q39).

**Table 9.24.** Item-total statistics for combined dimensions 'Independence' and 'Isolation', now 13 items and entitled 'Life skills' n=93

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q27 In the last week did you like to do things for yourself?	41.5	53.1	0.22	0.20	0.63
Q28 In the last week did your family encourage you to do things for yourself?	41.9	50.9	0.25	0.27	0.63
Q29 In the last week did you have as much freedom as your friends?	42.2	45.3	0.60	0.49	0.57
Q30 In the last week did your family let you make your own decision about what is safe?	42.3	49.2	0.33	0.47	0.62
Q31 In the last week did the teachers at school over protect you?	42.1	57.2	-0.08	0.28	0.68
Q32 In the last week did the teachers at school stop you doing things that you think are safe?	41.6	53.2	0.16	0.28	0.64
Q33 In the last week did your family let you choose your own activities?	41.9	49.9	0.35	0.40	0.61
Q34 In the last week did you see your friends outside of school?	42.5	51.1	0.19	0.23	0.64
Q35 In the last week were you able to do everything your friends do?	42.4	45.6	0.60	0.60	0.57
Q36 In the last week did you get to do lots of different activities?	42.2	48.4	0.38	0.40	0.61
Q37 In the last week did you feel different because you have to be more careful than your friends?	42.6	48.0	0.36	0.43	0.61
Q38 In the last week have people treated you differently because you have brittle bones?	42.5	46.7	0.46	0.55	0.59
Q39 In a normal school week do you do PE?	42.0	56.0	-0.05	0.26	0.69

**Table 9.25.** Item-total statistics for combined dimension (Life skills) with item removal (n=93)

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q27 In the last week did you like to do things for yourself?	34.3	50.5	0.24	0.16	0.72
Q28 In the last week did your family encourage you to do things for yourself?	34.7	48.4	0.26	0.26	0.72
Q29 In the last week did you have as much freedom as your friends?	35.0	43.0	0.61	0.48	0.67
Q30 In the last week did your family let you make your own decision about what is safe?	35.1	45.8	0.39	0.45	0.70
Q32 In the last week did the teachers at school stop you doing things that you think are safe?	34.4	52.0	0.10	0.18	0.74
Q33 In the last week did your family let you choose your own activities?	34.7	47.1	0.38	0.40	0.70
Q34 In the last week did you see your friends outside of school?	35.4	48.8	0.19	0.22	0.73
Q35 In the last week were you able to do everything your friends do?	35.3	42.8	0.65	0.58	0.66
Q36 In the last week did you get to do lots of different activities?	35.0	46.3	0.37	0.29	0.70
Q37 In the last week did you feel different because you have to be more careful than your friends?	35.5	45.2	0.40	0.43	0.70
Q38 In the last week have people treated you differently because you have brittle bones?	35.3	44.2	0.48	0.52	0.69

Removal of items Q31 and Q39 with poor ITC values results in an eleven item dimension with a higher Cronbach's alpha of 0.72, but still identifies some items with low ITC (Q32 and Q34), showing poor correlation with the other items (Table 9.25).

Using the item removal strategy of Cronbach's alpha >0.7 and ITC values >0.3, a further 4 items were removed (Q32, Q34, Q27, Q28), resulting in a 7 item dimension with a Cronbach's alpha score of 0.76 (Table 9.27).

**Table 9.26.** Reliability statistics of potential 7 item dimension Life skills.

Cronbach's Alpha	N of Items
0.76	7

**Table 9.27.** Item-total statistics for combined 7 item dimension with removal of 6 items.

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q29 In the last week did you have as much freedom as your friends?	19.9	25.4	0.64	0.47	0.69
Q35 In the last week were you able to do everything your friends do?	20.2	26.4	0.58	0.48	0.70
Q37 In the last week did you feel different because you have to be more careful than your friends?	20.4	26.3	0.47	0.35	0.73
Q38 In the last week have people treated you differently because you have brittle bones?	20.2	27.0	0.45	0.44	0.73
Q30 In the last week did your family let you make your own decision about what is safe?	20.0	27.6	0.40	0.40	0.74
Q33 In the last week did your family let you choose your own activities?	19.6	28.9	0.38	0.36	0.74
Q36 In the last week did you get to do lots of different activities?	19.9	27.9	0.40	0.26	0.74

#### 9.4.8 Possible questionnaire following item elimination

**Table 9.28.** Summary descriptive statistics for 29 item adapted OIQoL

	Number of items	Valid N	No. Missing	Cronbach's alpha	Mean	Median	SD
OIQoL Being safe and careful dimension (0-100)	6	94	1	0.84	34.2	29.2	25.6
OIQoL Reduced function dimension (0-100)	6	95	0	0.74	22.6	24.0	5.7
OIQoL Pain dimension (0-100)	6	95	0	0.75	74.3	79.2	20.7
OIQoL Fear dimension (0-100)	4	94	1	0.84	15.9	17	4.0
OIQoL Life skills (0-100)	7	93	2	0.76	23.4	23	5.9

#### 9.4.9 Test retest at one week

**Table 9.29.** Table to demonstrate item level stability of the OIQoL at one week test retest (max n=51) for those patients who reported no change in global rating of health change question at time 2.

item	N	Mean t=1	SD t=1	N	Mean t=2	SD t=2	Mean diff	Confidence Interval		Sig. (2-tailed)
								Lower	Upper	
Q1 In the last week did someone give you extra help to keep you safe? base	51	2.4	1.3	51	3.0	1.3	-0.61	-0.99	-0.23	0.00
Q2 In the last week did you keep away from busy areas to keep safe? base	51	2.5	1.3	51	3.1	1.2	-0.55	-0.88	-0.21	0.00
Q3 In the last week did you keep away from crowds to keep safe? base	51	2.6	1.4	51	3.2	1.4	-0.59	-0.97	-0.21	0.00
Q4 In the last week did you try to keep safe to stop you breaking a bone?	51	2.0	1.3	51	2.4	1.3	-0.35	-0.74	0.03	0.07
Q5 In the last week did you keep away from some activities to stop you having a broken bone?	51	2.7	1.5	51	3.0	1.2	-0.31	-0.67	0.04	0.08
Q6 In the last week did you think before playing sports to avoid having a broken bone?	50	2.3	1.4	50	2.6	1.5	-0.36	-0.83	0.11	0.13
Q7 In the last week have you felt tired in the day?	50	2.4	1.0	50	2.9	1.2	-0.42	-0.68	-0.16	0.00
Q8 In the last week have you felt tired by the end of the day?	50	2.4	1.2	50	2.4	1.1	0.00	-0.36	0.36	1.00
Q9 In the last week did you have to take rests in the day?	50	3.5	1.2	50	3.7	1.3	-0.18	-0.51	0.15	0.28
Q10 In the last week has having a broken bone stopped you doing things?	50	4.0	1.5	50	4.3	1.3	-0.32	-0.74	0.10	0.14
Q11 In the last week has it been more difficult to move around because of a broken bone?	50	4.3	1.2	50	4.4	1.3	-0.06	-0.37	0.25	0.70
Q12 In the last week have you had to do things differently because of a broken bone?	50	4.2	1.3	50	4.3	1.3	-0.14	-0.49	0.21	0.42
Q13 In the last week did you use equipment help you to move around?	50	3.7	1.6	50	3.9	1.4	-0.22	-0.60	0.16	0.25
Q14 In the last week did you have to use equipment to help at school or home?	50	3.7	1.6	50	3.5	1.6	0.22	-0.25	0.69	0.35
Q15 In the last week have you had pain in your back?	51	3.4	1.3	51	3.5	1.3	-0.14	-0.47	0.19	0.40
Q16 In the last week have you had pain in your legs or arms?	51	3.4	1.2	51	3.2	1.2	0.20	-0.12	0.51	0.22
Q17 In the last week have you had to take medicine for pain?	51	4.0	1.3	51	4.1	1.4	-0.06	-0.47	0.35	0.77

Q18 In the last week have you had to take medicine because you broke a bone?	51	4.7	1.0	51	4.9	.6	-0.22	-0.47	0.04	0.09
Q19 In the last week did you have pain because you had a broken bone?	51	4.3	1.3	51	4.7	.9	-0.41	-0.71	-0.11	0.01
Q20 In the last week have you missed meeting up with your friends because you had pain?	51	4.1	1.4	51	4.3	1.2	-0.12	-0.53	0.29	0.57
Q21 In the last week have you been worried about breaking a bone?	51	3.5	1.4	51	3.7	1.3	-0.20	-0.52	0.13	0.24
Q22 In the last week did you get scared about doing something that might make you break a bone?	51	3.8	1.3	51	3.6	1.3	0.16	-0.13	0.44	0.27
Q23 In the last week did you worry about coming into hospital?	51	4.2	1.2	51	4.2	1.1	-0.04	-0.36	0.28	0.81
Q24 In the last week did you get scared about needles?	50	3.5	1.6	50	4.2	1.3	-0.68	-1.12	-0.24	0.00
Q25 In the last week did you worry that someone might move you wrong and cause a broken bone?	51	4.2	1.3	51	4.4	1.0	-0.22	-0.52	0.08	0.15
Q26 In the last week have you worried about new people handling you?	51	4.2	1.1	51	4.4	1.1	-0.16	-0.46	0.14	0.30
Q27 In the last week did you like to do things for yourself?	51	1.9	1.1	51	1.8	.9	0.16	-0.12	0.43	0.25
Q28 In the last week did your family encourage you to do things for yourself?	51	2.2	1.3	51	2.3	1.3	-0.12	-0.49	0.26	0.53
Q29 In the last week did you have as much freedom as your friends?	51	2.7	1.2	51	2.7	1.2	0.02	-0.34	0.38	0.91
Q30 In the last week did your family let you make your own decision about what is safe?	50	2.8	1.4	50	2.5	1.2	0.36	-0.01	0.73	0.06
Q31 In the last week did the teachers at school over protect you?	51	3.5	1.3	51	3.7	1.4	-0.14	-0.47	0.20	0.42
Q32 In the last week did the teachers at school stop you doing things that you think are safe?	51	3.9	1.1	51	4.0	1.3	-0.10	-0.45	0.26	0.58
Q33 In the last week did your family let you choose your own activities?	51	2.3	1.2	51	2.2	1.2	0.14	-0.23	0.51	0.46
Q34 In the last week did you see your friends outside of school?	50	2.9	1.5	50	3.0	1.4	-0.12	-0.49	0.25	0.51
Q35 In the last week were you able to do everything your friends do?	50	2.9	1.2	50	2.8	1.2	0.08	-0.22	0.38	0.59
Q36 In the last week did you get to do lots of different activities?	50	2.7	1.3	50	2.9	1.1	-0.22	-0.56	0.12	0.19
Q37 In the last week did you feel different because you have to be more careful than your friends?	50	2.9	1.4	50	3.4	1.4	-0.52	-0.84	-0.20	0.00
Q38 In the last week have people treated you differently because you have brittle bones?	50	3.1	1.4	50	3.3	1.3	-0.14	-0.57	0.29	0.52
Q39 In a normal school week do you do PE?	50	2.2	1.5	50	2.3	1.5	-0.10	-0.42	0.22	0.53

**Table 9.30.** Table to demonstrate dimensional stability of OIQoL at one week test retest (max n=50) for those patients who reported no change in global rating of health change question at time 2.

	N	Mean t=1	SD t=1	Mean t=2	SD t=2	Mean diff	95% CI diff		p value	Correlation	ICC	95% CI ICC	
							lower	higher				Lower	higher
OIQoL Being safe and careful (0-100)	49	33.5	23.6	43.8	26.6	11.7	-17.80	-5.50	0.00	0.66	0.70	0.56	0.83
OIQoL Reduced function dimension (0-100)	49	58.3	19.1	65.3	21.7	3.5	-8.50	1.50	0.17	0.63	0.77	0.46	0.75
OIQoL Pain dimension (0-100)	50	73.1	20.6	77.9	19.8	3.1	-7.80	1.60	0.19	0.68	0.75	0.58	0.85
OIQoL Fear dimension (0-100)	49	69.5	24.3	76.1	22.4	4.7	-8.40	-1.00	0.01	0.82	0.67	0.49	0.80
OIQoL Independence dimension (0-100)	49	68	15.1	69.6	15.8	3.2	-7.20	0.80	0.11	0.60	0.81	0.67	0.89
OIQoL Isolation dimension (0-100)	49	55.7	20.2	57	21.9	1.3	-5.60	3.11	0.57	0.72	0.59	0.38	0.74

**Table 9.31.**

Table to demonstrate stability of the PedsQL and EQ5D one week test retest. (max n=50) for those patients who reported no change in global rating of health change question at time 2.

	N	Mean t=1	SD t=1	Mean t=2	SD t=2	Mean diff	95% CI diff		p value	Correlation	ICC	95% CI ICC	
							lower	higher				Lower	higher
EQ-5D Overall Utility (VAS)	50	71.1	21.0	73.6	22.3	-2.5	-5.60	0.61	0.11	0.88	0.87	0.78	0.92
EQ-5D Overall Utility (Tariff)	50	0.9	0.0	0.9	0.0	0.0	-0.01	0.02	0.69	0.16	0.16	-0.13	0.42
PedsQL Physical Functioning (0-100)	49	50.3	23.8	51.4	23.3	-1.1	-5.06	2.77	0.56	0.83	0.84	0.73	0.90
PedsQL Emotional Functioning (0-100)	48	67.8	21.3	73.3	23.1	-5.5	-10.40	-0.61	0.03	0.71	0.69	0.50	0.82
PedsQL Social Functioning (0-100)	49	69.2	18.9	71.6	19.5	-2.4	-5.77	0.87	0.14	0.82	0.82	0.70	0.89
PedsQL School Functioning (0-100)	49	61.9	19.8	61.7	16.9	0.2	-3.65	4.06	0.92	0.74	0.74	0.58	0.84
PedsQL Psychological Health Summary Score (0-100)	48	65.9	16.5	69.0	16.3	3.02	0.33	5.71	0.29	0.84	0.84	0.73	0.91

Test-retest at one week examines those participants who recorded their global health rating as static between baseline and one week completions. From the above tables (9.30 and 9.31) it is noted that 'Being safe and careful' and 'fear' are two dimensions which report significant difference in mean scores at one week test-retest. The mean difference (11.7) for the dimension 'being safe and careful' stands out as much greater than the 'fear' dimension (4.7). This is again noted at the item-level (table 9.29) where items Q1, Q2 and Q3, all of which are in the 'being safe and careful' dimension, demonstrate a significant difference between mean scores at baseline and retest. A significant difference is also seen at one week retest for items Q7, Q19, Q24 and Q37; item Q24 is present within the 'fear' dimension and may have lead to the significant difference at the dimension level (table 9.30). This may also be reflected in the fact that the correlation between baseline (t=1) and one week retest (t=2) for the 'fear' dimension was high (r=0.82). The correlation for test-retest within the 'isolation' dimension was also above the accepted level for reliable scale stability with a score of 0.72. All other dimensions demonstrate only moderate correlations between baseline (t=1) and one week (t=2) scores, ranging from 0.60 – 0.68. When examining the test-retest for the EQ5D and PedsQL with the OI cohort, it is noted that the mean difference scores between baseline (t=1) and one week (t=2) are quite small. However, the emotional functioning dimension of the PedsQL also demonstrates significant difference between baseline and one week scores (mean difference 5.5, sig 0.03) and therefore has poor test-retest within this cohort. Correlations between dimensions at baseline and one week retest are in the majority above the accepted level for reliable scale stability, with scores above 0.70. However the EQ5D tariff score demonstrates low correlation with a score of 0.16. The intra class correlation coefficient (ICC) also demonstrates the same low score.

9.4.10 Test retest at 3 months OIQoL

**Table 9.32.** Table to demonstrate dimensional stability of the OIQoL at three month test retest (max n=42) for those patients who reported no change in global rating of health change question at time 3.

	N	Mean t=1	SD t=1	Mean t=3	SD t=3	Mean diff	95% CI diff		p value	Correlation	95% CI ICC		
							lower	higher			ICC	Lower	higher
OIQoL Being safe and careful (0-100)	42	33.4	23.9	38.3	25.7	4.8	-2.03	11.73	0.16	0.59	0.59	0.35	0.75
OIQoL Reduced function dimension (0-100)	42	62.9	18.3	63.1	21.1	0.1	-4.20	4.49	0.95	0.75	0.75	0.58	0.86
OIQoL Pain dimension (0-100)	42	72.8	20.3	73.4	20.2	0.6	-4.63	5.79	0.82	0.65	0.66	0.45	0.80
OIQoL Fear dimension (0-100)	42	71.2	22.6	69.6	23.1	-1.6	-8.35	5.06	0.62	0.55	0.55	0.31	0.73
OIQoL Independence dimension (0-100)	40	66.9	16.6	71.8	15.4	5.6	-0.21	11.37	0.06	0.34	0.31	0.01	0.56
OIQoL Isolation dimension (0-100)	42	56.8	20.7	54.1	19.8	-2.7	-7.40	1.98	0.25	0.72	0.71	0.53	0.83

**Table 9.33.** Table to demonstrate stability of the PedsQL and at EQ5D three month test retest (max n=42) for those patients who reported no change in global rating of health change question at time 3.

	N	Mean t=1	SD t=1	Mean t=3	SD t=3	Mean diff	95% CI diff		p value	Correlation	ICC	95% CI ICC	
							lower	higher				Lower	higher
EQ-5D Overall Utility (VAS)	41	0.9	0.04	0.9	0.4	0.09	-0.01	0.03	0.28	0.65	0.05	-0.26	0.34
EQ-5D Overall Utility (Tariff)	41	72.2	20.6	71.4	18.6	-0.29	-5.41	4.84	0.91	0.05	0.65	0.44	0.80
PedsQL Physical Functioning (0-100)	42	49.1	20.5	45.0	24.7	-3.73	-7.91	0.45	0.08	0.84	0.83	0.70	0.90
PedsQL Emotional Functioning (0-100)	42	67.1	21.0	67.5	22.0	0.95	-4.26	6.16	0.71	0.70	0.70	0.50	0.83
PedsQL Social Functioning (0-100)	42	68.0	16.1	66.3	20.4	-1.31	-6.64	4.02	0.62	0.58	0.57	0.32	0.74
PedsQL School Functioning (0-100)	41	63.4	18.3	60.6	20.7	-1.83	-7.19	3.53	0.49	0.58	0.62	0.39	0.78
PedsQL psychosocial health summary score (0-100)	41	66.2	14.8	64.8	18.2	-0.93	-5.19	3.32	0.66	0.68	0.67	0.46	0.81

Table 9.34. Table to demonstrate item level responsiveness analysis of the OIQoL at 3 months.

Item	Health Change	N	Mean change	SD	95% Confidence Interval for Mean		Sig Value
					Lower Bound	Upper Bound	
Q1 In the last week did someone give you extra help to keep you safe?	BETTER	19	0.9	1.8	0.1	1.8	0.21
	SAME	43	0.3	1.5	-0.2	0.7	
	WORSE	9	0.0	1.0	-0.8	0.8	
	Total	71	0.4	1.6	0.1	0.8	
Q2 In the last week did you keep away from busy areas to keep safe?	BETTER	19	0.5	1.3	-0.2	1.1	0.12
	SAME	43	0.0	1.2	-0.4	0.3	
	WORSE	9	-0.6	1.5	-1.7	0.6	
	Total	71	0.0	1.3	-0.3	0.3	
Q3 In the last week did you keep away from crowds to keep safe?	BETTER	19	0.8	1.1	0.3	1.4	0.01
	SAME	43	0.3	1.3	-0.2	0.7	
	WORSE	9	-0.9	1.3	-1.9	0.1	
	Total	71	0.3	1.4	-0.1	0.6	
Q4 In the last week did you try to keep safe to stop you breaking a bone?	BETTER	19	0.5	1.2	-0.1	1.1	0.20
	SAME	43	0.3	1.2	-0.1	0.7	
	WORSE	9	-0.3	0.7	-0.9	0.2	
	Total	71	0.3	1.2	0	0.5	
Q5 In the last week did you keep away from some activities to stop you having a broken bone?	BETTER	19	0.3	1.3	-0.4	0.9	0.03
	SAME	43	0.1	1.7	-0.4	0.6	
	WORSE	9	-1.3	1.3	-2.4	-0.3	
	Total	71	0.0	1.6	-0.4	0.4	
Q6 In the last week did you think before playing sports to avoid having a broken bone?	BETTER	19	0.5	1.6	-0.3	1.2	0.08
	SAME	43	0.3	1.7	-0.3	0.8	
	WORSE	9	-1.0	1.4	-2.1	0.1	
	Total	71	0.2	1.7	-0.2	0.6	

Q7 In the last week have you felt tired in the day?	BETTER	19	0.8	1.0	0.3	1.3	0.13
	SAME	43	0.2	1.1	-0.1	0.6	
	WORSE	9	0.6	0.5	0.2	1	
	Total	71	0.4	1.1	0.2	0.7	
Q8 In the last week have you felt tired by the end of the day?	BETTER	19	0.4	1.6	-0.4	1.1	0.44
	SAME	43	-0.1	1.2	-0.5	0.3	
	WORSE	9	0.0	1.2	-0.9	0.9	
	Total	71	0.0	1.3	-0.3	0.4	
Q9 In the last week did you have to take rests in the day?	BETTER	19	0.2	1.1	-0.3	0.8	0.07
	SAME	43	-0.2	1.0	-0.5	0.1	
	WORSE	9	0.7	1.4	-0.4	1.8	
	Total	71	0.0	1.1	-0.3	0.3	
Q10 In the last week has having a broken bone stopped you doing things?	BETTER	19	0.9	1.4	0.3	1.6	0.02
	SAME	43	0.2	1.1	-0.2	0.5	
	WORSE	9	-0.4	1.5	-1.6	0.7	
	Total	71	0.3	1.3	0	0.6	
Q11 In the last week has it been more difficult to move around because of a broken bone?	BETTER	19	0.7	1.1	0.2	1.3	0.08
	SAME	43	0.1	0.8	-0.2	0.3	
	WORSE	9	0.0	1.9	-1.5	1.5	
	Total	71	0.2	1.1	0	0.5	
Q12 In the last week have you had to do things differently because of a broken bone?	BETTER	19	0.6	1.6	-0.1	1.4	0.23
	SAME	43	0.1	1.1	-0.3	0.4	
	WORSE	9	0.0	1.1	-0.9	0.9	
	Total	71	0.2	1.3	-0.1	0.5	
Q13 In the last week did you use equipment help you to move around?	BETTER	19	-0.3	0.8	-0.7	0.1	0.06
	SAME	43	0.0	1.1	-0.4	0.3	
	WORSE	9	0.8	1.6	-0.4	2	
	Total	71	0.0	1.1	-0.2	0.3	

Q14 In the last week did you have to use equipment to help at school or home?	BETTER	19	-0.2	2.1	-1.2	0.8	0.66
	SAME	43	-0.2	1.6	-0.7	0.3	
	WORSE	9	0.4	2.4	-1.4	2.3	
	Total	71	-0.1	1.8	-0.5	0.4	
Q15 In the last week have you had pain in your back?	BETTER	19	-0.3	1.4	-0.9	0.4	0.75
	SAME	43	0.0	1.3	-0.4	0.4	
	WORSE	9	-0.2	1.5	-1.4	0.9	
	Total	71	-0.1	1.3	-0.4	0.2	
Q16 In the last week have you had pain in your legs or arms?	BETTER	19	-0.4	1.8	-1.2	0.5	0.80
	SAME	43	-0.2	1.3	-0.6	0.2	
	WORSE	9	0.0	0.9	-0.7	0.7	
	Total	71	-0.2	1.4	-0.5	0.1	
Q17 In the last week have you had to take medicine for pain?	BETTER	19	-0.5	1.8	-1.4	0.3	0.32
	SAME	43	0.1	1.5	-0.3	0.6	
	WORSE	9	0.2	2.0	-1.4	1.8	
	Total	71	0.0	1.6	-0.4	0.3	
Q18 In the last week have you had to take medicine because you broke a bone?	BETTER	19	0.1	1.4	-0.6	0.8	0.46
	SAME	43	-0.1	1.0	-0.4	0.2	
	WORSE	9	-0.6	2.2	-2.2	1.1	
	Total	71	-0.1	1.3	-0.4	0.2	
Q19 In the last week did you have pain because you had a broken bone?	BETTER	19	0.3	1.4	-0.4	0.9	0.29
	SAME	43	0.2	1.1	-0.1	0.5	
	WORSE	9	-0.4	1.3	-1.5	0.6	
	Total	71	0.1	1.2	-0.1	0.4	
Q20 In the last week have you missed meeting up with your friends because you had pain?	BETTER	19	0.0	1.4	-0.7	0.7	0.86
	SAME	43	0.1	0.9	-0.2	0.4	
	WORSE	9	0.2	0.7	-0.3	0.7	
	Total	71	0.1	1.0	-0.2	0.3	

Q21 In the last week have you been worried about breaking a bone?	BETTER	19	-0.2	1.7	-1	0.6	0.93
	SAME	43	-0.1	1.3	-0.5	0.3	
	WORSE	9	-0.3	1.5	-1.5	0.8	
	Total	71	-0.2	1.4	-0.5	0.1	
Q22 In the last week did you get scared about doing something that might make you break a bone?	BETTER	19	-0.2	1.4	-0.9	0.5	0.57
	SAME	43	-0.2	1.3	-0.6	0.2	
	WORSE	9	0.3	1.5	-0.8	1.5	
	Total	71	-0.1	1.4	-0.5	0.2	
Q23 In the last week did you worry about coming into hospital?	BETTER	19	-0.2	1.3	-0.8	0.4	0.26
	SAME	43	0.1	1.4	-0.3	0.6	
	WORSE	9	-0.7	1.7	-2	0.7	
	Total	71	-0.1	1.4	-0.4	0.3	
Q24 In the last week did you get scared about needles?	BETTER	19	0.5	1.1	-0.1	1	0.20
	SAME	43	0.1	1.3	-0.3	0.5	
	WORSE	9	-0.4	1.3	-1.5	0.6	
	Total	71	0.2	1.3	-0.1	0.5	
Q25 In the last week did you worry that someone might move you wrong and cause a broken bone?	BETTER	19	-0.4	1.6	-1.2	0.4	0.11
	SAME	43	-0.2	1.1	-0.6	0.1	
	WORSE	9	0.7	1.1	-0.2	1.5	
	Total	71	-0.2	1.3	-0.5	0.2	
Q26 In the last week have you worried about new people handling you?	BETTER	19	0.2	0.6	-0.1	0.4	0.01
	SAME	43	-0.1	1.2	-0.5	0.2	
	WORSE	9	1.0	0.9	0.3	1.7	
	Total	71	0.1	1.1	-0.2	0.3	
Q27 In the last week did you like to do things for yourself?	BETTER	19	-0.2	1.0	-0.6	0.3	0.06
	SAME	43	-0.1	0.9	-0.4	0.1	
	WORSE	9	0.7	1.0	-0.1	1.4	
	Total	71	0.0	1.0	-0.3	0.2	

Q28 In the last week did your family encourage you to do things for yourself?	BETTER	19	0.0	1.2	-0.6	0.6	0.76
	SAME	43	0.0	1.4	-0.5	0.4	
	WORSE	9	0.3	1.3	-0.7	1.4	
	Total	71	0.0	1.3	-0.3	0.3	
Q29 In the last week did you have as much freedom as your friends?	BETTER	19	-0.3	1.3	-0.9	0.4	0.30
	SAME	43	0.0	1.2	-0.3	0.4	
	WORSE	9	0.6	1.7	-0.7	1.8	
	Total	71	0.0	1.3	-0.3	0.3	
Q30 In the last week did your family let you make your own decision about what is safe?	BETTER	19	0.1	1.6	-0.7	0.8	0.22
	SAME	41	-0.5	1.6	-1	0	
	WORSE	9	0.2	1.0	-0.5	1	
	Total	69	-0.3	1.5	-0.6	0.1	
Q31 In the last week did the teachers at school over protect you?	BETTER	19	0.2	1.9	-0.7	1.1	0.70
	SAME	43	0.5	1.4	0.1	0.9	
	WORSE	9	0.1	1.1	-0.7	0.9	
	Total	71	0.4	1.5	0	0.7	
Q32 In the last week did the teachers at school stop you doing things that you think are safe?	BETTER	19	0.4	1.4	-0.3	1.1	0.90
	SAME	43	0.2	1.4	-0.2	0.7	
	WORSE	9	0.3	0.7	-0.2	0.9	
	Total	71	0.3	1.4	-0.1	0.6	
Q33 In the last week did your family let you choose your own activities?	BETTER	19	0.0	1.4	-0.7	0.7	0.47
	SAME	43	-0.1	1.5	-0.6	0.3	
	WORSE	9	0.6	2.1	-1	2.1	
	Total	71	0.0	1.5	-0.4	0.3	
Q34 In the last week did you see your friends outside of school?	BETTER	19	0.1	1.5	-0.7	0.8	0.97
	SAME	43	0.0	1.5	-0.5	0.5	
	WORSE	9	-0.1	1.5	-1.3	1.1	
	Total	71	0.0	1.5	-0.4	0.4	

Q35 In the last week were you able to do everything your friends do?	BETTER	19	-0.4	1.5	-1.1	0.3	0.14
	SAME	43	0.3	1.2	-0.1	0.6	
	WORSE	9	0.3	1.3	-0.7	1.4	
	Total	71	0.1	1.3	-0.2	0.4	
Q36 In the last week did you get to do lots of different activities?	BETTER	19	-0.4	1.2	-1	0.2	0.20
	SAME	43	0.2	1.2	-0.2	0.5	
	WORSE	8	0.3	1.2	-0.7	1.2	
	Total	70	0.0	1.2	-0.3	0.3	
Q37 In the last week did you feel different because you have to be more careful than your friends?	BETTER	19	0.9	1.4	0.2	1.6	0.09
	SAME	43	0.0	1.4	-0.4	0.5	
	WORSE	9	0.2	1.1	-0.6	1.1	
	Total	71	0.3	1.4	0	0.6	
Q38 In the last week have people treated you differently because you have brittle bones?	BETTER	19	0.4	1.5	-0.3	1.2	0.11
	SAME	43	-0.2	1.1	-0.6	0.1	
	WORSE	9	0.6	1.5	-0.6	1.7	
	Total	71	0.1	1.3	-0.3	0.4	
Q39 In a normal school week do you do PE?	BETTER	19	0.3	1.3	-0.4	0.9	0.39
	SAME	43	0.1	1.4	-0.3	0.5	
	WORSE	9	0.8	1.9	-0.6	2.2	
	Total	71	0.2	1.4	-0.1	0.5	

Table 9.35. Table to demonstrate dimensional level responsiveness analysis of the OIQoL at 3 months.

		N	Mean	Std. Deviation	95% Confidence Interval for Mean		Sig.
					Lower Bound	Upper Bound	
OI PROM Being safe and careful dimension (0-100) Change from baseline to week 12	BETTER	19	14.7	25.4	2.5	26.9	0.00
	SAME	43	4.8	22.4	-2.0	11.7	
	WORSE	9	-17.1	16.6	-29.9	-4.4	
	Total	71	4.7	24.2	-1.0	10.4	
OI PROM Reduced function dimension (0-100) Change from baseline to week 12	BETTER	19	10.2	12.7	4.1	16.3	0.03
	SAME	43	0.1	14.1	-4.2	4.5	
	WORSE	9	6.3	15.5	-5.7	18.2	
	Total	71	3.6	14.4	0.2	7.0	
OI PROM Pain dimension (0-100) Change from baseline to week 12	BETTER	19	-3.3	28.1	-16.9	10.3	0.75
	SAME	43	0.6	16.9	-4.6	5.8	
	WORSE	9	-3.2	19.8	-18.5	12.0	
	Total	71	-0.9	20.6	-5.8	3.9	
OI PROM Fear dimension (0-100) Change from baseline to week 12	BETTER	19	-1.8	23.9	-13.3	9.8	0.88
	SAME	43	-1.6	21.8	-8.4	5.1	
	WORSE	9	2.3	16.6	-10.4	15.0	
	Total	71	-1.2	21.6	-6.3	3.9	
OI PROM Independence dimension (0-100) Change from baseline to week 12	BETTER	19	3.4	17.3	-4.9	11.7	0.18
	SAME	41	5.6	18.4	-0.2	11.4	
	WORSE	9	-6.7	16.8	-19.7	6.2	
	Total	69	3.4	18.1	-1.0	7.7	
OI PROM Isolation dimension (0-100) Change from baseline to week 12	BETTER	19	7.7	20.4	-2.1	17.5	0.09
	SAME	43	-2.7	15.2	-7.4	2.0	
	WORSE	8	-1.6	17.7	-16.3	13.2	
	Total	70	0.2	17.4	-3.9	4.4	

At three months the mean differences between test-retest at baseline (t=1) and three months (t=3) for those patients who reported no change in their global health were low for four dimensions of the OIQoL (reduced function, pain, fear and isolation). However the mean difference for dimensions being safe and careful and independence were a little higher (4.8 and 5.6 respectively), but only the independence dimension was close to demonstrating significant difference (0.06) in scores at baseline (t=1) and three months (t=3). Correlations between baseline and three month retest for dimension reduced function and isolation demonstrated adequate score (>0.70) for reliable scale stability. The independence dimension had low correlation (r=0.34) highlighting poor scale stability, but all other dimensions had moderate correlations (range 0.55 – 0.65), although falling outside the acceptable levels for scale stability.

Assessment of test retest between baseline and three month scores for individuals who reported no change in global health, demonstrated reliable scale stability for both the PedsQL and EQ5D. (table 9.33) mean differences between baseline and retest were low and no significant difference between test and retest scores were found. Both the physical functioning and emotional functioning dimensions of the PedsQL had acceptable levels of correlation (>0.70) for test-retest at 3 months. The other three dimensions within the PedsQL and EQ5D tariff scores demonstrated moderate correlation between baseline (t=1) and three month (t=3) retest scores. However, the tariff score for the EQ5D demonstrated very low correlation (0.05) and therefore poor test-retest reliability at three months.

Table 9.34 examines the item level responsiveness of the OIQoL at three month retest for those individuals who reported change (better, same, worse) on the global health question. From the table it can be seen that numerous items demonstrate the expected directional mean change in line with their self-reported global health question (Q1, Q2, Q3, Q4, Q5, Q6, Q11, Q12, Q18, Q19, Q24, Q27, Q28, Q29, Q35, Q36). For example, item Q2 has mean change values of 0.5 for those individuals who report feeling better at 3 month retest; 0.0 mean change value for those individuals who state they feel the same; -0.6 mean change for those who report they feel worse at three month retest. A similar pattern is seen for item Q29 (better -0.3, same 0.0, worse 0.6), however this item is reverse scored, with 'Always' scoring 5 and 'Never' scoring 1, as a result the numerical direction changes, but the transformed QoL score follows the same configuration. Other items follow a similar directional pattern, however fail to gain a 0.0 mean change score for those individuals who state they feel the same at three month retest. For example item Q4 (better 0.5, same 0.3, worse -0.3). However, although several items follow this expected directional pattern in relation to self-reported health change, this is significant in only three items Q3, Q5 and Q10. Table 9.35 demonstrates the dimensional level responsiveness for the reported change between baseline and three months. Only two dimensions demonstrate significant difference, however only the being safe and careful dimension has the expected directional change as mentioned above in the item level data.

## 9.5 Discussion

OI is a rare condition and those patients affected by the disease encounter fluctuating needs due to the incidence of fractures with minimal cause. For this reason children

and their families are often fearful of or avoid activities or events which may lead to fracture. Current treatment can involve inpatient hospital stays and the occurrence of a fracture and subsequent deformity may require surgical intervention. Therefore, it is imperative to quantify a child's QoL and currently there is no disease specific means of doing so (see Chapter 4).

The aim of this chapter has been to field test the 39-item OIQoL on a larger sample to examine its feasibility, acceptability, validity, internal consistency reliability and test-retest ability. In turn, those items which did not ensure a robust questionnaire were examined with a view to elimination and questionnaire revision. Although the content validity of the OIQoL had been ensured during its early development (Chapters 5 and 6) and pre-tested soon after (Chapter 8), the need to maintain this validity in the event of revision and item reduction is vastly important. Although some items have been examined with regards to elimination and questionnaire revision, the sample size within this psychometric evaluation was small, and therefore some less vital item exclusions will be postponed until the questionnaire could be examined more closely on a larger cohort.

This has been the first attempt to develop an OI specific QoL questionnaire for the paediatric OI population using a conceptual framework elicited from the children and their parents/carers, alongside expert opinion and literature review. The questionnaire was intended to be completed by children and adolescents; in the case of younger children (6 - 8 years) with the aid, if necessary, of their parents or carers. The early psychometric properties of the OIQoL were assessed on a sample which was varied for age (6-18 years), sex and severity of disease. Ninety five children and adolescents undertook the baseline questionnaires, with only 20% and 23% of participants lost to follow up at one week and three months respectively. The acceptability of the OIQoL was high, with minimal amounts of missing data; at most 2.2% of incomplete items and no complete missing forms. There was no pattern to the missing data, and no requirement to revise or eliminate items on these grounds.

To ensure a suitably robust questionnaire it is necessary to examine floor and ceiling effects. The OIQoL has some items which are causal in nature, relating to symptoms such as pain or fractures, or the consequence of these symptoms and their treatment. Other items Q10, Q11, Q12, Q18, Q19 and Q20 in retrospect were not well written, asking the individual two questions at the same time. Items such as Q10 (In the last week has having a broken bone stopped you doing things), forces all individuals who haven't sustained a fracture in the last week to answer 'never', and therefore promotes a ceiling effect. For this reason floor and ceiling effects were found in several items, some of which were related to symptoms and their management, some which were poorly constructed and some which affected only a small number of more severely affected individuals. These latter items, such as fear of handling in the severely affected participants, were deemed clinically important within the item generation and validation stages of questionnaire development. For this reason no items were eliminated on the grounds of floor or ceiling effects, as suggested by Fayers et al (1998). However those items which resulted in floor or ceiling effects, which with hindsight were asking two questions within the one item (Q10, Q11, Q12, Q18, Q19

and Q20), needed revision and further consideration prior to further testing. See appendix 13, suggested version 3 OIQoL following revision.

Similarly, Gorecki et al (2013) during psychometric analysis of the PU-QOL for pressure ulcers found their questionnaire had good data span across the ranges for all items, but noted a large number of items with floor effects greater than 15% with notably skewed data.

There was no initial evidence to highlight any item redundancy, with the majority of items demonstrating only low-moderate item-item correlation. A small selection of items were more highly correlated, but no item-item correlation reached the value of 0.90 suggested by Fayers and Machin (2007) for redundancy.

### 9.5.1 *Criterion Validity*

Criterion validity can be a difficult concept to assess or prove, particularly with disease specific QoL measures, where the impetus for development was the lack of a suitable alternative. The PedsQL and EQ5D were chosen as 'gold' standard questionnaires, alongside which to assess and compare the newly developed OIQoL. With hindsight, the EQ5D was more difficult for children with OI to complete. It is an adult based questionnaire, and uses more adult terminology within its questions. The older adolescents and young people were competent in its completion; however the younger children often needed the help of an adult to comprehend the questionnaire. The terms anxious or depressed were often replaced by worried or sad to aid the understanding of the younger children, and the term usual activities often sparked discussion. The correlations noted between the dimensions of the OIQoL and EQ5D are therefore only low to moderate. The PedsQL was developed for children, but it a generic questionnaire and was previously deemed not sensitive enough to meet the needs of a QoL questionnaire for the paediatric OI population. Its dimensions are more highly correlated with the dimensions of the OIQoL than that of the EQ5D, but the majority are still only moderately correlated. Nevertheless, dimensions such as physical functioning (PedsQL) and reduced function (OIQoL), and social functioning (PedsQL) and isolation (OIQoL) demonstrated slightly higher correlations of 0.63 and 0.61 respectively, which do offer some evidence to support validity. With hindsight, the Healthy Pathways Child Report scale may have been a suitable alternative to the EQ5D to examine criterion validity within the paediatric OI population. It is a paediatric measure, was developed well using bottom up methodology and consists of a single questionnaire covering a wide age range.

### 9.5.2 *Known Groups Validity*

The initial hypothesis on which to examine known groups validity, was that those children and adolescents with more severe disease would report lower QoL as a result. Alternatively, those individuals who were more mildly affected would describe a higher level of QoL. There is currently no evidence however to support this notion, but it may be sensible to consider that individuals who are more severely affected may report more pain, may have to be more careful to avoid fractures and may have poorer

function than their more mildly affected peers. However when the data is examined at the dimension level the only statistical difference is noted within the reduced function dimension, where those individuals with more severe disease report lower dimension scores. No difference is noted between the different severities across the other five dimensions of the OIQoL. Moreover, a similar picture is seen with the PedsQL, where a difference between the severities of disease is only noted in the physical functioning dimension.

Additionally, when the data is examined at the item level, some significant differences are noted to support this notion. Items relating to receiving extra help to keep safe, having to do things differently due to fractures and using equipment, all highlighted differences between the severity groups, with the more severely affected individuals reporting the lower scores. However a different picture related to severity is seen in the items related to fear of activities which may lead to fracture, with those more moderately affected reporting lower scores. This may have been due to the fact that those moderately affected individuals are troubled more often by fractures than those more mildly affected, and are often more mobile, less reliant on wheelchairs for mobility than their more severely affected peers and therefore more readily at risk of fractures, resulting in more reported fear.

QoL is often described as the difference between an individual's actual performance or QoL and their expectation of how they would like life to be or feel it ought to be. Anecdotally, it is often the more mildly affected teenagers that express disharmony with their QoL, as they more readily compare themselves with their peers. From experience on the other hand, our more severely affected patients seem less likely to do so. Perhaps this is due to the degree of functional difference between these groups, where those more mildly affected expect their functional activity and participation to be equal to that of their non-affected peers. This may explain the lack of difference seen between the severities for some of the items and the majority of dimensions within both the OIQoL and the PedsQL.

Examining the item level data to uncover any significant known groups difference related to treatment group highlighted only a small number of items. The three items related to doing things differently because of a fracture and having to use equipment, all demonstrated those patients receiving no treatment to have the highest scores. This may however be related to the fact that those individuals receiving no treatment are often those who are more mildly affected and therefore be linked to severity of disease rather than just treatment or lack thereof. It is interesting that two of these three items also demonstrated significant difference for severity groups. Those individuals scoring significantly lower scores for the three items mentioned above were those individuals receiving Zoledronate. This may be an effect of treatment, but could also be due to the fact that this group had the smallest number of participants (n=4). Further work to include a larger cohort of individuals treated with Zoledronate is required to further examine this effect.

The items related to seeing friends outside of school highlighted a different significant picture between treatment groups. Again those treated with Zoledronate reported the lowest QoL score, with 'never' the mean score documented at raw data level. However

this item demonstrated those individuals receiving Risedronate as having the better QoL score and more frequently seeing their friends outside of school.

As noted within the results section of this chapter, those individuals receiving Pamidronate therapy often report a cyclic up and down nature to their symptoms in relation to their treatment. Parents of younger children and self-reporting older children state they feel immediate benefit from their Pamidronate infusion, and this benefit is noted to wear off towards the end of the three months, prior to their next infusion. This was also described during the interview phase of this study. The item level data at one week retest, immediately following Pamidronate infusion, and at three month follow up immediately prior to re-treatment demonstrated significant difference between only a few items. Again those items related to using equipment highlighted significant difference between those individuals on Pamidronate and those receiving other treatment or nothing, however this difference was not in favour of Pamidronate at the one week retest, as suggested by the anecdotal evidence.

However the item related to feeling different because of having to be more careful did demonstrate significant difference in favour of Pamidronate therapy at the one week retest. Nevertheless this was not repeated at the three month follow up, and when this item is examined at baseline, one week retest and three month follow up; the suggested cyclic pattern is not present. This may have been due to small numbers, but could highlight that these suggested 'highs and lows' of Pamidronate therapy is not repeatedly experienced across the paediatric cohort, or could be highlighting poor responsiveness in the OIQoL.

### 9.5.3 *Internal Consistency*

Cronbach's alpha for the complete 39-item OIQoL is 0.86. This score is reasonable and demonstrates good internal consistency. However this value may be high as there are a large number of items within the current OIQoL, which as stated by Fayers and Machin (2007), would lead to increased reliability. For this reason it was necessary to examine the internal consistency and item-total correlations for the items within each individual dimension, to aid the decision making process with regards to questionnaire revision and possible item elimination.

'Being safe and careful' was a dimension which had the highest internal consistency with high Cronbach's alpha score and reasonable item-total correlations. The themes within this dimension were discussed at length within the interviews and focus groups and therefore good content validity is also ensured. There was therefore no requirement to make alterations to the items within this dimension.

The second dimension 'reduced function' also demonstrated reasonable internal consistency with a Cronbach's alpha score of greater than 0.70; however three items relating to fatigue had low item-total correlations. Removing all three of these items would benefit the internal consistency, but lead to reduced content validity. Alternatively, placing these three items within their own dimension may be a better option. Fatigue was a theme mentioned within the interviews and discussed at length within the focus groups, removing all three items would therefore not allow the

questionnaire to stay true to the qualitative data. The decision to wait until the questionnaire could be examined with a larger cohort prior to dimension revision or item elimination was therefore made.

The pain dimension had a reasonable Cronbach's alpha score above the threshold and all item-total correlations were moderate, demonstrating reasonable fit of the items within this dimension. There was therefore no requirement to consider item reduction at this stage on the ground of internal consistency.

The internal consistency of the fear dimension was above the required threshold, yet two items which related to being fearful of needles and hospital had very poor item-total correlation and therefore poor fit within this dimension. Removal of these items was considered; this would have a positive effect on the internal consistency of this dimension but may reduce content validity. However due to the small sample size, this item elimination was also postponed until evaluation with a larger cohort had taken place.

The latter two dimensions however had both poor internal consistency and validity. The items within both dimensions demonstrated poor fit, and elimination of any item did not improve the psychometric properties. For this reason combining the two dimensions was considered, to produce a five dimension questionnaire rather than the original six. Some items were eliminated to improve both internal consistency and validity and the resultant seven item dimension demonstrated reasonable internal consistency.

The small sample size was the prominent concern surrounding early item elimination, particularly in dimensions where internal consistency (Cronbach's alpha scores) were above the threshold (0.70). However, dimensions five (Independence) and six (Isolation) within the newly developed OIQoL had low reliability with poorly correlated items, hence revisions to these latter dimensions were deemed important. The original OIQoL consisted of six dimensions (being safe and careful (6 items), reduced function (8 items), pain (6 items), fear (6 items), independence (7 items), and isolation (6 items)). The potential adapted version is a five dimension questionnaire which includes the initial four dimensions, alongside a fifth dimension 'life skills' which includes seven items. Although consideration was made regarding item elimination in the reduced function and fear dimensions, for reasons related to small sample size, this was postponed until the OIQoL was evaluated alongside a larger sample.

Bevans et al (2010) developed the Healthy Pathways child-report scales from the previously developed Child health and illness profile (CHIP), in an attempt to develop a single questionnaire which allowed HRQoL to be monitored throughout childhood and into adolescence. They too discovered issues with a particular domain (resilience) which had a strong conceptual link, but was difficult to operationalise with poor internal consistency reliability. They chose however to revise this dimension, adding further items to improve reliability.

#### 9.5.4 *Test-retest*

The test-retest at both one week and three months highlighted some areas of potential poor scale stability in the OIQoL. The dimension being safe and careful at the one

week test-retest demonstrated significant difference between mean scores and only moderate correlation. At the item level, three items within this dimension demonstrated significant difference between baseline and one week retest. Although the fear dimension had a significant difference between mean scores at one week retest, it did demonstrate good correlation and is therefore less of a concern. It was initially felt that the test-retest at one week may be affected by treatment; a proportion of OI patients attending Sheffield Children's Hospital will have done so on an inpatient basis and this may have involved Pamidronate treatment. This three monthly bisphosphonate treatment can improve symptoms such as pain, making patients feel better. This may explain some of the differences noted at a dimensional level for the one week retest, particularly as all mean scores at one week were higher than those at baseline, and could be linked to patients feeling better, reporting less pain and therefore their QoL score increasing. However this was only the case for a small amount of items when item-level data was examined, and can therefore not completely explain any poor stability. Nevertheless, this improvement may not have been large enough to be apparent to the cohort, or may have been the normal improvement that OI patients feel following treatment and therefore this was not reflected in the global health question.

Although there is no significant difference in mean dimensional scores between the test-retest at three months for those individuals who report no change, the poor correlation within the isolation dimension is a little concerning. The mean differences for the isolation and fear dimensions at the three month retest were both negative scores, highlighting the reduction in QoL score. This could also have been an effect of treatment, or the lack of it. Anecdotal evidence from patients on three monthly bisphosphonate treatment supports the reduction in symptom suppression a few weeks prior to their next infusion. This may have caused their reported QoL dimension scores to be lower immediately prior to treatment. However, the item level data doesn't support this suggestion, and there appears to be no obvious pattern within the data. This reduction in QoL score is collaborated by the negative mean difference values for several dimensions within the PedsQL and the EQ5D tariff.

Responsiveness at an item level is also examined by comparing baseline scores with the three month retest, against the outcome of the global health question, for the complete cohort. Several items demonstrate the expected directional spread, where those individuals who state they had improved (better), report positive mean differences, for those items which are not reversed scored, minimal mean difference for those who report they feel the same, and negative mean difference for those individuals who report they are worse. This expected directional spread is not replicated across all items, and only a small proportion demonstrate this with significant value. A similar picture is seen at the dimensional level, where the expected directional spread is only significant within the being safe and careful dimension. This may be due to poor responsive properties in some items, and this may perhaps improve following the necessary revisions, particularly relating to the ceiling effects of some items. Alternatively, it may be the effect of small sample size, as those individuals reporting worsening QoL were very low in number. The global health question was also self reported, and this may have lead to some bias in its completion, with some individuals not feeling comfortable reporting their QoL as deteriorating, seeing this as failure or a weakness. Filocamo et al (2010) used a clinician assigned score, based on their

assessment of disease severity, with which to assess the responsiveness of their newly developed HRQoL measure for paediatric rheumatic diseases; therefore removing the need for a self reporting global health question. The addition of a clinician reporting health change, alongside the self reported global health question may be a useful adjunct to future studies.

## **9.6 Questionnaire Revision**

Items which demonstrated ceiling effects, which were due to poor item construction, will be revised. This will ensure that those items no longer ask two questions within the same item, and therefore reduce the chance of ceiling effects which were seen during both pilot phase and psychometric testing of the OIQoL. As a result of this change item Q18 will now be irrelevant as it replicates the content of item Q17.

Items within dimensions 'isolation' and 'independence' demonstrated poor internal consistency, and the suggestion was made to combine these latter two dimensions. This would result in a seven item dimension, with better internal consistency, however this would eliminate items which demonstrated good known groups validity for both severity of disease and effect of treatment. For this reason it is proposed that the two dimensions will be amalgamated, however items which demonstrated significant known groups validity would remain, resulting in an eight item dimension.

The three items related to fatigue within the 'reduced function' dimension demonstrated poor item-total correlation; however they have high content validity and were reported at length during both the one-to-one interview and focus group phases of this research. For this reason they cannot be eliminated and will be placed within a separate dimension entitled 'fatigue'.

## **9.7 Strengths and limitations**

A strength of this field testing stage is that the preliminary psychometric testing of the revised questionnaire enabled missing data, floor and ceiling effects and overall acceptability to be examined. Participants had completed the questionnaires in different locations; away from direct observation from the principle researcher, and therefore, less pressure was placed on the children and young people to fully complete the questionnaire, had they not wished to do so.

Several of the items/questions again demonstrated floor or ceiling effects, and some were due to the nature of the item and/or its construction. As previously mentioned in Chapter 8, those items which refer to both fractures and pain, or fractures and reduced function, have automatically provided an increased chance of floor or ceiling effects, and this is demonstrated in the data. A limitation of this research was not having the confidence to revise these items, following pilot testing, prior to this psychometric stage. This meant that poorly worded items were included in the psychometric testing stage of the study, which on a larger sample highlighted obvious ceiling effects. In hindsight making revisions to these items prior to this larger scale testing (n=95) would have proved more useful. As a result of this, these items will require revision or removal prior to further, multi-site research. Discussing the options for revision or

removal alongside the target population might aid this process, and could be considered prior to further testing. See appendix 13 for version 3 of the OIQoL with suggested revisions.

A further limitation to this phase of the research was the decision to use the EQ5D as a QoL measure with which to examine criterion validity. The EQ5D is an adult based measure and therefore not well received by the paediatric OI population, who had issues related to its completion. With hindsight the Healthy Pathways Child Report scale would have proved a more suitable option; it is well developed for the paediatric population and involves the use of a single questionnaire encompassing a wide age range.

The decision to use traditional methods to undertake psychometric analysis was made because of the size of the available sample ( $n=95$  OI patients), the experience and understanding of the principle researcher and the time constraints set by the nature of the doctoral study; this was a limitation to this stage of the study. The use of a larger sample would have enabled factor analysis and a more modern approach to psychometrics. The use of item response theory or Rasch analysis would have allowed the questionnaire to be submitted to rigorous testing alongside a hypothesised model to inform the overall construct. However, it would still be important to remain true to the initial qualitative process undertaken to uncover themes to inform item development and ensure high content validity. Item reduction would still warrant careful consideration and a balance between excellent psychometric properties and high content validity would have to be sought.

The newly developed OIQoL appears to include a number of causal items. Causal items however do not necessarily measure the same single construct (QoL), but rather measure elements or symptoms that lead to changes within the construct. As psychometric analysis often uses correlations to assess the validity of newly developed questionnaires, and causal items are often not well correlated with one another, this may not be the most suitable method to assess the validity of an instrument; particularly if it includes a large proportion of causal items and fewer effect or indicator items. These modern psychometric techniques could also have been used to identify the effect of causal items on the suitability of a summated total score, hence informing the researcher of the most appropriate method to ensure statistical robustness.

Exploration of factor structure would have provided more information on the psychometric qualities of the newly developed OIQoL. With additional knowledge and understanding the principle researcher plans to undertake factor analysis using the 95 baseline questionnaires, to enhance the development process.

As this was the first evaluation of the OIQoL and the sample size was small ( $n=95$ ), modern techniques such as Rasch analysis and item response theory were not possible. Further research on a larger sample would enable modern psychometric techniques and modelling of the construct.

## 9.8 Conclusion

This chapter describes the process of psychometric testing the newly developed OIQoL on a small sample of the paediatric OI population. Initial analysis demonstrates the OIQoL questionnaire has good acceptability across the age range (6 – 18 years), with minimal missing data and no missing forms. However, the analysis revealed issues with regards to the internal consistency of dimensions five (independence) and six (isolation), which improved with preliminary revisions resulting in a five dimension questionnaire. A few items within the 'fear' and 'reduced function' dimensions had poor item-total correlation, which would require further testing to inform possible item elimination, ensuring content validity is maintained, as informed by the initial stages of this research (Chapters 4 and 5).

The test-retest reliability highlighted some areas of poor scale stability, alongside some possible positive effects of treatment at one week and the subsequent negative effect at three months. Further test-retest reliability assessment is required on a larger sample, with particular attention paid to those participants who have received three monthly intravenous bisphosphonate therapy, compared with those on weekly oral treatment, six monthly therapy and those who are treatment naïve. Known groups validity demonstrated a difference between the severity of OI groups for only a small number of individual items and the reduced function dimension only, but this latter difference was replicated in the physical function domain of the PedsQoL, providing further evidence of construct validity.

The relatively small sample used to field test the newly developed OIQoL prevented the use of the more modern psychometric techniques, such as Rasch analysis and Item response theory. Following revision of some items, alongside elimination of others (see Appendix 13 for revised version 3 OIQoL), further testing on a larger sample of the paediatric OI population would enable more comprehensive analysis of the construct, reliability and responsiveness of the OIQoL. The principle researcher plans to do this further analysis on a larger, multicentre UK cohort.

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## Chapter 10

### Conclusion and future research

#### 10.1 Aim of the thesis

The overall aim of this study was to develop a disease specific quality of life (QoL) measure for children (aged 6-18 years) with Osteogenesis Imperfecta (OI). OI is a disease that effects only a small proportion of the population, approximately 1 in 20,000 (Glorieux, 2008) and has a wide range of severity. The disease course is varied, with severely affected individuals sustaining many fractures throughout life leading to deformity, pain, lack of independent mobility and the potential for reduced QoL.

This study has demonstrated how the initial 39-item OIQoL, a disease specific QoL measure for children with OI, was developed, pre-tested and finally psychometrically tested on a cohort of 95 children with varying severity of OI, resulting in a revised 33-item questionnaire.

#### 10.2 Initial questions

Prior to developing a QoL measure for the paediatric OI population it was important to ascertain whether there was a readily available generic QoL measure, or suitable disease specific questionnaire which was relevant to the OI population, thus negating the need to develop a disease specific version.

The requirements of either, a suitable relevant generic QoL measure, or a newly developed OI specific QoL measure was described in Chapter 4. Many children with OI attend both secondary and tertiary centres for their OI care. They are monitored and where necessary treated medically, surgically and therapeutically from birth into adulthood. Gaining an understanding and then quantifying a child's QoL throughout childhood and transition onto adult care is essential. Comprehending what interventions improve the QoL of these children allows services to provide the most suitable care at the best possible time and place. For these reasons a QoL measure suitable for the paediatric OI population should:

- Allow self completion by the child across a wide age range 6-18 years.
- Encourage the use of one single measure across the age range, negating the need for age specific modules, allowing a child's progress at whatever level to be monitored.
- Have been rigorously developed alongside the paediatric population ensuring high content validity.
- Include items relevant to the paediatric OI population.

Self completion by children ensures that the child's opinion is captured. Parents or proxy respondents have been shown to provide accurate reports of functional ability and other external observable concepts, but do not impart accurate responses for more social or emotional aspects, particularly of their teenage children who may spend large amounts of time outside the family home (Eiser and Varni, 2013).

The development of a single questionnaire covering a wide age range will prevent the need for separate age related modules with differing questions. The ability to monitor a child's self reported QoL from age 6 to 18 years will ensure they can be reliably monitored throughout childhood and transition to adult care. There will be no confusion as to which module is the most appropriate, particularly in the case of more mature children, who may not suit their age appropriate version. Questionnaire development using bottom up methodology ensures high content validity for the target population, encouraging the inclusion of more relevant, specific and appropriate concepts for the paediatric OI population.

The review of the literature surrounding generic and appropriate disease specific QoL measures (Chapter 4), alongside the initial conceptual framework (Figure 4.2, Chapter 4) highlighted the need to develop a questionnaire which was specific for the paediatric OI population.

Gaining an appreciation of what elements of a child's life is important to the quality of that life and their well-being can only be uncovered by working with children and asking them how they feel. This has been done previously in both children (Stevens, 2010) and adults (Gorecki et al, 2013) to elicit themes for a preference based measure and patient reported outcome measure (PROM) respectively. The use of bottom up methodology, alongside literature review and expert opinion, encourages the development of a questionnaire or instrument which includes items that are relevant to the target population and therefore pursues good content validity (Patrick et al, 2011a) and improved acceptability.

### **10.3 Key Findings**

This study used phenomenological based interviews with the OI population (children and parents) and those involved in their care (AHPs), to gain an awareness of this groups' lived experience of their disease. The initial sample size was relatively small (n=25) and therefore the need to validate the themes derived from these interviews was felt necessary, again adding to the depth of understanding and content validity.

The themes uncovered (Chapter 5), later validated (Chapter 6) and revised to inform the development of the conceptual framework, included:

- Being safe and careful.
- Reduced function.
- Pain.
- Fear.
- Independence.
- Isolation.

These themes, alongside sub themes, formed the basis of the conceptual framework on which the dimension headings within the newly developed OIQoL were written (Figure 6.1, Chapter 6). The cyclic nature of the conceptual framework highlighted an interesting phenomenon which became apparent as concepts were uncovered and participants discussed their lived experience of OI.

The diagnosis of OI in your child or yourself appears to lead to a cyclic thought process of altered activity in an attempt to keep safe, avoid fractures and resultant pain. Young people and parents described fractures in relation to the consequences which result. Fracture leads to pain, immobilisation and reduced function, subsequent loss of independence, isolation from activities and peers, and a resultant fear of a repeat event. This fear leads to a further change in behaviour in an attempt to stay safe and remain fracture free. This effort to stay safe and careful to avoid potential fractures, leads to an apparent choice to isolate oneself from activities which may result in fracture and also a subsequent isolation from the social interaction of such activity, often producing some further loss of independence. Interview and focus group participants reported gradually reducing their guard following a period without fracture, but as soon as a further fracture occurs the cycle restarts. Therefore, it is speculated that if the conceptual framework is an accurate and valid representation of QoL in OI, then an individual's reported QoL will reduce as a consequence of a fracture. Further research on a larger cohort would enable validation and a deeper understanding of this potential phenomenon.

#### **10.4 Questionnaire development**

Effort was made throughout this study, to be transparent with regards to questionnaire development. Within the literature this is not always the case, with large leaps being made between the stages of concept elicitation and questionnaire pre-testing (Brod et al, 2014; Bruce et al, 2010; Corona et al, 2011). One of the strengths of this study is its transparency; Chapter 7 provides a large amount of detail describing how initial themes were transformed into items, and how, using the children's language, the content validity, relevance and acceptability of the dimensions was ensured.

Primary school teachers and a small convenience sample of younger children were used to assess readability and understanding of some more complex items and the Likert response scale. To the best of the author's knowledge this is not a method previously used in instrument development. Nonetheless, working alongside children is a method that has been used to aid the development of the Likert scale, providing feedback regarding its content (Carlton, 2013), and the Likert scale levels themselves (Stevens, 2009).

Patrick et al (2011b) describes the need to assess the understanding, acceptability and comfort of the newly developed QoL instrument or patient reported outcome measure prior to psychometrically testing the questionnaire on a larger sample. The pilot or pretesting phase of this study (Chapter 8) proved to be very important in the development process, without which errors in understanding and logistical problems would not have come to light. Changes within the question stem were deemed necessary; children could remember and report their activities within the last week with ease, but often forgot the recall time towards the end of the dimension, rushing ahead to complete the item. For this reason each question stem was revised to include 'In the last week.....', to promote consistent accuracy in recall throughout each dimension.

During pilot testing the questionnaire was reported as acceptable and this was reflected within the lack of any missing data, although this may have differed had participants not been observed during completion. However one child did describe

some discomfort and upset when comparing herself to her peers. This appeared to be in relation to what activities she was able to participate in, and how she felt she missed out and was isolated from her friends as a result of her OI.

Pre-testing also highlighted some ceiling effects for several items; in hindsight revision and modification of these items at this stage would have enabled an improved version of the OIQoL undergoing psychometric testing within the latter stage of this study.

## **10.5 Psychometric evaluation**

The largest discussion point and ongoing internal argument which has resulted from this study, is how best to measure or assess the validity, reliability and responsiveness of a newly developed PROM or QoL questionnaire. This is discussed within the literature (Eiser and Morse, 2001; Cano and Hobart, 2011; Fayers and Machin, 2007) with authors expressing differing opinions as to what is the correct methodology. Some researchers feel emphasis should be placed on content validity, staying close to the items uncovered during concept elicitation alongside the target population. They report care should be taken when considering eliminating items on statistical reasons, particularly if the concepts were relevant to the patient population (Eiser, and Morse, 2001; Fayers and Machin, 2007).

Gaining a correct balance between ensuring content validity and relevance to the target population, alongside developing a psychometrically sound questionnaire appears to be a difficult undertaking. One can choose to develop a questionnaire which statistically stands up; items may be eliminated on statistical grounds and grouped into dimensions on the basis of modern psychometric tests such as Rasch analysis or item response theory. However, the outcome may clinically not meet the needs of the population and be deemed irrelevant. Alternatively, developers can choose to concentrate on achieving high content validity, relevance and therefore acceptability within the target population, which may statistically not reach accepted levels of internal consistency or correlation of items within dimensions.

Fayers and Machin (2007) express concern in relation to causal items; those which are reporting symptoms of a particular disease or the side effects of treatments. These items do not necessarily statistically behave in the same way that effect items behave; therefore they may not be well suited to traditional psychometric techniques. A number of items within the newly developed OIQoL appear on the face of it to be causal in nature, but without further assessment their exact meaning cannot be uncovered. Further research to expose the behaviour of causal items within the OIQoL, would highlight which psychometric tests would prove most suitable to assess its validity, reliability and appropriateness. This may be aided by the inclusion of Rasch theory, to examine the legitimacy of summing items to generate a total score and provide a greater understanding of the construct.

From both a clinical and research perspective, it would appear necessary to develop a questionnaire or instrument that is reliable and stable over time. For those patients whose global QoL does not change, this should be demonstrated as a stable QoL score on the newly developed instrument. Test-retest scores at one week for those children who reported no change in global QoL score demonstrated stability in most

dimensions of the OIQoL. However, this also highlighted significant positive change in the being safe and careful dimension, which initially was thought to have resulted from a treatment effect. This is supported at the item level, where three items within this dimension demonstrated significant improvement in QoL scores from baseline to one week retest. The anecdotal effect of Pamidronate has been discussed in chapter 9. It was initially suggested that these reported 'ups' and 'downs' of Pamidronate therapy may be the cause of some of the stability issues. However, when mean differences between treatment groups are examined at both baseline and retest, no noticeable difference is seen in favour of Pamidronate therapy at the one week retest in comparison with baseline scores.

It would also be encouraging if the newly developed questionnaire demonstrated known groups or criterion validity, yet this again appears to be somewhat subjective. Without the presence of a suitable 'gold standard' measure with which to compare a newly developed instrument, ensuring criterion validity is very difficult, particularly when the driving force behind the development of a disease specific QoL measure is the lack of a suitable relevant alternative. The Pedsq and the EQ5D were chosen as suitable questionnaires with which to assess criterion validity of the OIQoL, however with hindsight these may not have been the most appropriate choice.

Known groups validity at first glance would appear easier to assess. However, this would demand that groups or factions within the target population behave as a particular hypothesis would suggest. It appears common sense that children with more severe OI would report poorer QoL than their more mildly affected peers, but both this study and clinical experience highlights that this is not necessarily the case.

This study has demonstrated that children and young people with severe OI report lower scores within the reduced function dimension of the OIQoL and the physical functioning dimension of the PedsQL respectively. There is no other significant difference noted between the severity groups for any of the other dimensions within the OIQoL, PedsQL and EQ5D. At the item level significant difference is noted between the severity groups for a handful of items, but this difference is not always related to those more severely affected patients reporting lower QoL scores. This is not immediately explicable, however, it is postulated that those individuals within the paediatric OI population that are more mildly affected, may regularly compare themselves to their peers. The nature of their disease and the need to be safe and careful to avoid fracture prevents participation in some activities, resulting in an amount of isolation from peers and an ensuing dissatisfaction with their QoL. Alternatively, many children and young people who are more severely affected appear less likely to directly compare themselves with their peers, and therefore this may be reflected in the minimal difference noted between the severity groups across the other dimensions of the OIQoL. Moreover, the fact that this is replicated within the PedsQL, does offer some evidence to support criterion validity. Known groups validity in relation to treatment received demonstrated significant differences for only a small number of items. This could be due to the small number of participants in some treatment groups validity of the OIQoL. Perhaps examining a more suitable known groups validity would be beneficial; such as following fracture or surgical intervention.

The psychometric properties of the independence and isolation dimensions of the OIQoL were a little disappointing, highlighting a potential need for revision. These dimensions do not appear to include a large number of causal items, and therefore this is unlikely to be the reason behind the poor internal consistency of the items within. Moreover, the three fatigue related items within the reduced function dimension, also demonstrate poor item-total correlation. Tentative item elimination produced a seven item dimension entitled 'life skills', with improved internal consistency; a three item dimension entitled 'fatigue', and a resultant six dimension questionnaire. Initial item elimination involved removal of one item which demonstrated significant known groups validity and was also discussed during both the interview and focus groups phases of this research. For this reason, the decision was made at this stage not to remove this item until further testing had taken place.

On reflection the sample size used for psychometric testing was quite small (n=95). This enabled a satisfactory assessment of questionnaire understanding and acceptability, alongside an appreciation of any floor or ceiling effects and the data span across the Likert scale options. With minimal missing data and no complete missing forms, the newly developed OIQoL was deemed acceptable and understandable to the paediatric OI population aged 6-18 years old. However, this field testing did highlight items which were more relevant to some minority groups within the cohort (the need for handling to aid transfers within the severely affected children); the presence of some causal alongside some items which were poorly worded and required revision. The presence of these more extreme items did result in some more mildly affected children questioning the need to be handled, and thus demonstrated a difference between the severity groups.

Nonetheless, the small sample size did prevent the use of more modern psychometric methods such as item response theory and Rasch analysis. The latter method would have enabled assessment of the suitability of the items within the OI QoL to be summated to achieve a total score, alongside further assessment of the overall construct. The decision to eliminate items from the latter two dimensions (independence and isolation) of the OIQoL was a difficult one, particularly when the small sample size dictated the use of more traditional psychometric techniques. The items within the latter dimensions were not well correlated with each other and as a result the internal consistency of these dimensions was poor. It would seem appropriate to consider item elimination and then re-test the OIQoL on a larger sample of children, enabling the use of Rasch or item response theory, to inform the overall structure, consider the effects of causal items and reassess further potential item elimination.

## **10.6 Strengths and limitations**

This study has several strengths, particularly within its early stages.

- The repeat review of the literature, following the reviews undertaken previously by Eiser and Morse (2001), McCabe (2003) and Stevens (2008) enabled clarification of the need to develop a paediatric OI specific QoL instrument, as there was no suitable alternative available which included items relevant to the

OI population. It also uncovered information to facilitate the development of the conceptual framework surrounding QoL in children with OI.

- The use of bottom up methodology working with children and their families, alongside health professionals experienced in caring for and treating children with OI, identified concepts and themes which were highly relevant to the paediatric OI population. The subsequent development of a conceptual framework including these themes and how they interacted was used to inform the development of the OIQoL.
- Transparency throughout all stages of questionnaire development has allowed the children's own thematic based quotes to be used as items within the OIQoL, encouraging high content validity and acceptability of the newly developed questionnaire. Its readability, understanding and scoring format was assessed and improved with the help of a small sample of young children, to ensure suitability, comprehension and comfort across the age range.
- Observed pre-testing of the questionnaire with the addition of post completion interviews, allowed pauses and lack of understanding to be monitored, and questions to be asked. This highlighted areas of concern and discomfort which were later used to inform changes and revision of the OIQoL, particularly with reference to the item stem, which following revision has improved accuracy.

However, although this study demonstrated several strengths within the methodology, it is important to document its limitations.

- In retrospect the inclusion criteria used for systematically reviewing the literature, when appraising previously developed generic and suitable disease specific QoL measure was very strict. Had the criteria included only three of the four suggestions, questionnaires such as the Healthy Pathways Care scale may well have been appropriate and possibly a suitable alternative to the EQ5D for examination of criterion validity.
- A further concern regarding the methodology of the item generation phases of this research was the effect of the primary researcher. Acting as interviewer or focus group moderator alongside being a physiotherapist within the Metabolic Bone Disease Team may have effected the outcome. Participants may have been more inclined to take part as they already knew the principle researcher as a physiotherapist in the team. Alternatively they may have felt pressurised to enter into the study for the same reason. The principle researcher's previously relationship with the participants may however have put the children and young people at ease, enabling them to feel comfortable answering questions and talking about their QoL. Had the topic of the interviews or focus groups included questions about the provision of therapy or the treatment that the participants were receiving, then the relationship between the researcher and the children or young people may have had a very different effect on the outcome.
- The use of the EQ5D was also a further limitation of the final psychometric testing phase of the study. This adult based measure proved difficult for

younger children to complete, the wording was very adult in nature and many children didn't grasp what the thermometer was asking them to do. The use of an alternative, such as the Healthy Care Pathway scale may have proved beneficial and provided a better measure with which to assess criterion validity.

- Preliminary psychometric testing of the revised questionnaire enabled missing data, floor and ceiling effects and overall acceptability to be examined. Floor effects were uncovered in a couple of items related to being handled, which although these items affect only a small number of the more severely affected OI patients, the decision was made to keep these items within the OIQoL questionnaire. Ceiling effects were identified in several items which when examined more closely, were found to be poorly worded and required revision. These latter ceiling effects were seen in both the pre-testing (chapter 8) and psychometric phases of this study, with hindsight the methodology would have been improved had revisions been made immediately following the pilot phase, enabling a better quality questionnaire being involved in the psychometric testing. Delaying these revisions allowed the same ceiling effects to be demonstrated when the questionnaire was completed by 95 children and young people; further strengthening the evidence in favour of revision.
- The small sample size, alongside the limited experience and understanding of the primary researcher prevented the use of modern psychometric techniques to inform the construct of the newly developed OIQoL. These techniques could also have been used to identify the effect of causal items on the suitability of a summated total score, hence informing the researcher of the most appropriate method to ensure statistical robustness.
- The data surrounding known groups validity is disappointing; with the reduced function dimension and only a handful of items demonstrating any significant difference between the severity types of OI (mild, moderate, severe). A similar picture is seen when the potential known groups difference between treatment groups is examined, and any pattern uncovered between the treatment groups over the three month time period, is again only significant for a small number of items. This may be due to the poor validity and responsiveness of the newly developed OIQoL, or due to the small number of participants within some groups, alternatively it could be due to the nature of the known groups under investigation. With hindsight it may have been more sensible to initially examine known groups validity for those participants who had sustained a fracture or undergone surgical intervention compared to those who had not. This would have required a larger number of participants, and can therefore be investigated during further research.
- The lack of any modern psychometric evaluation makes the decisions to eliminate items at this stage a difficult one. The need to balance statistical robustness alongside high content validity and relevance to the target population can make item elimination a subjective process. This reinforces the belief that further psychometric evaluation should take place to reassess and potentially strengthen the need for any further item elimination and

questionnaire revision, and that this should take place within several centres across the UK to gather a more diverse cohort.

## **10.7 Future research**

It is therefore the opinion of the primary researcher, that further psychometric testing on a larger sample, enabling Rasch analysis or item response theory would help to inform the structure and internal consistency of the OIQoL. A closer look at the presence and effect of causal items would also enhance the understanding of the newly developed OIQoL. Triangulating the recent item revisions and eliminations within the OIQoL, alongside focus groups involving the paediatric OI populations would increase confidence in the newly developed OIQoL. This would ensure no important items have been eliminated on statistical grounds and promote ongoing content validity. Subsequently, a multicentre study is proposed, involving several centres within the UK, to include a larger patient cohort, enabling the use of modern psychometric techniques to ensure further improved validity, reliability and responsiveness of the OIQoL. Any future research should include wide diversity within the sample, enabling examination of any significant difference between groups such as; family background, parental employment status, ethnicity and family history of disease.

The principle researcher is also in contact with several other multidisciplinary teams internationally. Future long term plans involve translating the OIQoL into other languages (French, Spanish, German) and then further testing the psychometric properties of the OIQoL on different international cohorts (Canada, Spain, Australia, Portugal, USA).

It is also noted, that at several stages throughout this study, the opportunity was missed to develop a parent proxy measure alongside the child self-report. This would not replace the child self-report, but would both supplement and complement it. The principle researcher plans to revisit the interview data from the parent cohort and alongside focus groups involving parents of children with OI, the development of a proxy-report measure will be undertaken.

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Patrick D. L., Burke L. B., Gwaltney C. J., Leidy N. K., Martin M. L., Molsen E., Ring L. (2011b) Content Validity. Establishing and Reporting the Evidence in Newly Developed Patient-Reported Outcomes (PRO) Instruments for Medical Product Evaluation: ISPOR PRO Good Research Practices Task Force Report: Part 2. Assessing Respondent Understanding. *Value in Health*, 14, 978-988.

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## Appendix 1.

### Ethical approval letter.

#### Sheffield Research Ethics Committee

1st Floor Vickers Corridor  
Northern General Hospital  
Herries Road  
Sheffield  
S5 7AU

Telephone: 0114 271 4011  
Facsimile: 0114 256 2469

14 April 2010

Mrs Claire Hill  
New House  
Moorgate Grove  
ROTHERHAM  
S60 2TR

Dear Mrs Hill

**Study Title:** DEVELOPMENT OF AN OSTEOGENESIS IMPERFECTA  
QUALITY OF LIFE MEASURE AND VALIDATION AND  
RELIABILITY OF THE OSTEOGENESIS IMPERFECTA  
(OI) SPECIFIC ASSESSMENT TOOL

**REC reference number:** 10/H1308/18

**Protocol number:** 5

Thank you for your letter of 12 March 2010, responding to the Committee's request for further information on the above research [and submitting revised documentation].

The further information has been considered on behalf of the Committee by the Chair.

#### Confirmation of ethical opinion

On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation [as revised], subject to the conditions specified below.

#### Ethical review of research sites

The favourable opinion applies to all NHS sites taking part in the study, subject to management permission being obtained from the NHS/HSC R&D office prior to the start of the study (see "Conditions of the favourable opinion" below).

#### Conditions of the favourable opinion

The favourable opinion is subject to the following conditions being met prior to the start of the study.

Management permission or approval must be obtained from each host organisation

prior to the start of the study at the site concerned.

For NHS research sites only, management permission for research (“R&D approval”) should be obtained from the relevant care organisation(s) in accordance with NHS research governance arrangements. Guidance on applying for NHS permission for research is available in the Integrated Research Application System or at <http://www.rdforum.nhs.uk>. *Where the only involvement of the NHS organisation is as a Participant Identification Centre, management permission for research is not required but the R&D office should be notified of the study. Guidance should be sought from the R&D office where necessary.*

*Sponsors are not required to notify the Committee of approvals from host organisations.*

**It is the responsibility of the sponsor to ensure that all the conditions are complied with before the start of the study or its initiation at a particular site (as applicable).**

### Approved documents

The final list of documents reviewed and approved by the Committee is as follows:

<i>Document</i>	<i>Version</i>	<i>Date</i>	
Covering Letter	1	20 January 2010	
REC application	1	11 February 2010	
Rejection letter from Northern & Yorkshire	1	17 December 2009	
Investigator CV	1	10 February 2010	
CV Jill Birch	1	10 February 2010	
CV Elizabeth Anne Knowles	1	10 February 2010	
CV Davina Alexandra Ford	1	11 February 2010	
CV - Stephen Walters	1	11 February 2010	
Parent invitation letter - Phase 1 Interview (1)	1	08 October 2009	
Patient invitation letter - 16-18 years - phase 1 interview (2)	1	08 October 2009	
Parent invitation letter Phase 1 Focus Group (3)	1	08 October 2009	
Patient invitation letter 16-18 years - Phase 1 Focus group (4)	1	08 October 2009	
Parent invitation letter - Phase 2 Pilot study (5)	1	08 October 2009	
Patient invitation letter 16-18 years - Phase 2 Pilot Study (6)	1	08 October 2009	
Reply slip - Phases 1 & 2 (9)	1	08 October 2009	
Reply slip - Phase 3 (10)	1	08 October 2009	
Assent form for children and young people (13)	2.0	23 December 2009	
Participant Information Sheet: Patient information sheet (young children - age 0 - 5) (14)	2	23 December 2009	
Participant Information Sheet: For children (Phase 1 Interview age 6 -12) (15)	2	23 December 2009	
Participant Information Sheet: Information sheet - young children (age 0-5) Phase 2 Pilot Study (28)	2	23 December 2009	
Participant Information Sheet: Information sheet for children (Age 6-12) Phase 2 Pilot Study (29)	2	23 December 2009	
Participant Information Sheet: Information sheet for young children (age 0-5) Phase 3 QOL (34)	2	23 December 2009	
Participant Information Sheet: Information sheet for children (age 6-	2	23 December 2009	

12) Phase 3 QOL (35)			
Participant Information Sheet: Participation sheet for young children (age 0-5) Phase 3 Functional Assessment (40)	2	23 December 2009	
Participant Information Sheet: Information sheet for young children age 6-12 (Phase 3 Functional Assessment) (41)	2	23 December 2009	
Funding letter (45)	1	09 July 2008	
Letter from Statistician	1	27 October 2009	
Questionnaire: PedsQL Parent Report for Toddlers (age 2-4) (47)	4	01 April 2004	
Questionnaire: PedsQL Young Child Report (age5-7) (48)	4	01 August 2007	
Questionnaire: PedsQL Parent Report for Young Children (ages 5-7) (49)	4	11 February 2008	
Questionnaire: PedsQL Child Report (ages 8-12) (50)	4	01 August 2007	
Questionnaire: PedsQL Parent Report for children (ages 8-12) (51)	4	11 February 2008	
Questionnaire: PedsQL Teenager Report (ages 13-18) (52)	4	01 August 2007	
Questionnaire: PedsQL Parent Report for Teens (ages 13-18) (53)	4	11 February 2008	
Questionnaire: EQ-5D Health Questionnaire	1		
Gantt Chart (55)	2	23 December 2009	
Protocol	5	23 December 2009	
Investigator CV	1	16 February 2010	
Covering Letter		12 March 2010	
Participant Consent Form: Parent/Legal Guardian	3	12 March 2010	
Participant Consent Form: Young adult 16-18 years	3	12 March 2010	
Letter of invitation - Parent phase 3 (7)	2	12 March 2010	
Letter of invitation - 16-18 years phase 3 (8)	2	12 March 2010	
Response to Request for Further Information		12 March 2010	
Participant Information Sheet: Young people (aged 13-15) Phase I interview (16)	3	12 March 2010	
Participant Information Sheet: Young adult aged 16-18 phase I interview (17)	3	12 March 2010	
Participant Information Sheet: Parent/Guardian - child participation Phase I interview (18)	3	12 March 2010	
Participant Information Sheet: Parent/Guardian participation Phase I interview (19)	3	12 March 2010	
Participant Information Sheet: Health professionals Phase I interview (20)	3	12 March 2010	
Participant Information Sheet: Young people age 13-15 Phase 1 Focus Group 1 (21)	3	12 March 2010	
Participant Information Sheet: Young adult 16-18 Phase 1 Focus Group 1 (22)	3	12 March 2010	
Participant Information Sheet: Parent/Guardian child participation Phase 1 Focus Group 1 (23)	3	12 March 2010	
Participant Information Sheet: Young people age 13-15 Phase 1 Focus Group 2 (24)	3	12 March 2010	
Participant Information Sheet: Young adult 16-18 Phase I Focus Group 2 (25)	3	12 March 2010	
Participant Information Sheet: Parent/Guardian child participation Phase 1 Focus Group 2 (26)	3	12 March 2010	
Participant Information Sheet: Parent/Guardian participation Phase 1 Focus Group 2 (27)	3	12 March 2010	
Participant Information Sheet: Young people 13-15 Phase 2 Pilot Study (30)	3	12 March 2010	

Participant Information Sheet: Young adult 16-18 Phase 2 Pilot Study (31)	3	12 March 2010	
Participant Information Sheet: Parent/Guardian child participation Phase 2 Pilot Study (32)	3	12 March 2010	
Participant Information Sheet: Parent/Guardian participation Phase 2 Pilot Study (33)	3	12 March 2012	
Participant Information Sheet: Young People 13-15 Phase 3 QOL (36)	3	12 March 2010	
Participant Information Sheet: Young adult 16-18 Phase 3 QOL (37)	3	12 March 2010	
Participant Information Sheet: Parent/Guardian child participation Phase 3 QOL (38)	3	12 March 2010	
Participant Information Sheet: Parent/Guardian participation Phase 3 QOL (39)	3	12 March 2010	
Participant Information Sheet: Young People 13-15 Phase 3 Functional Assessment (42)	3	12 March 2010	
Participant Information Sheet: Young Adult 16-18 Phase 3 Functional Assessment (43)	3	12 March 2010	
Participant Information Sheet: Parent/Guardian child participation Phase 3 Functional Assessment (44)	3	12 March 2006	

### Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees (July 2001) and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

### After ethical review

Now that you have completed the application process please visit the National Research Ethics Service website > After Review

You are invited to give your view of the service that you have received from the National Research Ethics Service and the application procedure. If you wish to make your views known please use the feedback form available on the website.

The attached document "*After ethical review – guidance for researchers*" gives detailed guidance on reporting requirements for studies with a favourable opinion, including:

- Notifying substantial amendments
- Adding new sites and investigators
- Progress and safety reports
- Notifying the end of the study

The NRES website also provides guidance on these topics, which is updated in the light of changes in reporting requirements or procedures.

We would also like to inform you that we consult regularly with stakeholders to improve our service. If you would like to join our Reference Group please email [referencegroup@nres.npsa.nhs.uk](mailto:referencegroup@nres.npsa.nhs.uk).

**10/H1308/18**

**Please quote this number on all correspondence**

Yours sincerely

**Dr C A Moore**  
**Chair**

Email: april.dagnall@sth.nhs.uk

*Enclosures:* "After ethical review – guidance for researchers" [[SL-AR1 for CTIMPs](#),  
[SL- AR2 for other studies](#)]  
*Copy to:* Sheffield Children's Hospital Research Department

## Appendix 2

### Exhaustive list of items following interviews (Chapter 4)

Safe/careful	Transport
Being different	Needle phobia
Additional support	Stress on friendships
Environment – access	Resentment
Environment – barrier	Lack of support
Adaptation	Control
Tired	Lack of confidence
Mobility	Planning/organised
Fear	Rebelling
Equipment	Extra effort/time
Hobbies	Motivation/determination
Isolation	Proud
Independence	Time off work
Acceptance	Handling/bonding
Opportunities – more/less	Feeling down/depressed
Positive thinking	Trust
Effect of treatment	Letting go
Weakness	Achievement
Consequences	Stiffness/discomfort
Pain	Fine motor/writing
Aches	Orthotics
Resilience	Peer support
Pride	Hospitalisation
Being the same/normal	Financial impact
Anger	Empowerment
Coping strategies	Parent ‘v’ child expectations and desires
Endurance	Sibling resentment
Made fun of	Extra responsibility
Adapted psychologically	Handling
Activity restriction	Hypermobility
Over protection	Lack of exercise
Disappointment	Appearance/deformity
Upset/stress	Uncertainty of fractures
Reduced function	
Frustration	
Friendships/peer support	
Embarrassment	
Guilt	
Parental worry	
Medication/pain relief	
Fractures	
Additional attention	
Missed time from school	

## Appendix 3

### Invitation letters and reply slips



Sheffield Children's Hospital  
Western Bank  
Sheffield  
S10 2TH

Telephone 0114 2717000

<DATE>

<NAME>

<ADDRESS>

Re: Development of an Osteogenesis Imperfecta quality of life measure and validation and reliability of the Osteogenesis Imperfecta (OI) specific assessment tool.

The Metabolic Bone Disease Team at Sheffield Children's Hospital want to develop a quality of life measure to assess how children and young people feel about having Osteogenesis Imperfecta (Brittle Bone Disease). Alongside this we wish to calculate the validity and reliability of the newly developed quality of life measure and the previously developed Osteogenesis Imperfecta functional assessment tool.

We will be collecting views from a range of people, including patients, parents and health professionals, with regard to what should be included within this quality of life measure. We will then develop the quality of life measure, again asking a range of people what they think to its suitability.

We would like to invite you to take part in an interview to discuss quality of life in children and young people with Osteogenesis Imperfecta. The interview would be held at Sheffield Children's Hospital during your routine admission or out patient appointment and would take up to one hour.

Please take time to read the enclosed information sheets, which explain the research, returning the reply slip, if you wish to take part in the research study. Once you have returned the reply slip we will telephone you in a few days time to enquire about whether you are still willing to take part.

This study is multifaceted, with several sections. You can agree to take part in this section of the research alone if you prefer, or agree to take part in more than one section as they arise. Completing the reply slip enclosed will let the researchers know what you would like to be included in.

May I take this opportunity to thank you in anticipation.

Yours Sincerely

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's NHS Foundation Trust

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We would like to invite you to take a look at the newly developed quality of life measure and then take part in an interview to find out what you think about it. The interview would be held at Sheffield Children's Hospital during your routine admission or out patient appointment and would take approximately 10 minutes.

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Metabolic Bone Disease Team  
Sheffield Children's NHS Foundation Trust

Sheffield Children's Hospital  
Western Bank  
Sheffield  
S10 2TH

Telephone 0114 2717000

Dear Researcher

Re: Development of an Osteogenesis Imperfecta quality of life measure and validation  
and reliability of the Osteogenesis Imperfecta (OI) specific assessment tool.

I confirm that I would be willing to participate in the study. YES/NO

I confirm that I would be happy for my child to participate in the study. YES/NO

I consent to being contacted further and include my contact details below:

<p>NAME:</p>  <p>TELEPHONE NUMBER:</p>
--

I confirm that I would be happy for my child to be contacted for  
Participation in the other sections of this study YES/NO

**Please return this slip in the envelop provided to:**

Claire Hill  
Clinical Specialist Physiotherapist  
Physiotherapy Department  
Sheffield Children's NHS Foundation Trust  
Western Bank  
Sheffield  
S10 2TH

## **Appendix 4**

### **Information sheets**



## PARTICIPANT INFORMATION SHEET

### FOR CHILDREN

PHASE 1 INTERVIEW

Age 6-12

To be shown and read by parent/carer if required

#### **Study Title**

Development of a set of questions for children with Brittle Bone Disease.

#### **1. What is research?**

Research is what we do to find out the answer to an important question.



#### **2. What is Brittle Bone Disease?**

It means your bones can break easier and that your joints may be bendier than your friends or brothers and sisters.

#### **3. Why is this project being done?**

We want to develop a set of questions to help us work out how you feel about having Brittle Bone Disease.

#### **4. Why me?**

You have been chosen because you have Brittle Bones and you visit Sheffield Children's Hospital for your treatment and care. We are asking 10 children, 10 parents and 5 doctors and nurses to take part in this section.



## **5. Do I have to take part?**

No you do not. It is up to you. We would like you to read this information sheet. If you agree to take part, we would like you to write your name on two forms. We will also ask your Mum, Dad or carer to write their name on the forms and give one back to us. You can still change your mind later. If you don't want to take part, just say no. You may be asked to take part again in a month or two. If you don't want to, just let your Mum, Dad or carer know.

## **6. What will happen?**

We would like to talk to you and ask you some questions. The questions will be about what you think about having brittle bones. This will be recorded on audio cassette.

We will use the information to develop a set of questions to measure how children with brittle bones feel. When the assessment is finished we will send you a copy so you can tell us what you think.

We will talk to you about the research during your normal hospital visit. There will be no extra blood tests or x-rays. Your Mum, Dad or carer can stay with you during the interview.

## **7. Will joining in help me?**

No, but it may help us to know more about how children with brittle bones feel. We want to develop an assessment to measure how children with brittle bones feel so that we can improve our service.



### **8. What else might happen?**

We will only record the questions on tape. Then we can write down what you said, by listening to the tape. Once we have written it down we will give you a pretend name so that no one else will know what you have said.

### **9. What happened when the research study stops?**

We will collect what everyone has said together and use the information to make a special assessment about how children with brittle bones feel.

### **10. What if something goes wrong?**

Your Mum, Dad or carer will be able to talk to someone who will be able to tell them what they need to do about it.

### **11. What if I don't want to do the research anymore?**

Just tell your Mum, Dad, carer or doctor at any time. They will not be cross with you. You will still have the same care whilst you are at hospital.

### **12. What if I wish to complain about the study?**

If you wish to complain you or your Mum, Dad or carer can talk to Claire Hill or Mrs Linda Towers at this hospital.



### **13. Will anyone else know I am doing this?**

The people in our research team will know you are taking part. The doctor looking after you while you are in hospital will also

know. No one else will know because we will not use your name or address. You will get a pretend name instead.

#### **14. What happens to what the researchers find out?**

When we collect your information we will make sure it is stored in a safe place and only the people doing the research can look at it. We will use the information to develop an assessment to measure how children with brittle bones feel and put it in medical magazines and on websites that doctors and therapists read.



A short summary will also be on the hospital's research website and the Brittle Bone Society website. No one will know you were in the study.

#### **15. Did anyone else check the study is OK to do?**

The study has been checked by several people at the hospital and the university to make sure it is alright.



#### **16. How can I find out more about the study?**

Your Mum, Dad, carer or other grown-up you trust may be able to answer your questions. The doctors, nurses or therapists looking after you can also help you find out more about the study.

**Thank you for taking the time to read this - please ask any questions if you need to.**



## **PARTICIPANT INFORMATION SHEET**

YOUNG PEOPLE (Aged 13 – 15)

PHASE 1 INTERVIEW

### **Study Title**

Development of a Quality of Life measure for children with Osteogenesis Imperfecta (OI)

#### **1. Invitation paragraph**

We would like you to help us with our research study. This is an educational study. Please read this information carefully and talk to your Mum, Dad or carer about the study. Ask us if there is anything that is not clear or if you want to know more. Take time to decide if you want to take part. It is up to you if you want to do this. If you don't then that's fine, you'll be looked after at the hospital just the same.



#### **2. Why are we doing this research?**

We want to develop a Quality of Life measure to assess how children and young people feel about having Osteogenesis Imperfecta (Brittle Bone Disease). There are five sections in total (Phases 1a, 1b, 1c, 2 and 3), and by random selection you may be invited to take part in three of the five sections. This is Phase 1 and you may also be invited to take part in Phase 1c and Phase 3. This research is part of an educational qualification.

#### **3. Why have I been asked to take part?**

You have been chosen because you have Osteogenesis Imperfecta (Brittle Bone Disease). We are asking 10 children and young people, 10 parents and 5 health professionals to take part in this phase.

Osteogenesis Imperfecta (OI) is Brittle Bone Disease. It means that your bones can break easier and that your joints may be bendier than your friends, brothers and sisters.

#### **4. Do I have to take part?**

No it is entirely up to you. If you do decide to take part:

- You will be asked to sign a form to say that you agree to take part (a consent/assent form)
- You will be given this information sheet and a copy of your signed consent/assent form to keep.

You are free to stop taking part at any time during the research without giving a reason. If you decide to stop, this will not affect the care you receive whilst in this hospital.

You can agree to take part in this section of the research alone if you prefer, or agree to take part in more than one section as they arise. Completing the reply slip enclosed will let the researchers know what you would like to be included in.

#### **5. What will happen to me if I take part?**

If you agree to take part we will arrange a date and time convenient for you to come to Sheffield Children's Hospital for interview. You can do this during a clinic visit or when you are admitted for treatment.

We would like to interview you and ask you some questions. The questions will be about what you think about having Brittle Bone Disease (OI). The interview will be recorded.

We will use the information to develop a Quality of Life measure for children and young people with Brittle Bone Disease. When the Quality of Life measure is developed we will send you a copy so you can tell us what you think.

We will interview you during your normal hospital visit. There will be no extra blood tests or x-rays. You can choose to have someone stay with you during the interview, such as a parent/carer or friend.

#### **6. What will I be asked to do?**

We will ask you a few questions about how you feel about having Brittle Bone Disease. We would like to get your opinion about what it is like to have Brittle Bone Disease, and how this affects your daily life. We will record the interview, so that we can transcribe it to paper after the interview has finished. We will anonymise the transcript by giving you a different name. Once we have transcribed the interview to paper the tape recording will be destroyed.

**7. Is there anything else to be worried about?**

No. We want to develop a Quality of Life measure to enable us to assess how children and young people with Brittle Bone Disease feel about their daily life. We hope this new quality of life measure will help us provide better care for children and young people with OI.

If we find out something that we think is important about your Brittle Bone Disease, we will talk to your Mum, Dad or carer and ask them if they want you to come back and have you checked again at the hospital.

**8. Will the study help me?**

No, but the information we get will help us to develop the quality of life measure. We hope the new quality of life measure will improve the care of other children and young people with Brittle Bone Disease (OI).

**9. What happened when the research study stops?**

We will collect everyone's opinions and use the information to develop a Quality of Life measure for children and young people with Brittle Bones disease.

**10. Contact for further information**

If you would like any further information about this study you could contact:



Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
01142267890

**11. What if new information comes along?**

Sometimes during research, new things are found out about Brittle Bone Disease. If this happens, someone from the research team will tell you about it and discuss whether you want to continue the study. If you change your mind this will not affect any care you receive whilst in hospital. If you decide to continue in the study you will be asked to sign an updated consent/assent form.

**12. What if I don't want to do the research anymore?**

Just tell your Mum, Dad, carer, doctor or therapist at any time. They will not be cross with you. You will still have the same care whilst you are at hospital.

### **13. What if there is a problem or something goes wrong?**

Tell us if there is a problem and we will try to sort it out straight away. You and your Mum, Dad or carer can either contact the project co-ordinator:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
Tel: 01142267890



Or the hospital complaints co-ordinator:

Mrs Linda Towers  
Patient Advice and Liaison Co-ordinator  
Sheffield Children's Hospital NHS Trust  
Tel: 01142717594

### **14. Will anyone else know I'm doing this?**

The people in our research team will know you are taking part. The doctor looking after you while you are in hospital will also know.

Your medical notes may also be looked at by other people who work at the hospital to check that the study is being carried out correctly.

All the information that is collected about you during the research will be kept strictly confidential. Your transcript will be given a number; your name will be changed.

Any information about you that leaves the hospital will have your name and address removed so that you cannot be recognised from it. Once the study is complete all information will be destroyed or kept in your own confidential notes.

### **15. What happens to the results of the researchers study?**

When the study has finished we will present our findings to other doctors, nurses and therapists and we will put the results in medical magazines and websites that health professionals use. We would also like to put an article in the hospital newsletter and on the Brittle Bone Society website. The results will be anonymous, which means that you will not be identified from them.

### **16. Who is organising and funding the research?**

Researchers at Sheffield Children's NHS Trust are organising the study. They will not get any extra money for doing this.

**17. Who has checked the study?**

Before any study goes ahead it has to be checked by a Research Ethics Committee. This is a group of people who make sure the research is OK to do. This study has been looked at by Sheffield Research Ethics Committee.

It has also been checked by the research department at Sheffield Children's NHS Foundation Trust.

**18. How can I find out more about research?**

The Clinical Research Support Unit at this hospital has an information for families section on its website [www.sheffieldchildrenscrf.nhs.uk](http://www.sheffieldchildrenscrf.nhs.uk) or you could contact the hospital Clinical Research Support Unit:

Mrs Tracy N'Diaye  
Directorate Manager of Research  
Sheffield Children's NHS Foundation Trust  
Tel: 01142267904

**Thank you for taking the time to read this – please ask any questions if you need to.**

**Contact Claire Hill 01142267890**



## **PATIENT INFORMATION SHEET**

YOUNG ADULT AGED 16-18

PHASE 1 INTERVIEW

### **Study Title**

Development of a Quality of Life measure for children with Osteogenesis Imperfecta (OI)

#### **1. Invitation paragraph**

You are being asked to take part in a research study. This is an educational study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully. Talk to others about the study if you wish.

Ask us if there is anything that is not clear or if you would like more information (contact: Claire Hill on 01142267890). Take time to decide whether or not you want to take part.



#### **2. What is the purpose of the study?**

We want to develop a Quality of Life measure to assess how children and young people feel about having Osteogenesis Imperfecta (Brittle Bone Disease). This research involves several sections and you may be asked to take part in other sections of the research too. There are five sections in total (Phases 1a, 1b, 1c, 2 and 3), and by random selection you may be invited to take part in three of the five sections. This is Phase 1 and you may also be invited to take part in Phase 1c and Phase 3. This research is part of an educational qualification.

#### **3. Why have I been chosen?**

You have been chosen because you have with Osteogenesis Imperfecta (Brittle Bone Disease). Osteogenesis Imperfecta (OI) is Brittle Bone Disease. It means that your bones can break easier and that your joints may be bendier than your friends, brothers and sisters.

To develop a really useful quality of life measure for children and young people with Osteogenesis Imperfecta we need to find out what living with the condition is really like. We are asking 10 children and young people, 10 parents and 5 health professionals to take part in this phase.

#### **4. Do I have to take part?**

No. It is entirely up to you to decide whether or not to take part. You are free to withdraw from the research at any time without giving a reason. Your decisions about this will not affect the standard of care you will receive.

If you are happy to take part, and are happy with the explanations from the research team, you will be asked to sign a consent form. You will be given a copy of the information sheet and the signed consent/assent forms to keep for your records.

You can agree to take part in this section of the research alone if you prefer, or agree to take part in more than one section as they arise. Completing the reply slip enclosed will let the researchers know what you would like to be included in.

#### **5. What will happen if I agree to take part?**

If you agree to take part we will arrange a date and time convenient for you to come to Sheffield Children's Hospital for interview. If preferred, you can do this during a clinic visit or when you are admitted for treatment.

We would like to interview you and ask you some questions. The questions will be about what you think about having Brittle Bone Disease (OI). What makes your life easier or more difficult? The interview will be recorded.

We will use the information to develop a Quality of Life measure for children and young people with Brittle Bone Disease. When the Quality of Life measure is developed we will send you a copy so you can tell us what you think.

#### **6. What will I be asked to do?**

We will ask you a few questions about how you feel about having Brittle Bone Disease. We would like to get your opinion about what it is like to have Brittle Bone Disease, and how this affects your daily life. We will record the interview, so that we can transcribe it to paper after the interview has finished. We will anonymise the transcript by giving you a different name. Once we have transcribed the interview to paper and analysed the data, the tape recording will be destroyed.

#### **7. What are the possible disadvantages and risks of taking part?**

None. We want to develop a Quality of Life measure to enable us to assess how children and young people with Brittle Bone Disease feel about their daily life. We hope this new quality of life measure will help us provide better care for children and young people with OI.

**8. What are the possible benefits of taking part?**

You will not benefit from being part of this study. However, the information we collect will help us to develop the quality of life measure. We hope the new quality of life measure will improve the care of other children and young people with Brittle Bone Disease (OI).

**9. What happens when the research study stops?**

We will collate everyone's opinions and use the information to develop a Quality of Life measure for children and young people with Brittle Bones disease.

**10. What if there is a problem?**

Any complaint about the way you have been dealt with during the study or any possible harm you might suffer will be addressed. If you have any cause to complain about any aspect of the way in which you have been approached or treated during the course of this study, the normal National Health Service complaints mechanisms are available to you and you are not compromised in any way because you have taken part in a research study.

**11. Will my taking part in the research project be confidential?**

Yes. We will follow ethical and legal practice and all information about you will be handled in confidence. All information which is collected about you during the course of the research will be kept strictly confidential. Any information about you which leaves the hospital will have your name and address removed so that you cannot be recognised from it. Once the study is complete all information will be destroyed.

**12. Contact for any further information**

If you would like any further information about this study you could contact:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
01142267890

**13. What if new information becomes available?**

Sometimes during the course of a research project, new information becomes available about Osteogenesis Imperfecta. If this happens, someone from the research team will tell you about it and discuss whether you want to continue the study. If you change your mind this will not affect any care you receive

whilst in hospital. If you decide to continue in the study you will be asked to sign an updated consent form.

**14. What will happen if I don't want to carry on with the research?**

If you withdraw from the study we will destroy all your identifiable data, but we will need to use the data collected up to your withdrawal.

**15. What if there is a problem?**

**Complaints**

If you have any cause to complain about any aspect of the way in which you have been approached or treated during the course of this study, the normal National Health Service complaints mechanisms are available to you and you are not compromised in any way because you have taken part in a research study. If you have any complaints or concerns please contact either the project co-ordinator:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
Tel: 01142267890

Or the hospital complaints co-ordinator:

Mrs Linda Towers  
Patient Advice and Liaison Co-ordinator  
Sheffield Children's Hospital NHS Trust  
Tel: 01142717594

**Harm**

If you are harmed by taking part in this research project, there are no special compensation arrangements. If you are harmed due to someone else's fault, then you may have grounds for a legal action – but you may have to pay for it.

**16. Will taking part in this study be kept confidential?**

All information which is collected about you during the course of the research will be kept strictly confidential. Any information about you which leaves the hospital will have your name and address removed so that you cannot be recognised from it. Once the study is complete all information will be destroyed.

Our procedures for handling, processing, storage and destruction of data are compliant with the Data Protection Act 1998.

Your transcript will be given a number; your name will be changed.

**17. What happens to the results of the research study?**

When the study has finished we will present our findings to other doctors, nurses and therapists and we will put the results in medical magazines and websites that health professionals use. We would also like to put a brief summary on the hospital research website and on the Brittle Bone Society website, so that you will be able to read about our results too. This will be available at the end of the study, on [www.sheffieldchildrenscrf.nhs.uk](http://www.sheffieldchildrenscrf.nhs.uk). The results will also be included as part of the chief investigators educational qualification. The results will be anonymous, which means that you will not be identified from them.

**18. Who is organising and funding the research?**

Researchers at Sheffield Children's NHS Trust are organising the study. They will not get any extra money for doing this.

**19. Who has reviewed the study?**

This study was given a favourable ethical opinion for conduct in the NHS by Sheffield Research Ethics Committee.

It has also been checked by the research department at Sheffield Children's NHS Foundation Trust.

**20. How can we find out more about research?**

The Clinical Research Support Unit at this hospital has an **Information for Families** section on its website [www.sheffieldchildrenscrf.nhs.uk](http://www.sheffieldchildrenscrf.nhs.uk) or you could contact the hospital Clinical Research Support Unit:

Mrs Tracy N'Diaye  
Directorate Manager of Research  
Sheffield Children's NHS Foundation Trust  
Tel: 01142267904

**Thank you for taking the time to read this – please ask any questions if you need to.**

**Contact Claire Hill 01142267890**



## **PARENT/LEGAL GUARDIAN INFORMATION SHEET**

Child/young people participation

PHASE 1 INTERVIEW

### **Study Title**

Development of a Quality of Life measure for children with Osteogenesis Imperfecta (OI)

#### **1. Invitation paragraph**

Your child is being asked to take part in a research study. This is an educational study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully. Talk to others about the study if you wish.

Ask us if there is anything that is not clear or if you would like more information (contact: Claire Hill on 01142267890). Take time to decide whether or not you want your child to take part.



#### **2. What is the purpose of the study?**

We want to develop a Quality of Life measure to assess how children and young people feel about having Osteogenesis Imperfecta (Brittle Bone Disease). This research involves several sections and your child may be asked to take part in other stages of the research too. There are five sections in total (1a, 1b, 1c, 2 and 3), and by random selection you or your child may be invited to take part in three of the five. This is Phase 1 and you may also be invited to take part in Phase 1c and Phase 3. This research is part of an educational qualification.

#### **3. Why has my child been chosen?**

Your child has been chosen because they have Osteogenesis Imperfecta (Brittle Bone Disease). Osteogenesis Imperfecta (OI) is Brittle Bone Disease. It means that their bones can break easier and that their joints may be bendier than their friends, brothers and sisters.

To develop a useful quality of life measure for children and young people with Osteogenesis Imperfecta we need to find out what living with the condition is like. We are asking 10 children and young people, 10 parents and 5 health professionals to take part in this phase.

#### **4. Does my child have to take part?**

No. It is entirely up to you and your child (wherever possible) to decide whether or not to take part. You are both free to withdraw from the research at any time without giving a reason. Your decisions about this will not affect the standard of care your child will receive.

If you are happy to take part, and are happy with the explanations from the research team, you will be asked to sign a consent form. If your child is able to understand the research and is happy to take part and can write their name, they will be asked to sign an assent form with you, if they want to. You will be given a copy of the information sheet and the signed consent/assent forms to keep for your records.

You can agree to your child taking part in this section of the research alone if you prefer, or agree to them taking part in more than one section as they arise. Completing the reply slip enclosed will let the researchers know what you would like your child to be included in.

#### **5. What will happen to my child if we agree to take part?**

If you agree to take part we will arrange a date and time convenient for your child to come to Sheffield Children's Hospital for interview. If preferred you can do this during a clinic visit or when they are admitted for treatment.

We would like to interview your child and ask them some questions. The questions will be about what they think about having Brittle Bone Disease (OI). The interview will be recorded.

We will use the information to develop a Quality of Life measure for children and young people with Brittle Bone Disease. When the Quality of Life measure is developed we will send them a copy so they can tell us what they think.

We will interview them during your normal hospital visit. There will be no extra blood tests or x-rays. You can stay with them during the interview if they would prefer that.

#### **6. What will we be asked to do?**

We will ask your child a few questions about how they feel about having Brittle Bone Disease. We would like to get their opinion about what it is like to have Brittle Bone Disease, and how this affects their daily life. We will record the interview, so that we can transcribe it to paper after the interview has finished. We will anonymise the transcript by giving your child a different name. Once we have transcribed the interview to paper and analysed the data, the tape recording will be destroyed.

**7. What are the possible disadvantages and risks of taking part?**

None. We want to develop a Quality of Life measure to enable us to assess how children and young people with Brittle Bone Disease feel about their daily life. We hope this new quality of life measure will help us provide better care for children and young people with OI.

If we find out something that we think is important about your child's Brittle Bone Disease, we will talk to you and ask if you want to come back and have your child checked again at the hospital.

**8. What are the possible benefits of taking part?**

Your child will not benefit from being part of this study. However, the information we collect will help us to develop the quality of life measure. We hope the new quality of life measure will improve the care of other children and young people with Brittle Bone Disease (OI).

**9. What happens when the research study stops?**

We will collate everyone's opinions and use the information to develop a Quality of Life measure for children and young people with Brittle Bone disease.

**10. What if there is a problem?**

Any complaint about the way you or your child have been dealt with during the study or any possible harm you or your child might suffer will be addressed. If you have any cause to complain about any aspect of the way in which you have been approached or treated during the course of this study, the normal National Health Service complaints mechanisms are available to you and you are not compromised in any way because you have taken part in a research study.

**11. Will my child's taking part in the research project be confidential?**

Yes. We will follow ethical and legal practice and all information about your child will be handled in confidence. All information which is collected about your child during the course of the research will be kept strictly confidential. Any information about your child which leaves the hospital will have their name and address removed so that you cannot be recognised from it. Once the study is complete all information will either be destroyed or kept in your child's confidential notes.

## **12. Contact for any further information**

If you would like any further information about this study you could contact:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
01142267890

## **13. What if new information becomes available?**

Sometimes during the course of a research project, new information becomes available about Osteogenesis Imperfecta. If this happens, someone from the research team will tell you and your child about it and discuss whether you want your child to continue the study. If you change your mind this will not affect any care your child receives whilst in hospital. If you decide to continue in the study you and your child will be asked to sign an updated consent/assent form.

## **14. What will happen if we don't want to carry on with the research?**

If you withdraw from the study we will destroy all your child's identifiable data if you wish, but we will need to use the data collected up to their withdrawal.

## **15. What if there is a problem?**

### **Complaints**

If you have any cause to complain about any aspect of the way in which you or your child has been approached or treated during the course of this study, the normal National Health Service complaints mechanisms are available to you and you are not compromised in any way because you have taken part in a research study. If you have any complaints or concerns please contact either the project co-ordinator:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
Tel: 01142267890

Or the hospital complaints co-ordinator:

Mrs Linda Towers  
Patient Advice and Liaison Co-ordinator  
Sheffield Children's Hospital NHS Trust  
Tel: 01142717594

## **Harm**

If your child is harmed by taking part in this research project, there are no special compensation arrangements. If your child is harmed due to someone else's fault, then you may have grounds for a legal action – but you may have to pay for it.

### **16. Will taking part in this study be kept confidential?**

All information which is collected about your child during the course of the research will be kept strictly confidential. Any information about your child which leaves the hospital will have their name and address removed so that your child cannot be recognised from it. Once the study is complete all information will either be destroyed or kept in your child's confidential notes.

Our procedures for handling, processing, storage and destruction of data are compliant with the Data Protection Act 1998.

Your child's transcript will be given a number; their name will be changed. Your child's medical notes may also be looked at by other people within the hospital involved in the running and supervision of the study to check that it is being carried out correctly.

### **17. What happens to the results of the research study?**

When the study has finished we will present our findings to other doctors, nurses and therapists and we will put the results in medical magazines and websites that health professionals use. We would also like to put a brief summary on the hospital research website and on the Brittle Bone Society website, so that you will be able to read about our results too. This will be available at the end of the study, on [www.sheffieldchildrenscrf.nhs.uk](http://www.sheffieldchildrenscrf.nhs.uk). The results will also be included as part of the chief investigators educational qualification. The results will be anonymous, which means that your child will not be identified from them.

### **18. Who is organising and funding the research?**

Researchers at Sheffield Children's NHS Foundation Trust are organising the study. They will not get any extra money for doing this.

### **19. Who has reviewed the study?**

This study was given a favourable ethical opinion for conduct in the NHS by Sheffield Research Ethics Committee.

It has also been checked by the research department at Sheffield Children's NHS Foundation Trust.

**20. How can we find out more about research?**

The Clinical Research Support Unit at this hospital has an **Information for Families** section on its website [www.sheffieldchildrenscrf.nhs.uk](http://www.sheffieldchildrenscrf.nhs.uk) or you could contact the hospital Clinical Research Support Unit:

Mrs Tracy N'Diaye  
Directorate Manager of Research  
Sheffield Children's NHS Foundation Trust  
Tel: 01142267904

**Thank you for taking the time to read this – please ask any questions if you need to.**

**Contact Claire Hill 01142267890**



## **PARENT/LEGAL GUARDIAN INFORMATION SHEET**

Parental Participation  
PHASE 1 INTERVIEW

### **Study Title**

Development of a Quality of Life measure for children with Osteogenesis Imperfecta (OI)

#### **1. Invitation paragraph**

You are being asked to take part in a research study. This is an educational study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully. Talk to others about the study if you wish.

Ask us if there is anything that is not clear or if you would like more information (contact: Claire Hill on 01142267890). Take time to decide whether or not you want to take part.



#### **2. What is the purpose of the study?**

We want to develop a Quality of Life measure to assess how children and young people feel about having Osteogenesis Imperfecta (Brittle Bone Disease). This research involves several sections and you may be asked to take part in other sections of the research too. There are five sections in total (Phases 1a, 1b, 1c, 2 and 3), and by random selection you may be invited to take part in three of the five sections. This is Phase 1 and you may also be invited to take part in Phase 1c and Phase 3. This research is part of an educational qualification.

#### **3. Why have I been chosen?**

You have been chosen because you have a child/children with Osteogenesis Imperfecta (Brittle Bone Disease). Osteogenesis Imperfecta (OI) is Brittle Bone Disease. It means that your child's bones can break easier and that their joints may be bendier than their friends, brothers and sisters.

To develop a really useful quality of life measure for children and young people with Osteogenesis Imperfecta we need to find out what living with the condition is really like. We are asking 10 children and young people, 10 parents and 5 health professionals to take part in this phase.

#### **4. Do I have to take part?**

No. It is entirely up to you to decide whether or not to take part. You are free to withdraw from the research at any time without giving a reason. Your decisions about this will not affect the standard of care your child will receive.

If you are happy to take part, and are happy with the explanations from the research team, you will be asked to sign a consent form. You will be given a copy of the information sheet and the signed consent/assent forms to keep for your records.

You can agree to take part in this section of the research alone if you prefer, or agree to take part in more than one section as they arise. Completing the reply slip enclosed will let the researchers know what you would like to be included in.

#### **5. What will happen if I agree to take part?**

If you agree to take part we will arrange a date and time convenient for you to come to Sheffield Children's Hospital for interview. If preferred, you can do this during a clinic visit or when your child/children are admitted for treatment.

We would like to interview you and ask you some questions. The questions will be about what you think about looking after a child who has Brittle Bone Disease (OI). What makes their life easier or more difficult? The interview will be recorded.

We will use the information to develop a Quality of Life measure for children and young people with Brittle Bone Disease. When the Quality of Life measure is developed we will send you a copy so you can tell us what you think.

#### **6. What will I be asked to do?**

We will ask you a few questions about parenting a child/children with Brittle Bone Disease. We would like to get your opinion about what it is like to have a child with Brittle Bone Disease, and how this affects their daily life. We will record the interview, so that we can transcribe it to paper after the interview has finished. We will anonymise the transcript by giving you a different name. Once we have transcribed the interview to paper and analysed the data, the tape recording will be destroyed.

#### **7. What are the possible disadvantages and risks of taking part?**

None. We want to develop a Quality of Life measure to enable us to assess how children and young people with Brittle Bone Disease feel about their daily life. We hope this new quality of life measure will help us provide better care for children and young people with OI.

**8. What are the possible benefits of taking part?**

You will not benefit from being part of this study. However, the information we collect will help us to develop the quality of life measure. We hope the new quality of life measure will improve the care of other children and young people with Brittle Bone Disease (OI).

**9. What happens when the research study stops?**

We will collate everyone's opinions and use the information to develop a Quality of Life measure for children and young people with Brittle Bones disease.

**10. What if there is a problem?**

Any complaint about the way you have been dealt with during the study or any possible harm you might suffer will be addressed. If you have any cause to complain about any aspect of the way in which you have been approached or treated during the course of this study, the normal National Health Service complaints mechanisms are available to you and you are not compromised in any way because you have taken part in a research study.

**11. Will my taking part in the research project be confidential?**

Yes. We will follow ethical and legal practice and all information about you will be handled in confidence. All information which is collected about you during the course of the research will be kept strictly confidential. Any information about you which leaves the hospital will have your name and address removed so that you cannot be recognised from it. Once the study is complete all information will be destroyed.

**12. Contact for any further information**

If you would like any further information about this study you could contact:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
01142267890

**13. What if new information becomes available?**

Sometimes during the course of a research project, new information becomes available about Osteogenesis Imperfecta. If this happens, someone from the research team will tell you about it and discuss whether you want to continue the study. If you change your mind this will not affect any care your child

receives whilst in hospital. If you decide to continue in the study you will be asked to sign an updated consent form.

**14. What will happen if I don't want to carry on with the research?**

If you withdraw from the study we will destroy all your identifiable data, but we will need to use the data collected up to your withdrawal.

**15. What if there is a problem?**

**Complaints**

If you have any cause to complain about any aspect of the way in which you have been approached or treated during the course of this study, the normal National Health Service complaints mechanisms are available to you and you are not compromised in any way because you have taken part in a research study. If you have any complaints or concerns please contact either the project co-ordinator:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
Tel: 01142267890

Or the hospital complaints co-ordinator:

Mrs Linda Towers  
Patient Advice and Liaison Co-ordinator  
Sheffield Children's Hospital NHS Trust  
Tel: 01142717594

**Harm**

If you are harmed by taking part in this research project, there are no special compensation arrangements. If you are harmed due to someone else's fault, then you may have grounds for a legal action – but you may have to pay for it.

**16. Will taking part in this study be kept confidential?**

All information which is collected about you during the course of the research will be kept strictly confidential. Any information about you which leaves the hospital will have your name and address removed so that you cannot be recognised from it. Once the study is complete all information will be destroyed.

Our procedures for handling, processing, storage and destruction of data are compliant with the Data Protection Act 1998.

Your transcript will be given a number; your name will be changed.

**17. What happens to the results of the research study?**

When the study has finished we will present our findings to other doctors, nurses and therapists and we will put the results in medical magazines and websites that health professionals use. We would also like to put a brief summary on the hospital research website and on the Brittle Bone Society website, so that you will be able to read about our results too. This will be available at the end of the study, on [www.sheffieldchildrenscrf.nhs.uk](http://www.sheffieldchildrenscrf.nhs.uk). The results will also be included as part of the chief investigators educational qualification. The results will be anonymous, which means that you or your child will not be identified from them.

**18. Who is organising and funding the research?**

Researchers at Sheffield Children's NHS Foundation Trust are organising the study. They will not get any extra money for doing this.

**19. Who has reviewed the study?**

This study was given a favourable ethical opinion for conduct in the NHS by Sheffield Research Ethics Committee.

It has also been checked by the research department at Sheffield Children's NHS Foundation Trust.

**20. How can we find out more about research?**

The Clinical Research Support Unit at this hospital has an **Information for Families** section on its website [www.sheffieldchildrenscrf.nhs.uk](http://www.sheffieldchildrenscrf.nhs.uk) or you could contact the hospital Clinical Research Support Unit:

Mrs Tracy N'Diaye  
Directorate Manager of Research  
Sheffield Children's NHS Foundation Trust  
Tel: 01142267904

**Thank you for taking the time to read this – please ask any questions if you need to.**

**Contact Claire Hill 01142267890**



## **HEALTH PROFESSIONALS INFORMATION SHEET**

### PHASE 1 INTERVIEW

#### **Study Title**

Development of a Quality of Life measure for children with Osteogenesis Imperfecta (OI)

#### **1. Invitation paragraph**

You are being asked to take part in a research study. This is an educational study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully. Talk to others about the study if you wish.

Ask us if there is anything that is not clear or if you would like more information (contact: Claire Hill on 01142267890). Take time to decide whether or not you want to take part.

#### **2. What is the purpose of the study?**

We want to develop a Quality of Life measure to assess how children and young people feel about having Osteogenesis Imperfecta (Brittle Bone Disease) and how it affects their daily life. This research is part of an educational qualification.

#### **3. Why have I been chosen?**

You have been chosen because you work with children and young people who have Osteogenesis Imperfecta (Brittle Bone Disease). We feel it is very important to gain a professional perspective of quality of life in your patients.

To develop a really useful quality of life measure for children and young people with Osteogenesis Imperfecta we need to find out what living with the condition is really like. We are asking 10 children and young people, 10 parents and 5 health professionals to take part in this phase.

#### **4. Do I have to take part?**

No. It is entirely up to you to decide whether or not to take part. You are free to withdraw from the research at any time without giving a reason. If you are happy to take part, and are happy with the explanations from the research team, you will be asked to sign a consent form. You will be given a copy of the information sheet and the signed consent form to keep for your records.

**5. What will happen if I agree to take part?**

If you agree to take part we will arrange a date and time convenient for you to come to Sheffield Children's Hospital for interview. You can do this during normal working hours, at lunch time or at the end of the working day.

We would like to interview you and ask you some questions. The questions will ask; how you think having Osteogenesis Imperfecta affects a child's quality of life and the life of their family. The interview will be recorded.

We will use the information to develop a Quality of Life measure for children and young people with Osteogenesis Imperfecta. When the Quality of Life measure is developed we will send you a copy so you can tell us what you think.

**6. What will I be asked to do?**

We will ask you a few questions about treating children with Osteogenesis Imperfecta. We would like to get your opinion about how Osteogenesis Imperfecta affects your patients' daily life. We will record the interview, so that we can transcribe it to paper after the interview has finished. We will anonymise the transcript by giving you a different name. Once we have transcribed the interview to paper and analysed the data, the tape recording will be destroyed.

**7. What are the possible disadvantages and risks of taking part?**

None. We want to develop a Quality of Life measure to enable us to assess how children and young people with Osteogenesis Imperfecta feel about their daily life. We hope this new quality of life measure will help us provide better care for children and young people with OI.

**8. What are the possible benefits of taking part?**

You will not benefit from being part of this study. However, the information we collect will help us to develop the quality of life measure. We hope the new quality of life measure will improve the care of other children and young people with Osteogenesis Imperfecta (OI).

**9. What happens when the research study stops?**

We will collate everyone's opinions and use the information to develop a Quality of Life measure for children and young people with Osteogenesis Imperfecta.

**10. What if there is a problem?**

Any complaint about the way you have been dealt with during the study or any possible harm you might suffer will be addressed. If you have any cause to complain about any aspect of the way in which you have been approached or

treated during the course of this study, the normal National Health Service complaints mechanisms are available to you and you are not compromised in any way because you have taken part in a research study.

**11. Will my taking part in the research project be confidential?**

Yes. We will follow ethical and legal practice and all information about you will be handled in confidence. All information which is collected about you during the course of the research will be kept strictly confidential. Any information about you which leaves the hospital will have your name and address removed so that you cannot be recognised from it. Once the study is complete all information will be destroyed.

**12. Contact for any further information**

If you would like any further information about this study you could contact:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
01142267890

**13. What if new information becomes available?**

Sometimes during the course of a research project, new information becomes available about Osteogenesis Imperfecta. If this happens, someone from the research team will tell you about it and discuss whether you want to continue the study. If you decide to continue in the study you will be asked to sign an updated consent form.

**14. What will happen if I don't want to carry on with the research?**

If you withdraw from the study we will destroy all your identifiable data if you wish, but we will need to use the data collected up to your withdrawal.

**15. What if there is a problem?**

**Complaints**

If you have any cause to complain about any aspect of the way in which you have been approached or treated during the course of this study, the normal National Health Service complaints mechanisms are available to you and you are not compromised in any way because you have taken part in a research study. If you have any complaints or concerns please contact either the project co-ordinator:

Claire Hill  
Clinical Specialist Physiotherapist

Metabolic Bone Disease Team  
Sheffield Children's Hospital  
Tel: 01142267890

Or the hospital complaints co-ordinator:

Mrs Linda Towers  
Patient Advice and Liaison Co-ordinator  
Sheffield Children's Hospital NHS Trust  
Tel: 01142717594

### **Harm**

If you are harmed by taking part in this research project, there are no special compensation arrangements. If you are harmed due to someone else's fault, then you may have grounds for a legal action – but you may have to pay for it.

### **16. Will taking part in this study be kept confidential?**

All information which is collected about you during the course of the research will be kept strictly confidential. Any information about you which leaves the hospital will have your name and address removed so that you cannot be recognised from it. Once the study is complete all information will be destroyed.

Our procedures for handling, processing, storage and destruction of data are compliant with the Data Protection Act 1998.

Your transcript will be given a number; your name will be changed.

### **17. What happens to the results of the research study?**

When the study has finished we will present our findings to other doctors, nurses and therapists and we will put the results in medical magazines and websites that health professionals use. We would also like to put a brief summary on the hospital research website. This will be available at the end of the study, on [www.sheffieldchildrenscrf.nhs.uk](http://www.sheffieldchildrenscrf.nhs.uk). The results will also be included as part of the chief investigators educational qualification. The results will be anonymous, which means that you will not be identified from them.

### **18. Who is organising and funding the research?**

Researchers at Sheffield Children's NHS Foundation Trust are organising the study. They will not get any extra money for doing this.

**19. Who has reviewed the study?**

This study was given a favourable ethical opinion for conduct in the NHS by Sheffield Research Ethics Committee.

It has also been checked by the Research and Development department at the hospital.

**20. How can we find out more about research?**

The Clinical Research Support Unit at this hospital has an **Information for Families** section on its website [www.sheffieldchildrenscrf.nhs.uk](http://www.sheffieldchildrenscrf.nhs.uk) or you could contact the hospital Clinical Research Support Unit:

Mrs Tracy N'Diaye  
Directorate Manager of Research  
Sheffield Children's NHS Foundation Trust  
Tel: 01142267904

**Thank you for taking the time to read this – please ask any questions if you need to.**

**Contact Claire Hill 01142267890**



## **PARTICIPANT INFORMATION SHEET**

### **FOR YOUNG PEOPLE (Age 13-15)**

PHASE 1 FOCUS GROUP 1

#### **Study Title**

Development of a Quality of Life measure for children with Osteogenesis Imperfecta (OI)

#### **1. Invitation paragraph**

We would like you to help us with our research study. This is an educational study. Please read this information carefully and talk to your Mum, Dad or carer about the study. Ask us if there is anything that is not clear or if you want to know more. Take time to decide if you want to take part. It is up to you if you want to do this. If you don't then that's fine, you'll be looked after at the hospital just the same.



#### **2. Why are we doing this research?**

We want to develop a Quality of Life measure to assess how children and young people feel about having Osteogenesis Imperfecta (Brittle Bone Disease). There are five sections in total (Phases 1a, 1b, 1c, 2 and 3), and by random selection you may be invited to take part in three of the five sections. This is Phase 1b and you may also be invited to take part in Phase 1a and Phase 3. This research is part of an educational qualification.

#### **3. Why have I been asked to take part?**

You have been chosen because you have Osteogenesis Imperfecta (Brittle Bone Disease). We are asking 5 - 10 children and young people to take part in this phase.

Osteogenesis Imperfecta (OI) is Brittle Bone Disease. It means that your bones can break easier and that your joints may be bendier than your friends, brothers and sisters.

#### **4. Do I have to take part?**

No it is entirely up to you. If you do decide to take part:

- You will be asked to sign a form to say that you agree to take part (a consent/assent form)

- You will be given this information sheet and a copy of your signed consent/assent form to keep.

You are free to stop taking part at any time during the research without giving a reason. If you decide to stop, this will not affect the care you receive whilst in this hospital.

You can agree to take part in this section of the research alone if you prefer, or agree to take part in more than one section as they arise. Completing the reply slip enclosed will let the researchers know what you would like to be included in.

### **5. What will happen to me if I take part?**

If you agree to take part we will arrange a date and time convenient for you to come to Sheffield Children's Hospital. We would like to chat to you and some other children and young people in a group. This is called a focus group.

We would like to ask you some questions. The questions will be about what you think about having Brittle Bone Disease (OI). We will ask you about some of the ideas we have found out about quality of life and Brittle Bone Disease so far. The focus group will be recorded on DVD. If you do not wish to be identified on the DVD your face can be pixellated/obscured.

We will use the information to develop a Quality of Life measure for children and young people with Brittle Bone Disease. When the Quality of Life measure is developed we will send you a copy so you can tell us what you think.

There will be no extra blood tests or x-rays.

### **6. What will I be asked to do?**

We will ask you a few questions about how you feel about having Brittle Bone Disease. We will ask you to look at some of the ideas and information that has been suggested so far. We will record the focus group, so that we can transcribe it to paper after the interview has finished. We will anonymise the transcript by giving you a different name. Once we have transcribed the focus group to paper and completed the research the DVD recording will be destroyed.

### **7. Is there anything else to be worried about?**

No. We want to develop a Quality of Life measure to enable us to assess how children and young people with Brittle Bone Disease feel about their daily life. We hope this new quality of life measure will help us provide better care for children and young people with OI.

If we find out something that we think is important about your Brittle Bone Disease, we will talk to your Mum, Dad or carer and ask them if they want you to come back and have you checked again at the hospital.

#### **8. Will the study help me?**

No, but the information we get will help us to develop the quality of life measure. We hope the new quality of life measure will improve the care of other children and young people with Brittle Bone Disease (OI).

#### **9. What happened when the research study stops?**

We will collect everyone's opinions and use the information to develop a Quality of Life measure for children and young people with Brittle Bone Disease.

#### **10. Contact for further information**

If you would like any further information about this study you could contact:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
01142267890



#### **11. What if new information comes along?**

Sometimes during research, new things are found out about Brittle Bone Disease. If this happens, someone from the research team will tell you about it and discuss whether you want to continue the study. If you change your mind this will not affect any care you receive whilst in hospital. If you decide to continue in the study you will be asked to sign an updated consent/assent form.

#### **12. What if I don't want to do the research anymore?**

Just tell your Mum, Dad, carer, doctor or therapist at any time. They will not be cross with you. You will still have the same care whilst you are at hospital.

#### **13. What if there is a problem or something goes wrong?**

Tell us if there is a problem and we will try to sort it out straight away. You and your Mum, Dad or carer can either contact the project co-ordinator:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital



Tel: 01142267890

Or the hospital complaints co-ordinator:

Mrs Linda Towers  
Patient Advice and Liaison Co-ordinator  
Sheffield Children's Hospital NHS Foundation Trust  
Tel: 01142717594

**14. Will anyone else know I'm doing this?**

The people in our research team will know you are taking part. The doctor looking after you while you are in hospital will also know.

Your medical notes may also be looked at by other people who work at the hospital to check that the study is being carried out correctly.

All the information that is collected about you during the research will be kept strictly confidential. Your transcript will be given a number; your name will be changed.

Any information about you that leaves the hospital will have your name and address removed so that you cannot be recognised from it. Once the study is complete all information will be destroyed or kept in your own confidential notes.

**15. What happens to the results of the researchers study?**

When the study has finished we will present our findings to other doctors, nurses and therapists and we will put the results in medical magazines and websites that health professionals use. We would also like to put an article in the hospital newsletter and on the Brittle Bone Society website. The results will be anonymous, which means that you will not be identified from them.

**16. Who is organising and funding the research?**

Researchers at Sheffield Children's NHS Trust are organising the study. They will not get any extra money for doing this.

**17. Who has checked the study?**

Before any study goes ahead it has to be checked by a Research Ethics Committee. This is a group of people who make sure the research is OK to do. This study has been looked at by Sheffield Research Ethics Committee.

It has also been checked by the research department at Sheffield Children's NHS Foundation Trust.

**18. How can I find out more about research?**

The Clinical Research Support Unit at this hospital has an information for families section on its website [www.sheffieldchildrenscrf.nhs.uk](http://www.sheffieldchildrenscrf.nhs.uk) or you could contact the hospital Clinical Research Support Unit:

Mrs Tracy N'Diaye  
Directorate Manager of Research  
Sheffield Children's NHS Foundation Trust  
Tel: 01142267904

**Thank you for taking the time to read this – please ask any questions if you need to.**

**Contact Claire Hill 01142267890**



## **PATIENT INFORMATION SHEET**

YOUNG ADULT AGED 16-18

PHASE 1 FOCUS GROUP 1

### **Study Title**

Development of a Quality of Life measure for children with Osteogenesis Imperfecta (OI)

#### **1. Invitation paragraph**

You are being asked to take part in a research study. This is an educational study. Before you decided it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully. Talk to others about the study if you wish.

Ask us if there is anything that is not clear or if you would like more information (contact: Claire Hill on 01142267890). Take time to decide whether or not you want to take part.



#### **2. What is the purpose of the study?**

We want to develop a Quality of Life measure to assess how children and young people feel about having Osteogenesis Imperfecta (Brittle Bone Disease). There are five sections in total (Phases 1a, 1b, 1c, 2 and 3), and by random selection you may be invited to take part in three of the five sections. This is Phase 1b and you may also be invited to take part in Phase 3. This research is part of an educational qualification.

#### **3. Why have I been chosen?**

You have been chosen because you have Osteogenesis Imperfecta (Brittle Bone Disease). We are asking 5 - 10 children and young people to take part in this phase.

Osteogenesis Imperfecta (OI) is Brittle Bone Disease. It means that your bones can break easier and that your joints may be bendier than your friends, brothers and sisters.

To develop a useful quality of life measure for children and young people with Osteogenesis Imperfecta we need to find out what living with the condition is really like. We have already asked 10 children and young people, 10 parents

and 5 health professionals about their views. We would now like to validate these views by asking you what you think to the items already suggested.

#### **4. Do I have to take part?**

No. It is entirely up to you to decide whether or not to take part. You are free to withdraw from the research at any time without giving a reason. Your decisions about this will not affect the standard of care you will receive.

If you are happy to take part, and are happy with the explanations from the research team, you will be asked to sign a consent form. You will be given a copy of the information sheet and the signed consent form to keep for your records.

You can agree to take part in this section of the research alone if you prefer, or agree to take part in more than one section as they arise. Completing the reply slip enclosed will let the researchers know what you would like to be included in.

#### **5. What will happen if I agree to take part?**

If you agree to take part we will arrange a date and time convenient for your child to come to Sheffield Children's Hospital for the focus group. We will try to do this during a clinic visit or when you are admitted for treatment where possible.

We would like you to take part in a focus group. We would like to ask the focus group some questions about the items we have already generated (from previous interviews). The questions will be about what they think of the newly generated items, and their relevance to living with Brittle Bone Disease (OI). The focus group will be recorded on DVD. If you do not wish to be identified on the DVD your face can be pixellated/obscured.

We will use the information to further develop a Quality of Life measure for children and young people with Brittle Bone Disease. When the Quality of Life measure is developed we will send you a copy so you can tell us what you think.

There will be no extra blood tests or x-rays.

#### **6. What will we be asked to do?**

We will ask you a few questions about what you feel about the newly generated quality of life items. We would like to get your opinion about their suitability for inclusion in the newly developed quality of life measure. We will record the focus group on DVD, so that we can transcribe it to paper. We will anonymise the transcript by giving you a different name. Once we have transcribed the focus group to paper and the research complete the DVD recording will be destroyed.

**7. What are the possible disadvantages and risks of taking part?**

None. We want to develop a Quality of Life measure to enable us to assess how children and young people with Brittle Bone Disease feel about their daily life. We hope this new quality of life measure will help us provide better care for children and young people with OI.

If we find out something that we think is important about your Brittle Bone Disease, we will talk to you and ask if you want to come back and be checked again at the hospital.

**8. What are the possible benefits of taking part?**

You will not benefit from being part of this study. However, the information we collect will help us to develop the quality of life measure. We hope the new quality of life measure will improve the care of other children and young people with Brittle Bone Disease (OI).

**9. What happened when the research study stops?**

We will collate everyone's opinions and use the information to develop a Quality of Life measure for children and young people with Brittle Bone Disease.

**10. What if there is a problem?**

Any complaint about the way you have been dealt with during the study or any possible harm you might suffer will be addressed. If you have any cause to complain about any aspect of the way in which you have been approached or treated during the course of this study, the normal National Health Service complaints mechanisms are available to you and you are not compromised in any way because you have taken part in a research study.



**11. Will my taking part in the research project be confidential?**

Yes. We will follow ethical and legal practice and all information about you will be handled in confidence. All information which is collected about you during the course of the research will be kept strictly confidential. Any information about you which leaves the hospital will have your name and address removed so that you cannot be recognised from it. Once the study is complete all information will either be destroyed.

**12. Contact for any further information**

If you would like any further information about this study you could contact:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team

**13. What if new information becomes available?**

Sometimes during the course of a research project, new information becomes available about Osteogenesis Imperfecta. If this happens, someone from the research team will tell you about it and discuss whether you want to continue the study. If you change your mind this will not affect any care you receive whilst in hospital. If you decide to continue in the study you will be asked to sign an updated consent form.



**14. What will happen if we don't want to carry on with the research?**

If you withdraw from the study we will destroy all your identifiable samples if you wish, but we will need to use the data collected up to your withdrawal.

**15. What if there is a problem?**

**Complaints**

If you have any cause to complain about any aspect of the way in which you have been approached or treated during the course of this study, the normal National Health Service complaints mechanisms are available to you and you are not compromised in any way because you have taken part in a research study. If you have any complaints or concerns please contact either the project co-ordinator:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
Tel: 01142267890

Or the hospital complaints co-ordinator:

Mrs Linda Towers  
Patient Advice and Liaison Co-ordinator  
Sheffield Children's Hospital NHS Foundation Trust  
Tel: 01142717594

**Harm**

If you are harmed by taking part in this research project, there are no special compensation arrangements. If you are harmed due to someone else's fault, then you may have grounds for a legal action – but you may have to pay for it.

**16. Will taking part in this study be kept confidential?**

All information which is collected about you during the course of the research will be kept strictly confidential. Any information about you which leaves the hospital will have your name and address removed so that you cannot be recognised from it. Once the study is complete all information will either be destroyed or kept in your confidential notes.

Our procedures for handling, processing, storage and destruction of data are compliant with the Data Protection Act 1998.

Your transcript will be given a number; your name will be changed. Your medical notes may also be looked at by other people within the hospital involved in the running and supervision of the study to check that it is being carried out correctly.

**17. What happens to the results of the research study?**

When the study has finished we will present our findings to other doctors, nurses and therapists and we will put the results in medical magazines and websites that health professionals use. We would also like to put a brief summary on the hospital research website and on the Brittle Bone Society website, so that you will be able to read about our results too. This will be available at the end of the study, on [www.sheffieldchildrenscrf.nhs.uk](http://www.sheffieldchildrenscrf.nhs.uk). The results will also be included as part of the chief investigators educational qualification. The results will be anonymous, which means that you will not be identified from them.

**18. Who is organising and funding the research?**

Researchers at Sheffield Children's NHS Foundation Trust are organising the study. They will not get any extra money for doing this.

**19. Who has reviewed the study?**

This study was given a favourable ethical opinion for conduct in the NHS by Sheffield Research Ethics Committee.

It has also been checked by the research department at the Sheffield Children's NHS Foundation Trust.

**20. How can we find out more about research?**

The Clinical Research Support Unit at this hospital has an **Information for Families** section on its website [www.sheffieldchildrenscrf.nhs.uk](http://www.sheffieldchildrenscrf.nhs.uk) or you could contact the hospital Clinical Research Support Unit:

Mrs Tracy N'Diaye  
Directorate Manager of Research  
Sheffield Children's NHS Foundation Trust  
Tel: 01142267904

**Thank you for taking the time to read this – please ask any questions if you need to.**

**Contact Claire Hill 01142267890**



## **PARENT/LEGAL GUARDIAN INFORMATION SHEET**

Child/young people participation

PHASE 1 FOCUS GROUP 1

### **Study Title**

Development of a Quality of Life measure for children with Osteogenesis Imperfecta (OI)

#### **1. Invitation paragraph**

Your child is being asked to take part in a research study. This is an educational study. Before you decided it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully. Talk to others about the study if you wish.

Ask us if there is anything that is not clear or if you would like more information (contact: Claire Hill on 01142267890). Take time to decide whether or not you want your child to take part.



#### **2. What is the purpose of the study?**

We want to develop a Quality of Life measure to assess how children and young people feel about having Osteogenesis Imperfecta (Brittle Bone Disease). There are five sections in total (Phases 1a, 1b, 1c, 2 and 3), and by random selection you or your child may be invited to take part in three of the five sections. This is Phase 1b and you may also be invited to take part in Phase 3. This research is part of an educational qualification.

#### **3. Why has my child been chosen?**

Your child has been chosen because they have Osteogenesis Imperfecta (Brittle Bone Disease). We are asking 5 - 10 children and young people to take part in this phase.

Osteogenesis Imperfecta (OI) is Brittle Bone Disease. It means that their bones can break easier and that their joints may be bendier than their friends, brothers and sisters.

To develop a really useful quality of life measure for children and young people with Osteogenesis Imperfecta we need to find out what living with the condition is really like. We have already asked 10 children and young people, 10 parents

and 5 health professionals about their views. We would now like to validate these views by asking your child what they think to the items already suggested.

#### **4. Does my child have to take part?**

No. It is entirely up to you and your child (wherever possible) to decide whether or not to take part. You are both free to withdraw from the research at any time without giving a reason. Your decisions about this will not affect the standard of care your child will receive.

If you are happy for your child to take part, and are happy with the explanations from the research team, you will be asked to sign a consent form. If your child is able to understand the research and is happy to take part and can write their name, they will be asked to sign an assent form with you, if they want to. You will be given a copy of the information sheet and the signed consent/assent forms to keep for your records.

You can agree to your child taking part in this section of the research alone if you prefer, or agree to them taking part in more than one section as they arise. Completing the reply slip enclosed will let the researchers know what you would like your child to be included in.

#### **5. What will happen to my child if we agree to take part?**

If you agree to take part we will arrange a date and time convenient for your child to come to Sheffield Children's Hospital for the focus group. We will try to do this during a clinic visit or when they are admitted for treatment where possible.

We would like your child to take part in a focus group. We would like to ask the focus group some questions about the items we have already generated (from previous interviews). The questions will be about what they think of the newly generated items, and their relevance to living with Brittle Bone Disease (OI). The focus group will be recorded on DVD. If you do not wish to be identified on the DVD your face can be pixellated/obscured.

We will use the information to further develop a Quality of Life measure for children and young people with Brittle Bone Disease. When the Quality of Life measure is developed we will send them a copy so they can tell us what they think.

There will be no extra blood tests or x-rays.

#### **6. What will we be asked to do?**

We will ask your child a few questions about what they feel about the newly generated quality of life items. We would like to get their opinion about their suitability for inclusion in the newly developed Quality of life measure. We will

record the focus group on DVD, so that we can transcribe it to paper. We will anonymise the transcript by giving your child a different name. Once we have transcribed the focus group to paper and the research complete the DVD recording will be destroyed.

**7. What are the possible disadvantages and risks of taking part?**

None. We want to develop a Quality of Life measure to enable us to assess how children and young people with Brittle Bone Disease feel about their daily life. We hope this new quality of life measure will help us provide better care for children and young people with OI.

If we find out something that we think is important about your child's Brittle Bone Disease, we will talk to you and ask if you want to come back and have your child checked again at the hospital.

**8. What are the possible benefits of taking part?**

Your child will not benefit from being part of this study. However, the information we collect will help us to develop the quality of life measure. We hope the new quality of life measure will improve the care of other children and young people with Brittle Bone Disease (OI).

**9. What happened when the research study stops?**

We will collate everyone's opinions and use the information to develop a Quality of Life measure for children and young people with Brittle Bones disease.

**10. What if there is a problem?**

Any complaint about the way you or your child have been dealt with during the study or any possible harm you or your child might suffer will be addressed. If you have any cause to complain about any aspect of the way in which you have been approached or treated during the course of this study, the normal National Health Service complaints mechanisms are available to you and you are not compromised in any way because you have taken part in a research study.



**11. Will my child's taking part in the research project be confidential?**

Yes. We will follow ethical and legal practice and all information about your child will be handled in confidence. All information which is collected about your child during the course of the research will be kept strictly confidential. Any information about your child which leaves the hospital will have their name and address removed so that they cannot be recognised from it. Once the study is complete all information will either be destroyed or kept in your child's confidential notes.

## **12. Contact for any further information**

If you would like any further information about this study you could contact:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
01142267890

## **13. What if new information becomes available?**

Sometimes during the course of a research project, new information becomes available about Osteogenesis Imperfecta. If this happens, someone from the research team will tell you and your child about it and discuss whether you want your child to continue the study. If you change your mind this will not affect any care your child receives whilst in hospital. If you decide to continue in the study you and your child will be asked to sign an updated consent/assent form.



## **14. What will happen if we don't want to carry on with the research?**

If you withdraw from the study we will destroy all your child's identifiable samples if you wish, but we will need to use the data collected up to their withdrawal.

## **15. What if there is a problem?**

### **Complaints**

If you have any cause to complain about any aspect of the way in which you or your child has been approached or treated during the course of this study, the normal National Health Service complaints mechanisms are available to you and you are not compromised in any way because you have taken part in a research study. If you have any complaints or concerns please contact either the project co-ordinator:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
Tel: 01142267890

Or the hospital complaints co-ordinator:

Mrs Linda Towers  
Patient Advice and Liaison Co-ordinator  
Sheffield Children's Hospital NHS Foundation Trust

Tel: 01142717594

### **Harm**

If your child is harmed by taking part in this research project, there are no special compensation arrangements. If your child is harmed due to someone else's fault, then you may have grounds for a legal action – but you may have to pay for it.

### **16. Will taking part in this study be kept confidential?**

All information which is collected about your child during the course of the research will be kept strictly confidential. Any information about your child which leaves the hospital will have their name and address removed so that your child cannot be recognised from it. Once the study is complete all information will either be destroyed or kept in your child's confidential notes.

Our procedures for handling, processing, storage and destruction of data are compliant with the Data Protection Act 1998.

Your child's transcript will be given a number; their name will be changed. Your child's medical notes may also be looked at by other people within the hospital involved in the running and supervision of the study to check that it is being carried out correctly.

### **17. What happens to the results of the research study?**

When the study has finished we will present our findings to other doctors, nurses and therapists and we will put the results in medical magazines and websites that health professionals use. We would also like to put a brief summary on the hospital research website and on the Brittle Bone Society website, so that you will be able to read about our results too. This will be available at the end of the study, on [www.sheffieldchildrenscrf.nhs.uk](http://www.sheffieldchildrenscrf.nhs.uk). The results will also be included as part of the chief investigators educational qualification. The results will be anonymous, which means that your child will not be identified from them.

### **18. Who is organising and funding the research?**

Researchers at Sheffield Children's NHS Foundation Trust are organising the study. They will not get any extra money for doing this.

**19. Who has reviewed the study?**

This study was given a favourable ethical opinion for conduct in the NHS by Sheffield Research Ethics Committee.

It has also been checked by the research department at the Sheffield Children's NHS Foundation Trust.

**20. How can we find out more about research?**

The Clinical Research Support Unit at this hospital has an **Information for Families** section on its website [www.sheffieldchildrenscrf.nhs.uk](http://www.sheffieldchildrenscrf.nhs.uk) or you could contact the hospital Clinical Research Support Unit:

Mrs Tracy N'Diaye  
Directorate Manager of Research  
Sheffield Children's NHS Foundation Trust  
Tel: 01142267904

**Thank you for taking the time to read this – please ask any questions if you need to.**

**Contact Claire Hill 01142267890**



## **PARTICIPANT INFORMATION SHEET**

### **FOR YOUNG PEOPLE (Age 13-15)**

PHASE 1 FOCUS GROUP 2

#### **Study Title**

Development of a Quality of Life measure for children with Osteogenesis Imperfecta (OI)

#### **1. Invitation paragraph**

We would like you to help us with our research study. This is an educational study. Please read this information carefully and talk to your Mum, Dad or carer about the study. Ask us if there is anything that is not clear or if you want to know more. Take time to decide if you want to take part. It is up to you if you want to do this. If you don't then that's fine, you'll be looked after at the hospital just the same.



#### **2. Why are we doing this research?**

We have developed a Quality of Life measure to assess how children and young people feel about having Osteogenesis Imperfecta (Brittle Bone Disease). We now want to assess the suitability and usefulness of the items/questions. There are five sections in total (Phases 1a, 1b, 1c, 2 and 3), and by random selection you may be invited to take part in three of the five sections. This is Phase 1c and you may also be invited to take part in Phase 1a and Phase 3. This research is part of an educational qualification.

#### **3. Why have I been asked to take part?**

You have been chosen because you have Osteogenesis Imperfecta (Brittle Bone Disease), and you participated in the previous interviews to generate items. We are asking 5 - 10 young people and parents to take part in this phase.

Osteogenesis Imperfecta (OI) is Brittle Bone Disease. It means that your bones can break easier and that your joints may be bendier than your friends, brothers and sisters.

#### **4. Do I have to take part?**

No it is entirely up to you. If you do decide to take part:

- You will be asked to sign a form to say that you agree to take part (a consent/assent form)
- You will be given this information sheet and a copy of your signed consent/assent form to keep.

You are free to stop taking part at any time during the research without giving a reason. If you decide to stop, this will not affect the care you receive whilst in this hospital.

You can agree to take part in this section of the research alone if you prefer, or agree to take part in more than one section as they arise. Completing the reply slip enclosed will let the researchers know what you would like to be included in.

## **5. What will happen to me if I take part?**

If you agree to take part we will arrange a date and time convenient for you to come to Sheffield Children's Hospital. We will show you a copy of the newly developed quality of life measure. We would like to chat to you and some other young people in a group. This is called a focus group.

We would like to ask you some questions. We would like to ask you what you think about the suitability of the new quality of life measure. The focus group will be recorded on DVD. If you do not wish to be identified on the DVD your face can be pixellated/obscured.

We will use the information to further develop the new Quality of Life measure for children and young people with Brittle Bone Disease. When the final Quality of Life measure is developed we will send you a copy.

There will be no extra blood tests or x-rays.

## **6. What will I be asked to do?**

We would like you to discuss the new Quality of Life measure within a focus group. We will record the focus group, so that we can transcribe it to paper after the interview has finished. We will anonymise the transcript by giving you a different name. Once we have transcribed the interview to paper and completed the research the DVD recording will be destroyed.

## **7. Is there anything else to be worried about?**

No. We want to further develop a Quality of Life measure to enable us to assess how children and young people with Brittle Bone Disease feel about their daily life. We hope this new Quality of Life measure will help us provide better care for children and young people with OI.

If we find out something that we think is important about your Brittle Bone Disease, we will talk to your Mum, Dad or carer and ask them if they want to come back and have you checked again at the hospital.

**8. Will the study help me?**

No, but the information we get will help us to develop the quality of life measure. We hope the new quality of life measure will improve the care of other children and young people with Brittle Bone Disease (OI).

**9. What happened when the research study stops?**

We will collect everyone's opinions and use the information to further develop a Quality of Life measure for children and young people with Brittle Bones disease.

**10. Contact for further information**

If you would like any further information about this study you could contact:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
01142267890



**11. What if new information comes along?**

Sometimes during research, new things are found out about Brittle Bone Disease. If this happens, someone from the research team will tell you about it and discuss whether you want to continue the study. If you change your mind this will not affect any care you receive whilst in hospital. If you decide to continue in the study you will be asked to sign an updated consent/assent form.

**12. What if I don't want to do the research anymore?**

Just tell your Mum, Dad, carer, doctor or therapist at any time. They will not be cross with you. You will still have the same care whilst you are at hospital.

**13. What if there is a problem or something goes wrong?**

Tell us if there is a problem and we will try to sort it out straight away. You and your Mum, Dad or carer can either contact the project co-ordinator:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
Tel: 01142267890



Or the hospital complaints co-ordinator:

Mrs Linda Towers  
Patient Advice and Liaison Co-ordinator  
Sheffield Children's Hospital NHS Foundation Trust  
Tel: 01142717594

**14. Will anyone else know I'm doing this?**

The people in our research team will know you are taking part. The doctor looking after you while you are in hospital will also know.

Your medical notes may also be looked at by other people who work at the hospital to check that the study is being carried out correctly.

All the information that is collected about you during the research will be kept strictly confidential. Your transcript will be given a number; your name will be changed. Any information about you that leaves the hospital will have your name and address removed so that you cannot be recognised from it. Once the study is complete all information will be destroyed or kept in your own confidential notes.

**15. What happens to the results of the researchers study?**

When the study has finished we will present our findings to other doctors, nurses and therapists and we will put the results in medical magazines and websites that health professionals use. We would also like to put an article in the hospital newsletter and on the Brittle Bone Society website. The results will be anonymous, which means that you will not be identified from them.

**16. Who is organising and funding the research?**

Researchers at Sheffield Children's NHS Foundation Trust are organising the study. They will not get any extra money for doing this.

**17. Who has checked the study?**

Before any study goes ahead it has to be checked by a Research Ethics Committee. This is a group of people who make sure the research is OK to do. This study has been looked at by Sheffield Research Ethics Committee.

It has also been checked by the research department at the Sheffield Children's NHS Foundation Trust.

**18. How can I find out more about research?**

The Clinical Research Support Unit at this hospital has an information for families section on its website [www.sheffieldchildrenscrf.nhs.uk](http://www.sheffieldchildrenscrf.nhs.uk) or you could contact the hospital Clinical Research Support Unit:

Mrs Tracy N'Diaye  
Directorate Manager of Research  
Sheffield Children's NHS Foundation Trust  
Tel: 01142267904

**Thank you for taking the time to read this – please ask any questions if  
you need to.**

**Contact Claire Hill 01142267890**



## **PATIENT INFORMATION SHEET**

YOUNG ADULT AGED 16-18

PHASE 1 FOCUS GROUP 2

### **Study Title**

Development of a Quality of Life measure for children with Osteogenesis Imperfecta (OI)

#### **1. Invitation paragraph**

You are being asked to take part in a research study. This is an educational study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully. Talk to others about the study if you wish.

Ask us if there is anything that is not clear or if you would like more information (contact: Claire Hill on 01142267890). Take time to decide whether or not you want to take part.



#### **2. What is the purpose of the study?**

We want to develop a Quality of Life measure to assess how children and young people feel about having Osteogenesis Imperfecta (Brittle Bone Disease). There are five sections in total (Phases 1a, 1b, 1c, 2 and 3), and by random selection you may be invited to take part in three of the five sections. This is Phase 1c and you may also be invited to take part in Phase 1a and Phase 3. This research is part of an educational qualification.

#### **3. Why have I been chosen?**

You have been chosen because you have Osteogenesis Imperfecta (Brittle Bone Disease). Osteogenesis Imperfecta (OI) is Brittle Bone Disease. It means that your bones can break easier and that their joints may be bendier than your friends, brothers and sisters.

We are asking 5 - 10 young people and parents to take part in this phase.

To develop a useful quality of life measure for children and young people with Osteogenesis Imperfecta we need to find out what living with the condition is really like. We have already asked 10 children and young people, 10 parents and 5 health professionals about their views. We would now like to validate

these views by asking you what you think to the newly developed Quality of Life (QoL) measure.

#### **4. Do I have to take part?**

No. It is entirely up to you to decide whether or not to take part. You are free to withdraw from the research at any time without giving a reason. Your decisions about this will not affect the standard of care you will receive.

If you are happy to take part, and are happy with the explanations from the research team, you will be asked to sign a consent form. You will be given a copy of the information sheet and the signed consent form to keep for your records.

You can agree to take part in this section of the research alone if you prefer, or agree to take part in more than one section as they arise. Completing the reply slip enclosed will let the researchers know what you would like to be included in.

#### **5. What will happen if I agree to take part?**

If you agree to take part we will arrange a date and time convenient for you to come to Sheffield Children's Hospital for the focus group. We will try to do this during a clinic visit or when you are admitted for treatment where possible.

We would like to show you a copy of the newly developed Quality of Life measure. We would then like you to take part in a focus group. We would like to ask the focus group some questions about the suitability of the new quality of life measure. The focus group will be recorded on DVD. If you do not wish to be identified on the DVD your face can be pixellated/obscured.

We will use the information to further develop a Quality of Life measure for children and young people with Brittle Bone Disease. When the Quality of Life measure is developed we will send you a copy so you can tell us what you think.

#### **6. What will I be asked to do?**

We would like you to discuss the new Quality of Life measure within a focus group. We will record the focus group on DVD, so that we can transcribe it to paper after the interview has finished. We will anonymise the transcript by giving you a different name. Once we have transcribed the interview to paper and completed the research the DVD recording will be destroyed.

**7. What are the possible disadvantages and risks of taking part?**

None. We want to develop a Quality of Life measure to enable us to assess how children and young people with Brittle Bone Disease feel about their daily life. We hope this new quality of life measure will help us provide better care for children and young people with OI.

If we find out something that we think is important about your Brittle Bone Disease, we will talk to you and ask if you want to come back to be checked again at the hospital.

**8. What are the possible benefits of taking part?**

You will not benefit from being part of this study. However, the information we collect will help us to develop the Quality of Life measure. We hope the new Quality of Life measure will improve the care of other children and young people with Brittle Bone Disease (OI).

**9. What happened when the research study stops?**

We will collate everyone's opinions and use the information to further develop a Quality of Life measure for children and young people with Brittle Bone Disease.

**10. What if there is a problem?**

Any complaint about the way you have been dealt with during the study or any possible harm you might suffer will be addressed. If you have any cause to complain about any aspect of the way in which you have been approached or treated during the course of this study, the normal National Health Service complaints mechanisms are available to you and you are not compromised in any way because you have taken part in a research study.



**11. Will my taking part in the research project be confidential?**

Yes. We will follow ethical and legal practice and all information about you will be handled in confidence. All information which is collected about you during the course of the research will be kept strictly confidential. Any information about you which leaves the hospital will have your name and address removed so that you cannot be recognised from it. Once the study is complete all information will be destroyed.

**12. Contact for any further information**

If you would like any further information about this study you could contact:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team

**13. What if new information becomes available?**

Sometimes during the course of a research project, new information becomes available about Osteogenesis Imperfecta. If this happens, someone from the research team will tell you about it and discuss whether you want to continue the study. If you change your mind this will not affect any care you receive whilst in hospital. If you decide to continue in the study you will be asked to sign an updated consent form.



**14. What will happen if I don't want to carry on with the research?**

If you withdraw from the study we will destroy all your identifiable data if you wish, but we will need to use the data collected up to your withdrawal.

**15. What if there is a problem?**

**Complaints**

If you have any cause to complain about any aspect of the way in which you have been approached or treated during the course of this study, the normal National Health Service complaints mechanisms are available to you and you are not compromised in any way because you have taken part in a research study. If you have any complaints or concerns please contact either the project co-ordinator:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
Tel: 01142267890

Or the hospital complaints co-ordinator:

Mrs Linda Towers  
Patient Advice and Liaison Co-ordinator  
Sheffield Children's Hospital NHS Foundation Trust  
Tel: 01142717594

**Harm**

If you are harmed by taking part in this research project, there are no special compensation arrangements. If you are harmed due to someone else's fault, then you may have grounds for a legal action – but you may have to pay for it.

**16. Will taking part in this study be kept confidential?**

All information which is collected about you during the course of the research will be kept strictly confidential. Any information about you which leaves the hospital will have your name and address removed so that you cannot be recognised from it. Once the study is complete all information will either be destroyed or kept in your confidential notes.

Our procedures for handling, processing, storage and destruction of data are compliant with the Data Protection Act 1998.

Your transcript will be given a number; your name will be changed. Your medical notes may also be looked at by other people within the hospital involved in the running and supervision of the study to check that it is being carried out correctly.

**17. What happens to the results of the research study?**

When the study has finished we will present our findings to other doctors, nurses and therapists and we will put the results in medical magazines and websites that health professionals use. We would also like to put a brief summary on the hospital research website and on the Brittle Bone Society website, so that you will be able to read about our results too. This will be available at the end of the study, on [www.sheffieldchildrenscrf.nhs.uk](http://www.sheffieldchildrenscrf.nhs.uk). The results will also be included as part of the chief investigators educational qualification. The results will be anonymous, which means that you will not be identified from them.

**18. Who is organising and funding the research?**

Researchers at Sheffield Children's NHS Foundation Trust are organising the study. They will not get any extra money for doing this.

**19. Who has reviewed the study?**

This study was given a favourable ethical opinion for conduct in the NHS by Sheffield Research Ethics Committee.

It has also been checked by the research department at the Sheffield Children's NHS Foundation Trust.

**20. How can we find out more about research?**

The Clinical Research Support Unit at this hospital has an **Information for Families** section on its website [www.sheffieldchildrenscrf.nhs.uk](http://www.sheffieldchildrenscrf.nhs.uk) or you could contact the hospital Clinical Research Support Unit:

Mrs Tracy N'Diaye  
Directorate Manager of Research  
Sheffield Children's NHS Foundation Trust  
Tel: 01142267904

**Thank you for taking the time to read this – please ask any questions if you need to.**

**Contact Claire Hill 01142267890**



## **PARENT/LEGAL GUARDIAN INFORMATION SHEET**

Child/young people participation

PHASE 1 FOCUS GROUP 2

### **Study Title**

Development of a Quality of Life measure for children with Osteogenesis Imperfecta (OI)

#### **1. Invitation paragraph**

Your child is being asked to take part in a research study. This is an educational study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully. Talk to others about the study if you wish.

Ask us if there is anything that is not clear or if you would like more information (contact: Claire Hill on 01142267890). Take time to decide whether or not you want your child to take part.



#### **2. What is the purpose of the study?**

We want to develop a Quality of Life measure to assess how children and young people feel about having Osteogenesis Imperfecta (Brittle Bone Disease). There are five sections in total (Phases 1a, 1b, 1c, 2 and 3), and by random selection you or your child may be invited to take part in three of the five sections. This is Phase 1c and you may also be invited to take part in Phase 1a and Phase 3. This research is part of an educational qualification.

#### **3. Why has my child been chosen?**

Your child has been chosen because they have Osteogenesis Imperfecta (Brittle Bone Disease). We are asking 5 - 10 children and young people to take part in this phase.

Osteogenesis Imperfecta (OI) is Brittle Bone Disease. It means that their bones can break easier and that their joints may be bendier than their friends, brothers and sisters.

To develop a really useful quality of life measure for children and young people with Osteogenesis Imperfecta we need to find out what living with the condition is really like. We have already asked 10 children and young people, 10 parents

and 5 health professionals about their views. We would now like to validate these views by asking your child what they think to the newly developed quality of life measure.

#### **4. Does my child have to take part?**

No. It is entirely up to you and your child (wherever possible) to decide whether or not to take part. You are both free to withdraw from the research at any time without giving a reason. Your decisions about this will not affect the standard of care your child will receive.

If you are happy for your child to take part, and are happy with the explanations from the research team, you will be asked to sign a consent form. If your child is able to understand the research and is happy to take part and can write their name, they will be asked to sign an assent form with you, if they want to. You will be given a copy of the information sheet and the signed consent/assent forms to keep for your records.

You can agree to your child taking part in this section of the research alone if you prefer, or agree to them taking part in more than one section as they arise. Completing the reply slip enclosed will let the researchers know what you would like your child to be included in.

#### **5. What will happen to my child if we agree to take part?**

If you agree to take part we will arrange a date and time convenient for your child to come to Sheffield Children's Hospital for the focus group. We will try to do this during a clinic visit or when they are admitted for treatment where possible.

We would like to show your child a copy of the newly developed Quality of Life measure. We would then like them to take part in a focus group. We would like to ask the focus group some questions about the suitability of the new Quality of Life measure. The focus group will be recorded on DVD. If you do not wish to be identified on the DVD your face can be pixellated/obscured.

We will use the information to further develop a Quality of Life measure for children and young people with Brittle Bone Disease. When the Quality of Life measure is developed we will send them a copy so they can tell us what they think.

There will be no extra blood tests or x-rays.

#### **6. What will we be asked to do?**

We would like your child to discuss the new Quality of Life measure within a focus group. We will record the focus group, so that we can transcribe it to paper after the interview has finished. We will anonymise the transcript by

giving them a different name. Once we have transcribed the interview to paper and completed the research the DVD recording will be destroyed.

**7. What are the possible disadvantages and risks of taking part?**

None. We want to develop a Quality of Life measure to enable us to assess how children and young people with Brittle Bone Disease feel about their daily life. We hope this new quality of life measure will help us provide better care for children and young people with OI.

If we find out something that we think is important about your child's Brittle Bone Disease, we will talk to you and ask if you want to come back and have your child checked again at the hospital.

**8. What are the possible benefits of taking part?**

Your child will not benefit from being part of this study. However, the information we collect will help us to develop the quality of life measure. We hope the new quality of life measure will improve the care of other children and young people with Brittle Bone Disease (OI).

**9. What happened when the research study stops?**

We will collate everyone's opinions and use the information to further develop a Quality of Life measure for children and young people with Brittle Bone Disease.

**10. What if there is a problem?**

Any complaint about the way you or your child have been dealt with during the study or any possible harm you or your child might suffer will be addressed. If you have any cause to complain about any aspect of the way in which you have been approached or treated during the course of this study, the normal National Health Service complaints mechanisms are available to you and you are not compromised in any way because you have taken part in a research study.



**11. Will my child's taking part in the research project be confidential?**

Yes. We will follow ethical and legal practice and all information about your child will be handled in confidence. All information which is collected about your child during the course of the research will be kept strictly confidential. Any information about your child which leaves the hospital will have their name and address removed so that you cannot be recognised from it. Once the study is complete all information will either be destroyed.

## **12. Contact for any further information**

If you would like any further information about this study you could contact:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
01142267890

## **13. What if new information becomes available?**

Sometimes during the course of a research project, new information becomes available about Osteogenesis Imperfecta. If this happens, someone from the research team will tell you and your child about it and discuss whether you want your child to continue the study. If you change your mind this will not affect any care your child receives whilst in hospital. If you decide to continue in the study you and your child will be asked to sign an updated consent/assent form.



## **14. What will happen if we don't want to carry on with the research?**

If you withdraw from the study we will destroy all your child's identifiable data if you wish, but we will need to use the data collected up to their withdrawal.

## **15. What if there is a problem?**

### **Complaints**

If you have any cause to complain about any aspect of the way in which you or your child has been approached or treated during the course of this study, the normal National Health Service complaints mechanisms are available to you and you are not compromised in any way because you have taken part in a research study. If you have any complaints or concerns please contact either the project co-ordinator:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
Tel: 01142267890

Or the hospital complaints co-ordinator:

Mrs Linda Towers  
Patient Advice and Liaison Co-ordinator  
Sheffield Children's Hospital NHS Foundation Trust  
Tel: 01142717594

## **Harm**

If your child is harmed by taking part in this research project, there are no special compensation arrangements. If your child is harmed due to someone else's fault, then you may have grounds for a legal action – but you may have to pay for it.

### **16. Will taking part in this study be kept confidential?**

All information which is collected about your child during the course of the research will be kept strictly confidential. Any information about your child which leaves the hospital will have their name and address removed so that your child cannot be recognised from it. Once the study is complete all information will either be destroyed or kept in your child's confidential notes.

Our procedures for handling, processing, storage and destruction of data are compliant with the Data Protection Act 1998.

Your child's transcript will be given a number; their name will be changed. Your child's medical notes may also be looked at by other people within the hospital involved in the running and supervision of the study to check that it is being carried out correctly.

### **17. What happens to the results of the research study?**

When the study has finished we will present our findings to other doctors, nurses and therapists and we will put the results in medical magazines and websites that health professionals use. We would also like to put a brief summary on the hospital research website and on the Brittle Bone Society website, so that you will be able to read about our results too. This will be available at the end of the study, on [www.sheffieldchildrenscrf.nhs.uk](http://www.sheffieldchildrenscrf.nhs.uk). The results will also be included as part of the chief investigators educational qualification. The results will be anonymous, which means that your child will not be identified from them.

**18. Who is organising and funding the research?**

Researchers at Sheffield Children's NHS Foundation Trust are organising the study. They will not get any extra money for doing this.

**19. Who has reviewed the study?**

This study was given a favourable ethical opinion for conduct in the NHS by Sheffield Research Ethics Committee.

It has also been checked by the research department at the Sheffield Children's NHS Foundation Trust.

**20. How can we find out more about research?**

The Clinical Research Support Unit at this hospital has an **Information for Families** section on its website [www.sheffieldchildrenscrf.nhs.uk](http://www.sheffieldchildrenscrf.nhs.uk) or you could contact the hospital Clinical Research Support Unit:

Mrs Tracy N'Diaye  
Directorate Manager of Research  
Sheffield Children's NHS Foundation Trust  
Tel: 01142267904

**Thank you for taking the time to read this – please ask any questions if you need to.**

**Contact Claire Hill 01142267890**



## **PARENT/LEGAL GUARDIAN INFORMATION SHEET**

(Parental participation)

PHASE 1 FOCUS GROUP 2

### **Study Title**

Development of a Quality of Life measure for children with Osteogenesis Imperfecta (OI)

#### **1. Invitation paragraph**

You are being asked to take part in a research study. This is an educational study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully. Talk to others about the study if you wish.

Ask us if there is anything that is not clear or if you would like more information (contact: Claire Hill on 01142267890). Take time to decide whether or not you want to take part.



#### **2. What is the purpose of the study?**

We want to develop a Quality of Life measure to assess how children and young people feel about having Osteogenesis Imperfecta (Brittle Bone Disease). There are five sections in total (Phases 1a, 1b, 1c, 2 and 3), and by random selection you or your child may be invited to take part in three of the five sections. This is Phase 1c and you may also be invited to take part in Phase 1a and Phase 3. This research is part of an educational qualification.

#### **3. Why have I been chosen?**

You have been chosen because you have a child/children with Osteogenesis Imperfecta (Brittle Bone Disease). Osteogenesis Imperfecta (OI) is Brittle Bone Disease. It means that your child's bones can break easier and that their joints may be bendier than their friends, brothers and sisters.

We are asking 5 - 10 young people and parents to take part in this phase.

To develop a really useful quality of life measure for children and young people with Osteogenesis Imperfecta we need to find out what living with the condition is really like. We have already asked 10 children and young people, 10 parents and 5 health professionals about their views. We would now like to validate

these views by asking you what you think to the newly developed quality of life (QoL) measure.

#### **4. Do I have to take part?**

No. It is entirely up to you to decide whether or not to take part. You are free to withdraw from the research at any time without giving a reason. Your decisions about this will not affect the standard of care your child will receive.

If you are happy to take part, and are happy with the explanations from the research team, you will be asked to sign a consent form. You will be given a copy of the information sheet and the signed consent form to keep for your records.

You can agree to take part in this section of the research alone if you prefer, or agree to take part in more than one section as they arise. Completing the reply slip enclosed will let the researchers know what you would like to be included in.

#### **5. What will happen if I agree to take part?**

If you agree to take part we will arrange a date and time convenient for you to come to Sheffield Children's Hospital for the focus group. We will try to do this during a clinic visit or when your child is admitted for treatment where possible.

We would like to show you a copy of the newly developed Quality of Life measure. We would then like you to take part in a focus group. We would like to ask the focus group some questions about the suitability of the new Quality of Life measure. The focus group will be recorded on DVD. If you do not wish to be identified on the DVD your face can be pixellated/obscured.

We will use the information to further develop a Quality of Life measure for children and young people with Brittle Bone Disease. When the Quality of Life measure is developed we will send you a copy so you can tell us what you think.

#### **6. What will we be asked to do?**

We would like you to discuss the new Quality of Life measure within a focus group. We will record the focus group, so that we can transcribe it to paper after the interview has finished. We will anonymise the transcript by giving you a different name. Once we have transcribed the focus group to paper and completed the research the DVD recording will be destroyed.

#### **7. What are the possible disadvantages and risks of taking part?**

None. We want to develop a Quality of Life measure to enable us to assess how children and young people with Brittle Bone Disease feel about their daily

life. We hope this new Quality of Life measure will help us provide better care for children and young people with OI.

If we find out something that we think is important about your child's Brittle Bone Disease, we will talk to you and ask if you want to come back and have your child checked again at the hospital.

**8. What are the possible benefits of taking part?**

You will not benefit from being part of this study. However, the information we collect will help us to develop the quality of life measure. We hope the new quality of life measure will improve the care of other children and young people with Brittle Bone Disease (OI).

**9. What happened when the research study stops?**

We will collate everyone's opinions and use the information to further develop a Quality of Life measure for children and young people with Brittle Bone Disease.

**10. What if there is a problem?**

Any complaint about the way you have been dealt with during the study or any possible harm you might suffer will be addressed. If you have any cause to complain about any aspect of the way in which you have been approached or treated during the course of this study, the normal National Health Service complaints mechanisms are available to you and you are not compromised in any way because you have taken part in a research study.



**11. Will my taking part in the research project be confidential?**

Yes. We will follow ethical and legal practice and all information about you will be handled in confidence. All information which is collected about you during the course of the research will be kept strictly confidential. Any information about you which leaves the hospital will have your name and address removed so that you cannot be recognised from it. Once the study is complete all information will either be destroyed.

**12. Contact for any further information**

If you would like any further information about this study you could contact:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
01142267890

### **13. What if new information becomes available?**

Sometimes during the course of a research project, new information becomes available about Osteogenesis Imperfecta. If this happens, someone from the research team will tell you about it and discuss whether you want to continue the study. If you change your mind this will not affect any care your child receives whilst in hospital. If you decide to continue in the study you will be asked to sign an updated consent form.



### **14. What will happen if I don't want to carry on with the research?**

If you withdraw from the study we will destroy all your identifiable data if you wish, but we will need to use the data collected up to your withdrawal.

### **15. What if there is a problem?**

#### **Complaints**

If you have any cause to complain about any aspect of the way in which you or your child has been approached or treated during the course of this study, the normal National Health Service complaints mechanisms are available to you and you are not compromised in any way because you have taken part in a research study. If you have any complaints or concerns please contact either the project co-ordinator:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
Tel: 01142267890

Or the hospital complaints co-ordinator:

Mrs Linda Towers  
Patient Advice and Liaison Co-ordinator  
Sheffield Children's Hospital NHS Foundation Trust  
Tel: 01142717594

#### **Harm**

If you or your child is harmed by taking part in this research project, there are no special compensation arrangements. If your child is harmed due to someone

else's fault, then you may have grounds for a legal action – but you may have to pay for it.

**16. Will taking part in this study be kept confidential?**

All information which is collected about you during the course of the research will be kept strictly confidential. Any information about you which leaves the hospital will have their name and address removed so that you cannot be recognised from it. Once the study is complete all information will either be destroyed or kept in your child's confidential notes.

Our procedures for handling, processing, storage and destruction of data are compliant with the Data Protection Act 1998.

Your transcript will be given a number; your name will be changed. Your child's medical notes may also be looked at by other people within the hospital involved in the running and supervision of the study to check that it is being carried out correctly.

**17. What happens to the results of the research study?**

When the study has finished we will present our findings to other doctors, nurses and therapists and we will put the results in medical magazines and websites that health professionals use. We would also like to put a brief summary on the hospital research website and on the Brittle Bone Society website, so that you will be able to read about our results too. This will be available at the end of the study, on [www.sheffieldchildrenscr.f.nhs.uk](http://www.sheffieldchildrenscr.f.nhs.uk). The results will also be included as part of the chief investigators educational qualification. The results will be anonymous, which means that you or your child will not be identified from them.

**18. Who is organising and funding the research?**

Researchers at Sheffield Children's NHS Foundation Trust are organising the study. They will not get any extra money for doing this.

**19. Who has reviewed the study?**

This study was given a favourable ethical opinion for conduct in the NHS by Sheffield Research Ethics Committee.

It has also been checked by the research department at the Sheffield Children's NHS Foundation Trust.

**20. How can we find out more about research?**

The Clinical Research Support Unit at this hospital has an **Information for Families** section on its website [www.sheffieldchildrenscrf.nhs.uk](http://www.sheffieldchildrenscrf.nhs.uk) or you could contact the hospital Clinical Research Support Unit:

Mrs Tracy N'Diaye  
Directorate Manager of Research  
Sheffield Children's NHS Foundation Trust  
Tel: 01142267904

**Thank you for taking the time to read this – please ask any questions if you need to.**

**Contact Claire Hill 01142267890**



## PARTICIPANT INFORMATION SHEET

### FOR CHILDREN

PHASE 2 PILOT STUDY

Age 6-12

**To be shown and read by parent/carer if required**

#### **Study Title**

Development of a set of questions for children with Brittle Bone Disease

#### **1. What is research?**

Research is what we do to find out the answer to an important question.



#### **2. What is Brittle Bone Disease?**

It means your bones can break easier and that your joints may be bendier than your friends or brothers and sisters.

#### **3. Why is this project being done?**

We have developed an assessment to help us work out how you feel about having Brittle Bone Disease. Now we want to know what you think about it.

#### **4. Why me?**

You have been chosen because you have Brittle Bones and you visit Sheffield Children's Hospital for your treatment and care. We are asking 30 children to take part in this section.



## **5. Do I have to take part?**

No you do not. It is up to you. We would like you to read this information sheet. If you agree to take part, we would like you to write your name on two forms. We will also ask your Mum, Dad or carer to write their name on the forms and give one back to us. You can still change your mind later. If you don't want to take part, just say no. You may be asked to take part again in a month or two. If you don't want to, just let your Mum, Dad or carer know.

## **6. What will happen?**

We would like you to answer some questions about our new assessment. Your Mum, Dad or carer can help you. We would then like to ask you what you think to the new assessment. This will be recorded on audio cassette.

We will use the information to further develop the assessment to measure how children with brittle bones feel. When the assessment is finished we will send you a copy.

We will talk to you during your normal hospital visit. There will be no extra blood tests or x-rays. Your Mum, Dad or carer can stay with you during the interview.

## **7. Will joining in help me?**

No, but it may help us to know more about how children with brittle bones feel. We want to develop an assessment to measure how children with brittle bones feel so that we can improve our service.



## **8. What else might happen?**

We will only record your interview on tape. Then we can write down what you say by listening to the tape. Once we have written it down we will give you a pretend name so that no one else will know what you have said.

## **9. What happened when the research study stops?**

We will collect what everyone has said together and use the information to make improvements to the special assessment about how children with brittle bones feel.

## **10. What if something goes wrong?**

Your Mum, Dad or carer will be able to talk to someone who will be able to tell them what they need to do about it.

## **11. What if I don't want to do the research anymore?**

Just tell your Mum, Dad, carer, doctor or physiotherapist at any time. They will not be cross with you. You will still have the same care whilst you are at hospital.

## **12. What if I wish to complain about the study?**

If you wish to complain you or your Mum, Dad or carer can talk to Claire Hill or Mrs Linda Towers at This hospital.



## **13. Will anyone else know I am doing this?**

The people in our research team will know you are taking part. The doctor looking after you while you are in hospital will also know. No one else will know because we will not use your name or address. You will get a pretend name instead.

#### **14. What happens to what the researchers find out?**

When we collect your information we will make sure it is stored in a safe place and only the people doing the research can look at it. We will use the information to develop an assessment to measure how children with brittle bones feel and put it in medical magazines and on websites that doctors and therapists read.

A short summary will also be on the hospital's research website and the Brittle Bone Society website. No one will know you were in the study.

#### **15. Did anyone else check the study is OK to do?**

The study has been checked by several people at the hospital and the university to make sure it is alright.



#### **16. How can I find out more about the study?**

Your Mum, Dad, carer or other grown-up you trust may be able to answer your questions. The doctors, nurses or therapists looking after you can also help you find out more about the study.

**Thank you for taking the time to read this - please ask any questions if you need to.**



## **PARTICIPANT INFORMATION SHEET**

YOUNG PEOPLE (Aged 13 – 15)

PHASE 2 PILOT STUDY

### **Study Title**

Development of a Quality of Life measure for children with Osteogenesis Imperfecta (OI)

#### **1. Invitation paragraph**

We would like you to help us with our research study. This is an educational study. Please read this information carefully and talk to your Mum, Dad or carer about the study. Ask us if there is anything that is not clear or if you want to know more. Take time to decide if you want to take part. It is up to you if you want to do this. If you don't then that's fine, you'll be looked after at the hospital just the same.



#### **2. Why are we doing this research?**

We want to further develop a Quality of Life measure to assess how children and young people feel about having Osteogenesis Imperfecta (Brittle Bone Disease). There are five sections in total (Phases 1a, 1b, 1c, 2 and 3), and by random selection you may be invited to take part in three of the five sections. This is Phase 2 and you may also be invited to take part in Phase 3. This research is part of an educational qualification.

#### **3. Why have I been asked to take part?**

You have been chosen because you have Osteogenesis Imperfecta (Brittle Bone Disease). We are asking 30 children and young people to take part in this phase.

Osteogenesis Imperfecta (OI) is Brittle Bone Disease. It means that your bones can break easier and that your joints may be bendier than your friends, brothers and sisters.

#### **4. Do I have to take part?**

No it is entirely up to you. If you do decide to take part:

- You will be asked to sign a form to say that you agree to take part (a consent/assent form)
- You will be given this information sheet and a copy of your signed consent/assent form to keep.

You are free to stop taking part at any time during the research without giving a reason. If you decide to stop, this will not affect the care you receive whilst in this hospital.

You can agree to take part in this section of the research alone if you prefer, or agree to take part in more than one section as they arise. Completing the reply slip enclosed will let the researchers know what you would like to be included in.

## **5. What will happen to me if I take part?**

If you agree to take part we will arrange a date and time convenient for you to come to Sheffield Children's Hospital for interview. You can do this during a clinic visit or when you are admitted for treatment.

We would like you to undertake the newly developed Quality of Life assessment. We would then like to interview you and ask you some questions. The questions will be about the suitability of the new assessment and what you think about the feel of the questions. The interview will be recorded on audio cassette.

We will use the information to further develop a Quality of Life measure for children and young people with Brittle Bone Disease. When the Quality of Life measure is developed further we will send you a copy so you can tell us what you think.

We will interview you during your normal hospital visit. There will be no extra blood tests or x-rays. You can choose to have someone stay with you during the interview, such as a parent/carer or friend.

## **6. What will I be asked to do?**

We will ask you to complete the newly developed Quality of Life assessment. We will ask you a few questions about how the assessment feels and what you thought about the questions. We would like to find out if you think the assessment is suitable for children and young people with Brittle Bone disease. We will record the interview, so that we can transcribe it to paper after the interview has finished. We will anonymise the transcript by giving you a different name. Once we have transcribed the interview to paper and the research is completed the tape recording will be destroyed.

**7. Is there anything else to be worried about?**

No. We want to further develop a Quality of Life measure to enable us to assess how children and young people with Brittle Bone Disease feel about their daily life. We hope this new quality of life measure will help us provide better care for children and young people with OI.

If we find out something that we think is important about your Brittle Bone Disease, we will talk to your Mum, Dad or carer and ask them if they want you to come back and have you checked again at the hospital.

**8. Will the study help me?**

No, but the information we get will help us to develop the Quality of Life measure. We hope the new Quality of Life measure will improve the care of other children and young people with Brittle Bone Disease (OI).

**9. What happened when the research study stops?**

We will collect everyone's opinions and use the information to further develop a Quality of Life measure for children and young people with Brittle Bones disease.

**10. Contact for further information**

If you would like any further information about this study you could contact:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
01142267890



**11. What if new information comes along?**

Sometimes during research, new things are found out about Brittle Bone Disease. If this happens, someone from the research team will tell you about it and discuss whether you want to continue the study. If you change your mind this will not affect any care you receive whilst in hospital. If you decide to continue in the study you will be asked to sign an updated consent/assent form.

**12. What if I don't want to do the research anymore?**

Just tell your Mum, Dad, carer, doctor or therapist at any time. They will not be cross with you. You will still have the same care whilst you are at hospital.

### **13. What if there is a problem or something goes wrong?**

Tell us if there is a problem and we will try to sort it out straight away. You and your Mum, Dad or carer can either contact the project co-ordinator:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
Tel: 01142267890



Or the hospital complaints co-ordinator:

Mrs Linda Towers  
Patient Advice and Liaison Co-ordinator  
Sheffield Children's Hospital NHS Foundation Trust  
Tel: 01142717594

### **14. Will anyone else know I'm doing this?**

The people in our research team will know you are taking part. The doctor looking after you while you are in hospital will also know.

Your medical notes may also be looked at by other people who work at the hospital to check that the study is being carried out correctly.

All the information that is collected about you during the research will be kept strictly confidential. Your transcript will be given a number; your name will be changed.

Any information about you that leaves the hospital will have your name and address removed so that you cannot be recognised from it. Once the study is complete all information will be destroyed or kept in your own confidential notes.

### **15. What happens to the results of the researchers study?**

When the study has finished we will present our findings to other doctors, nurses and therapists and we will put the results in medical magazines and websites that health professionals use. We would also like to put an article in the hospital newsletter and on the Brittle Bone Society website. The results will be anonymous, which means that you will not be identified from them.

### **16. Who is organising and funding the research?**

Researchers at Sheffield Children's NHS Foundation Trust are organising the study. They will not get any extra money for doing this.

**17. Who has checked the study?**

Before any study goes ahead it has to be checked by a Research Ethics Committee. This is a group of people who make sure the research is OK to do. This study has been looked at by Sheffield Research Ethics Committee.

It has also been checked by the research department at the Sheffield Children's NHS Foundation Trust.

**18. How can I find out more about research?**

The Clinical Research Support Unit at this hospital has an information for families section on its website [www.sheffieldchildrenscrf.nhs.uk](http://www.sheffieldchildrenscrf.nhs.uk) or you could contact the hospital Clinical Research Support Unit:

Mrs Tracy N'Diaye  
Directorate Manager of Research  
Sheffield Children's NHS Foundation Trust  
Tel: 01142267904

**Thank you for taking the time to read this – please ask any questions if you need to.**

**Contact Claire Hill 01142267890**



## **PATIENT INFORMATION SHEET**

YOUNG ADULT AGED 16-18

PHASE 2 PILOT STUDY

### **Study Title**

Development of a Quality of Life measure for children with Osteogenesis Imperfecta (OI)

#### **1. Invitation paragraph**

You are being asked to take part in a research study. This is an educational study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully. Talk to others about the study if you wish.

Ask us if there is anything that is not clear or if you would like more information (contact: Claire Hill on 01142267890). Take time to decide whether or not you want to take part.



#### **2. What is the purpose of the study?**

We want to further develop a Quality of Life measure to assess how children and young people feel about having Osteogenesis Imperfecta (Brittle Bone Disease). There are five sections in total (Phases 1a, 1b, 1c, 2 and 3), and by random selection you may be invited to take part in three of the five sections. This is Phase 2 and you may also be invited to take part in Phase 3. This research is part of an educational qualification.

#### **3. Why have I been chosen?**

You have been chosen because you have Osteogenesis Imperfecta (Brittle Bone Disease) and attend Sheffield Children's Hospital for treatment or review. We are asking 30 children and young people to take part in this phase.

Osteogenesis Imperfecta (OI) is Brittle Bone Disease. It means that your bones can break easier and that your joints may be bendier than your friends, brothers and sisters.

To develop a really useful quality of life measure for children and young people with Osteogenesis Imperfecta we need to find out what living with the condition is really like. We have already developed the Quality of Life measure by asking

children, young people with OI and their parents/carers what they think should be included in the Quality of Life measure. We would now like to validate these views by asking you what you think to the newly developed Quality of Life measure. Whether you think the items are suitable, understandable and feel ok to answer.

#### **4. Do I have to take part?**

No. It is entirely up to you to decide whether or not to take part. You are free to withdraw from the research at any time without giving a reason. Your decisions about this will not affect the standard of care you will receive.

If you are happy to take part, and are happy with the explanations from the research team, you will be asked to sign a consent form. You will be given a copy of the information sheet and the signed consent form to keep for your records.

You can agree to take part in this section of the research alone if you prefer, or agree to take part in more than one section as they arise. Completing the reply slip enclosed will let the researchers know what you would like to be included in.

#### **5. What will happen if I agree to take part?**

If you agree to take part we will arrange a date and time convenient for you to come to Sheffield Children's Hospital for interview. You can do this during a clinic visit or when you are admitted for treatment.

We would like you to undertake the newly developed Quality of Life assessment. We would then like to interview you and ask them some questions. The questions will be about the suitability of the new assessment and what you think about the feel of the questions. The interview will be recorded on audio cassette.

We will use the information to further develop a Quality of Life measure for children and young people with Brittle Bone Disease. When the Quality of Life measure is developed we will send you a copy so you can tell us what you think.

We will interview you during your normal hospital visit.

#### **6. What will I be asked to do?**

We will ask you a few questions about what you think about the newly developed Quality of Life measure. We would like to get your opinion about the suitability of the newly developed Quality of Life measure. We will tape record the interview, so that we can transcribe it to paper. We will anonymise the transcript by giving you a different name. Once we have transcribed the

interviews to paper and completed the research, the tape recording will be destroyed.

**7. What are the possible disadvantages and risks of taking part?**

None. We want to further develop a Quality of Life measure to enable us to assess how children and young people with Brittle Bone Disease feel about their daily life. We hope this new quality of life measure will help us provide better care for children and young people with OI.

**8. What are the possible benefits of taking part?**

You will not benefit from being part of this study. However, the information we collect will help us to develop the Quality of Life measure. We hope the new Quality of Life measure will improve the care of other children and young people with Brittle Bone Disease (OI).

**9. What happens when the research study stops?**

We will collate everyone's opinions and use the information to further develop a Quality of Life measure for children and young people with Brittle Bone Disease.

**10. What if there is a problem?**

Any complaint about the way you have been dealt with during the study or any possible harm you might suffer will be addressed. If you have any cause to complain about any aspect of the way in which you have been approached or treated during the course of this study, the normal National Health Service complaints mechanisms are available to you and you are not compromised in any way because you have taken part in a research study.

**11. Will my taking part in the research project be confidential?**

Yes. We will follow ethical and legal practice and all information about you will be handled in confidence. All information which is collected about you during the course of the research will be kept strictly confidential. Any information about you which leaves the hospital will have your name and address removed so that you cannot be recognised from it. Once the study is complete all information will either be destroyed.

**12. Contact for any further information**

If you would like any further information about this study you could contact:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
01142267890

**13. What if new information becomes available?**

Sometimes during the course of a research project, new information becomes available about Osteogenesis Imperfecta. If this happens, someone from the research team will tell you about it and discuss whether you want to continue the study. If you change your mind this will not affect any care you receive whilst in hospital. If you decide to continue in the study you will be asked to sign an updated consent form.

**14. What will happen if I don't want to carry on with the research?**

If you withdraw from the study we will destroy all your identifiable samples if you wish, but we will need to use the data collected up to your withdrawal.

**15. What if there is a problem?**

**Complaints**

If you have any cause to complain about any aspect of the way in which you have been approached or treated during the course of this study, the normal National Health Service complaints mechanisms are available to you and you are not compromised in any way because you have taken part in a research study. If you have any complaints or concerns please contact either the project co-ordinator:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
Tel: 01142267890

Or the hospital complaints co-ordinator:

Mrs Linda Towers  
Patient Advice and Liaison Co-ordinator  
Sheffield Children's Hospital NHS Foundation Trust  
Tel: 01142717594

**Harm**

If you are harmed by taking part in this research project, there are no special compensation arrangements. If you are harmed due to someone else's fault, then you may have grounds for a legal action – but you may have to pay for it.

**16. Will taking part in this study be kept confidential?**

All information which is collected about you during the course of the research will be kept strictly confidential. Any information about you which leaves the hospital will have your name and address removed so that you cannot be recognised from it. Once the study is complete all information will either be destroyed.

Our procedures for handling, processing, storage and destruction of data are compliant with the Data Protection Act 1998.

Your transcript will be given a number; your name will be changed.

**17. What happens to the results of the research study?**

When the study has finished we will present our findings to other doctors, nurses and therapists and we will put the results in medical magazines and websites that health professionals use. We would also like to put a brief summary on the hospital research website and on the Brittle Bone Society website, so that you will be able to read about our results too. This will be available at the end of the study, on [www.sheffieldchildrenscrf.nhs.uk](http://www.sheffieldchildrenscrf.nhs.uk). The results will also be included as part of the chief investigators educational qualification. The results will be anonymous, which means that you or your child will not be identified from them.

**18. Who is organising and funding the research?**

Researchers at Sheffield Children's NHS Foundation Trust are organising the study. They will not get any extra money for doing this.

**19. Who has reviewed the study?**

This study was given a favourable ethical opinion for conduct in the NHS by Sheffield Research Ethics Committee.

It has also been checked by the research department at the Sheffield Children's NHS Foundation Trust.

**20. How can we find out more about research?**

The Clinical Research Support Unit at this hospital has an **Information for Families** section on its website [www.sheffieldchildrenscrf.nhs.uk](http://www.sheffieldchildrenscrf.nhs.uk) or you could contact the hospital Clinical Research Support Unit:

Mrs Tracy N'Diaye  
Directorate Manager of Research  
Sheffield Children's NHS Foundation Trust  
Tel: 01142267904

**Thank you for taking the time to read this – please ask any questions if you need to.**

**Contact Claire Hill 01142267890**



## **PARENT/LEGAL GUARDIAN INFORMATION SHEET**

Child/young people participation

PHASE 2 PILOT STUDY

### **Study Title**

Development of a Quality of Life measure for children with Osteogenesis Imperfecta (OI)

#### **1. Invitation paragraph**

Your child is being asked to take part in a research study. This is an educational study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully. Talk to others about the study if you wish.

Ask us if there is anything that is not clear or if you would like more information (contact: Claire Hill on 01142267890). Take time to decide whether or not you want your child to take part.



#### **2. What is the purpose of the study?**

We have developed a Quality of Life measure to assess how children and young people feel about having Osteogenesis Imperfecta (Brittle Bone Disease). We now want to assess the suitability, acceptability and feel of the items/questions. There are five sections in total (Phases 1a, 1b, 1c, 2 and 3), and by random selection you or your child may be invited to take part in three of the five sections. This is Phase 2 and you may also be invited to take part in Phase 3. This research is part of an educational qualification.

#### **3. Why has my child been chosen?**

Your child has been chosen because they have Osteogenesis Imperfecta (Brittle Bone Disease), and they attend Sheffield Children's Hospital for treatment or review. We are asking 30 children and young people to take part in this phase.

Osteogenesis Imperfecta (OI) is Brittle Bone Disease. It means that their bones can break easier and that their joints may be bendier than their friends, brothers and sisters.

To further develop a really useful Quality of Life measure for children and young people with Osteogenesis Imperfecta we need to find out what living with the condition is really like. We have already developed the Quality of Life measure by asking children, young people with OI and their parents/carers what they think should be included in the Quality of Life measure. We would now like to validate these views by asking your child what they think to the newly developed Quality of Life measure. Whether they think the items are suitable, understandable and feel ok to answer.

#### **4. Does my child have to take part?**

No. It is entirely up to you and your child (wherever possible) to decide whether or not to take part. You are free to withdraw from the research at any time without giving a reason. Your decisions about this will not affect the standard of care your child will receive.

If you are happy for your child to take part, and are happy with the explanations from the research team, you will be asked to sign a consent form. If your child is able to understand the research and is happy to take part and can write their name, they will be asked to sign an assent form with you, if they want to. You will be given a copy of the information sheet and the signed consent/assent forms to keep for your records.

You can agree to your child taking part in this section of the research alone if you prefer, or agree to them taking part in more than one section as they arise. Completing the reply slip enclosed will let the researchers know what you would like your child to be included in.

#### **5. What will happen to my child if we agree to take part?**

If you agree to take part we will arrange a date and time convenient for your child to come to Sheffield Children's Hospital to coincide with your routine appointment or inpatient admission.

We would like your child to undertake the newly developed Quality of Life assessment. We would then like to interview your child and ask them some questions. The questions will be about the suitability of the new assessment and what they think about the feel of the questions. The interview will be recorded on audio cassette.

We will use the information to further develop the Quality of Life measure for children and young people with Brittle Bone Disease. When the Quality of Life measure is developed we will send you a copy.

There will be no extra blood tests or x-rays. You can stay with them during the interview if they would prefer that.

**6. What will we be asked to do?**

We will ask your child a few questions about what they think about the newly developed Quality of Life measure. We would like to get their opinion about the suitability of the newly developed Quality of Life measure. We will tape record the interview, so that we can transcribe it to paper. We will anonymise the transcript by giving your child a different name. Once we have transcribed the interviews to paper and completed the research, the tape recording will be destroyed.

**7. What are the possible disadvantages and risks of taking part?**

None. We want to further develop a Quality of Life measure to enable us to assess how children and young people with Brittle Bone Disease feel about their daily life. We hope this new quality of life measure will help us provide better care for children and young people with OI.

If we find out something that we think is important about your child's Brittle Bone Disease, we will talk to you and ask if you want to come back and have your child checked again at the hospital.

**8. What are the possible benefits of taking part?**

Your child will not benefit from being part of this study. However, the information we collect will help us to further develop the Quality of Life measure. We hope the new Quality of Life measure will improve the care of other children and young people with Brittle Bone Disease (OI).

**9. What happened when the research study stops?**

We will collate everyone's opinions and use the information to further develop a Quality of Life measure for children and young people with Brittle Bone Disease.

**10. What if there is a problem?**

Any complaint about the way you or your child have been dealt with during the study or any possible harm your child might suffer will be addressed. If you have any cause to complain about any aspect of the way in which you have been approached or treated during the course of this study, the normal National Health Service complaints mechanisms are available to you and you are not compromised in any way because you have taken part in a research study.



**11. Will my child's taking part in the research project be confidential?**

Yes. We will follow ethical and legal practice and all information about your child will be handled in confidence. All information which is collected about your child during the course of the research will be kept strictly confidential. Any information about your child which leaves the hospital will have their name and address removed so that you cannot be recognised from it. Once the study is complete all information will either be destroyed.

**12. Contact for any further information**

If you would like any further information about this study you could contact:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
01142267890

**13. What if new information becomes available?**

Sometimes during the course of a research project, new information becomes available about Osteogenesis Imperfecta. If this happens, someone from the research team will tell you and your child about it and discuss whether you want your child to continue the study. If you change your mind this will not affect any care your child receives whilst in hospital. If you decide to continue in the study you and your child will be asked to sign an updated consent/assent form.



**14. What will happen if we don't want to carry on with the research?**

If you withdraw from the study we will destroy all your child's identifiable samples if you wish, but we will need to use the data collected up to their withdrawal.

**15. What if there is a problem?**

**Complaints**

If you have any cause to complain about any aspect of the way in which you or your child has been approached or treated during the course of this study, the normal National Health Service complaints mechanisms are available to you and you are not compromised in any way because you have taken part in a research study. If you have any complaints or concerns please contact either the project co-ordinator:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
Tel: 01142267890

Or the hospital complaints co-ordinator:

Mrs Linda Towers  
Patient Advice and Liaison Co-ordinator  
Sheffield Children's Hospital NHS Foundation Trust  
Tel: 01142717594

## **Harm**

If your child is harmed by taking part in this research project, there are no special compensation arrangements. If your child is harmed due to someone else's fault, then you may have grounds for a legal action – but you may have to pay for it.

### **16. Will taking part in this study be kept confidential?**

All information which is collected about your child during the course of the research will be kept strictly confidential. Any information about your child which leaves the hospital will have their name and address removed so that your child cannot be recognised from it. Once the study is complete all information will either be destroyed or kept in your child's confidential notes.

Our procedures for handling, processing, storage and destruction of data are compliant with the Data Protection Act 1998.

Your child's transcript will be given a number; their name will be changed. Your child's medical notes may also be looked at by other people within the hospital involved in the running and supervision of the study to check that it is being carried out correctly.

### **17. What happens to the results of the research study?**

When the study has finished we will present our findings to other doctors, nurses and therapists and we will put the results in medical magazines and websites that health professionals use. We would also like to put a brief summary on the hospital research website and on the Brittle Bone Society website, so that you will be able to read about our results too. This will be available at the end of the study, on [www.sheffieldchildrenscrf.nhs.uk](http://www.sheffieldchildrenscrf.nhs.uk). The results will also be included as part of the chief investigators educational

qualification. The results will be anonymous, which means that your child will not be identified from them.

**18. Who is organising and funding the research?**

Researchers at Sheffield Children's NHS Foundation Trust are organising the study. They will not get any extra money for doing this.

**19. Who has reviewed the study?**

This study was given a favourable ethical opinion for conduct in the NHS by Sheffield Research Ethics Committee.

It has also been checked by the research department at the Sheffield Children's NHS Foundation Trust.

**20. How can we find out more about research?**

The Clinical Research Support Unit at this hospital has an **Information for Families** section on its website [www.sheffieldchildrenscrf.nhs.uk](http://www.sheffieldchildrenscrf.nhs.uk) or you could contact the hospital Clinical Research Support Unit:

Mrs Tracy N'Diaye  
Directorate Manager of Research  
Sheffield Children's NHS Foundation Trust  
Tel: 01142267904

**Thank you for taking the time to read this – please ask any questions if you need to.**

**Contact Claire Hill 01142267890**



## PARTICIPANT INFORMATION SHEET

### FOR CHILDREN

Age 6-12  
PHASE 3 QOL

To be shown and read by parent/carer if required

#### **Study Title**

Development of a set of questions for children with Brittle Bone Disease

#### **1. What is research?**

Research is what we do to find out the answer to an important question.



#### **2. What is Osteogenesis Imperfecta?**

It means your bones can break easier and that your joints may be bendier than your friends or brothers and sisters.

#### **3. Why is this project being done?**

We have developed a set of questions to help us work out how you feel about having Brittle Bone Disease. Now we want to find out if it works well.

#### **4. Why me?**

You have been chosen because you have Brittle Bones and you visit Sheffield Children's Hospital for your treatment and care. We are asking up to 150 patients to take part in this section.



## **5. Do I have to take part?**

No you do not. It is up to you. We would like you to read this information sheet. If you agree to take part, we would like you to write your name on two forms. We will also ask your Mum, Dad or carer to write their name on the forms and give one back to us. You can still change your mind later. If you don't want to take part, just say no. You may be asked to take part again in a month or two. If you don't want to, just let your Mum, Dad or carer know.

## **6. What will happen?**

We would like you to answer some questions in our new assessment. Your Mum, Dad or carer can help you. We would then like to send you another copy (in the post) for you to do again at home a week later, and then 3 months later when you come back to Sheffield for your review or treatment.

We will use the information to further develop the assessment to measure how children with brittle bones feel. When the assessment is finished we will send you a copy.

We will talk to you during your normal hospital visit. There will be no extra blood tests or x-rays.

## **7. Will joining in help me?**

No, but it may help us to know more about how children with brittle bones feel. We want to further develop the assessment to measure how children with brittle bones feel.



## **8. What else might happen?**

Nothing else will happen to you. You will just be asked a few questions in an assessment about how you feel about having Brittle Bones.

## **9. What happened when the research study stops?**

We will collect what everyone has said together and use the information to make improvements to the new assessment about how children with brittle bones feel.

## **10. What if something goes wrong?**

Your Mum, Dad or carer will be able to talk to someone who will be able to tell them what they need to do about it.

## **11. What if I don't want to do the research anymore?**

Just tell your Mum, Dad, carer, doctor or physiotherapist at any time. They will not be cross with you. You will still have the same care whilst you are at hospital.

## **12. What if I wish to complain about the study?**

If you wish to complain you or your Mum, Dad or carer can talk to Claire Hill or Mrs Linda Towers at This hospital.



## **13. Will anyone else know I am doing this?**

The people in our research team will know you are taking part. The doctor looking after you while you are in hospital will also know. No one else will know because we will not use your name or address. You will get a pretend name instead.

#### **14. What happens to what the researchers find out?**

When we collect your information we will make sure it is stored in a safe place and only the people doing the research can look at it. We will use the information to develop an assessment to measure how children with brittle bones feel and put it in medical magazines and on websites that doctors and therapists read.

A short summary will also be on the hospital's research website and on the Brittle Bone Society website. No one will know you were in the study.

#### **15. Did anyone else check the study is OK to do?**

The study has been checked by several people at the hospital and the university to make sure it is alright.



#### **16. How can I find out more about the study?**

Your Mum, Dad, carer or other grown-up you trust may be able to answer your questions. The doctors, nurses or therapists looking after you can also help you find out more about the study.

**Thank you for taking the time to read this – please ask any questions if you need to.**



## **PARTICIPANT INFORMATION SHEET**

YOUNG PEOPLE (Aged 13 – 15)

PHASE 3 QOL

### **Study Title**

Development of a Quality of Life measure for children with Osteogenesis Imperfecta (OI)

#### **1. Invitation paragraph**

We would like you to help us with our research study. This is an educational study. Please read this information carefully and talk to your Mum, Dad or carer about the study. Ask us if there is anything that is not clear or if you want to know more. Take time to decide if you want to take part. It is up to you if you want to do this. If you don't then that's fine, you'll be looked after at the hospital just the same.



#### **2. Why are we doing this research?**

We want to further develop a Quality of Life measure to assess how children and young people feel about having Osteogenesis Imperfecta (Brittle Bone Disease). Now we want to find out if it works well. There are five sections in total (Phases 1a, 1b, 1c, 2 and 3), and by random selection you may be invited to take part in three of the five sections. This is Phase 3 and you may also have been invited to take part in Phase 1 or 2. This research is part of an educational qualification.

#### **3. Why have I been asked to take part?**

You have been chosen because you have Osteogenesis Imperfecta (Brittle Bone Disease). We are asking up to 150 children and young people take part in this phase.

Osteogenesis Imperfecta (OI) is Brittle Bone Disease. It means that your bones can break easier and that your joints may be bendier than your friends, brothers and sisters.

#### **4. Do I have to take part?**

No it is entirely up to you. If you do decide to take part:

- You will be asked to sign a form to say that you agree to take part (a consent/assent form)
- You will be given this information sheet and a copy of your signed consent/assent form to keep.

You are free to stop taking part at any time during the research without giving a reason. If you decide to stop, this will not affect the care you receive whilst in this hospital.

You can agree to take part in this section of the research alone if you prefer, or agree to take part in more than one section as they arise. Completing the reply slip enclosed will let the researchers know what you would like to be included in.

## **5. What will happen to me if I take part?**

If you agree to take part we will arrange a date and time convenient for you to come to Sheffield Children's Hospital. You can do this during a clinic visit or when you are admitted for treatment.

We would like you to undertake the newly developed Quality of Life assessment and two other well known assessments that measure Quality of Life. We will then contact you one week later by post, and 3 months later during a routine hospital visit, and ask you to repeat the assessments.

We will use the information to further develop a Quality of Life measure for children and young people with Brittle Bone Disease. When the Quality of Life measure is developed we will send you a copy.

We will see you during your normal hospital visit. There will be no extra blood tests or x-rays. You can choose to have someone stay with you during the interview, such as a parent/carer or friend.

## **6. What will I be asked to do?**

You will be asked to repeat three Quality of Life assessments on three separate occasions.

- Firstly, we would like you to undertake the newly developed Quality of Life assessment and two other well known assessments that measure Quality of Life, during a routine visit to Sheffield Children's Hospital.
- We will then contact you by post one week later and ask you to repeat the three Quality of Life assessments at home. We will also ask you if your health has changed over the last week.
- Three months later during a routine visit to Sheffield Children's Hospital we will then ask you to repeat the three assessments again.

You can choose to have someone stay with you during the interview, such as a parent/carer or friend.

**7. Is there anything else to be worried about?**

No. We want to further develop a Quality of Life measure to enable us to assess how children and young people with Brittle Bone Disease feel about their daily life. We hope this new quality of life measure will help us provide better care for children and young people with OI.

If we find out something that we think is important about your Brittle Bone Disease, we will talk to your Mum, Dad or carer and ask them if they want you to come back and have you checked again at the hospital.

**8. Will the study help me?**

No, but the information we get will help us to develop the quality of life measure. We hope the new quality of life measure will improve the care of other children and young people with Brittle Bone Disease (OI).

**9. What happened when the research study stops?**

We will collect everyone's assessments and use the information to work out how useful the newly developed Quality of Life measure is for children and young people with Brittle Bone Disease. If you have also taken part in the functional assessment tool section of this study, we will compare the scores to give us more information about assessing children and young people with Brittle Bones.

**10. Contact for further information**

If you would like any further information about this study you could contact:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
01142267890



**11. What if new information comes along?**

Sometimes during research, new things are found out about Brittle Bone Disease. If this happens, someone from the research team will tell you about it and discuss whether you want to continue the study. If you change your mind this will not affect any care you receive whilst in hospital. If you decide to continue in the study you will be asked to sign an updated consent/assent form.

**12. What if I don't want to do the research anymore?**

Just tell your Mum, Dad, carer, doctor or therapist at any time. They will not be cross with you. You will still have the same care whilst you are at hospital.

**13. What if there is a problem or something goes wrong?**

Tell us if there is a problem and we will try to sort it out straight away. You and your Mum, Dad or carer can either contact the project co-ordinator:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
Tel: 01142267890



Or the hospital complaints co-ordinator:

Mrs Linda Towers  
Patient Advice and Liaison Co-ordinator  
Sheffield Children's Hospital NHS Foundation Trust  
Tel: 01142717594

**14. Will anyone else know I'm doing this?**

The people in our research team will know you are taking part. The doctor looking after you while you are in hospital will also know.

Your medical notes may also be looked at by other people who work at the hospital to check that the study is being carried out correctly.

All the information that is collected about you during the research will be kept strictly confidential. Your transcript will be given a number; your name will be changed.

Any information about you that leaves the hospital will have your name and address removed so that you cannot be recognised from it. Once the study is complete all information will be destroyed or kept in your own confidential notes.

**17. What happens to the results of the researchers study?**

When the study has finished we will present our findings to other doctors, nurses and therapists and we will put the results in medical magazines and websites that health professionals use. We would also like to put an article in the hospital newsletter and on the Brittle Bone Society website. The results will be anonymous, which means that you will not be identified from them.

**18. Who is organising and funding the research?**

Researchers at Sheffield Children's NHS Foundation Trust are organising the study. They will not get any extra money for doing this.

**19. Who has checked the study?**

Before any study goes ahead it has to be checked by a Research Ethics Committee. This is a group of people who make sure the research is OK to do. This study has been looked at by Sheffield Research Ethics Committee.

It has also been checked by the research department at the Sheffield Children's NHS Foundation Trust.

**20. How can I find out more about research?**

The Clinical Research Support Unit at this hospital has an information for families section on its website [www.sheffieldchildrenscrf.nhs.uk](http://www.sheffieldchildrenscrf.nhs.uk) or you could contact the hospital Clinical Research Support Unit:

Mrs Tracy N'Diaye  
Directorate Manager of Research  
Sheffield Children's NHS Foundation Trust  
Tel: 01142267904

**Thank you for taking the time to read this – please ask any questions if you need to.**

**Contact Claire Hill 01142267890**



## **PATIENT INFORMATION SHEET**

YOUNG ADULT (AGED 16-18)

PHASE 3 QOL

### **Study Title**

Development of a Quality of Life measure for children with Osteogenesis Imperfecta (OI)

#### **1. Invitation paragraph**

You are being asked to take part in a research study. This is an educational study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully. Talk to others about the study if you wish.

Ask us if there is anything that is not clear or if you would like more information (contact: Claire Hill on 01142267890). Take time to decide whether or not you want to take part.



#### **2. What is the purpose of the study?**

We want to further develop a Quality of Life measure to assess how children and young people feel about having Osteogenesis Imperfecta (Brittle Bone Disease). We now want to work out if it is a valid, reliable and useful tool. There are five sections in total (Phases 1a, 1b, 1c, 2 and 3), and by random selection you or your child may be invited to take part in three of the five sections. This is Phase 3 and you may also have been invited to take part in Phase 1 or 2. This research is part of an educational qualification.

#### **3. Why have I been chosen?**

You have been chosen because you have Osteogenesis Imperfecta (Brittle Bone Disease) and you attend Sheffield Children's Hospital for treatment or review. We are asking 150 children and young people to take part in this phase.

Osteogenesis Imperfecta (OI) is Brittle Bone Disease. It means that your bones can break easier and that your joints may be bendier than your friends, brothers and sisters.

To develop a really useful quality of life measure for children and young people with Osteogenesis Imperfecta we need to find out what living with the condition

is really like. We have already developed the Quality of Life measure by asking children, young people with OI and their parents/carers what they think should be included in the Quality of Life measure. This stage of the research will tell us if the newly developed Quality of Life measure is valid, reliable and useful. We would now like to validate these views by asking you to complete the Quality of Life measure.

#### **4. Do I have to take part?**

No. It is entirely up to you to decide whether or not to take part. You are free to withdraw from the research at any time without giving a reason. Your decisions about this will not affect the standard of care you will receive.

If you are happy to take part, and are happy with the explanations from the research team, you will be asked to sign a consent form. You will be given a copy of the information sheet and the signed consent form to keep for your records.

You can agree to take part in this section of the research alone if you prefer, or agree to take part in more than one section as they arise. Completing the reply slip enclosed will let the researchers know what you would like to be included in.

#### **5. What will happen if I agree to take part?**

If you agree to take part we will arrange a date and time convenient for you to come to Sheffield Children's Hospital to coincide with your routine appointment or inpatient admission.

We would like you to undertake the newly developed Quality of Life assessment and two other well known assessments that measure Quality of Life. We will then contact you one week later by post, and 3 months later during a routine visit to Sheffield, to repeat the assessments.

We will use the information to further develop a Quality of Life measure for children and young people with Brittle Bone Disease. When the Quality of Life measure is developed we will send you a copy.

#### **6. What will I be asked to do?**

We would like you to repeat three quality of life assessments on three separate occasions.

- Firstly, we would like you to undertake the newly developed Quality of Life assessment and two other well known assessments that measure Quality of Life, during a routine visit to Sheffield Children's Hospital.

- We would then like to contact you by post one week later and ask you to repeat the three Quality of Life assessments at home. We will also ask you if your health has changed over the last week.
- Three months later during a routine visit to Sheffield Children's Hospital we will then ask you to repeat the three assessments again.

**7. What are the possible disadvantages and risks of taking part?**

None. We want to further develop a Quality of Life measure to enable us to assess how children and young people with Brittle Bone Disease feel about their daily life. We hope this new quality of life measure will help us provide better care for children and young people with OI.

**8. What are the possible benefits of taking part?**

You will not benefit from being part of this study. However, the information we collect will help us to develop the quality of life measure. We hope the new Quality of Life measure will improve the care of other children and young people with Brittle Bone Disease (OI).

**9. What happens when the research study stops?**

We will collate everyone's opinions and use the information to further develop a Quality of Life measure for children and young people with Brittle Bone Disease. If you have also taken part in the functional assessment tool section of this study we will compare the scores to give us more information about assessing children and young people with Brittle Bones.

**10. What if there is a problem?**

Any complaint about the way you have been dealt with during the study or any possible harm you might suffer will be addressed. If you have any cause to complain about any aspect of the way in which you have been approached or treated during the course of this study, the normal National Health Service complaints mechanisms are available to you and you are not compromised in any way because you have taken part in a research study.

**11. Will my taking part in the research project be confidential?**

Yes. We will follow ethical and legal practice and all information about you will be handled in confidence. All information which is collected about you during the course of the research will be kept strictly confidential. Any information about you which leaves the hospital will have your name and address removed so that you cannot be recognised from it. Once the study is complete all information will be destroyed or filed in your confidential notes.

## **12. Contact for any further information**

If you would like any further information about this study you could contact:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
01142267890

## **13. What if new information becomes available?**

Sometimes during the course of a research project, new information becomes available about Osteogenesis Imperfecta. If this happens, someone from the research team will tell you about it and discuss whether you want to continue the study. If you change your mind this will not affect any care you receive whilst in hospital. If you decide to continue in the study you will be asked to sign an updated consent form.

## **14. What will happen if I don't want to carry on with the research?**

If you withdraw from the study we will destroy all your identifiable samples if you wish, but we will need to use the data collected up to your withdrawal.

## **15. What if there is a problem?**

### **Complaints**

If you have any cause to complain about any aspect of the way in which you have been approached or treated during the course of this study, the normal National Health Service complaints mechanisms are available to you and you are not compromised in any way because you have taken part in a research study. If you have any complaints or concerns please contact either the project co-ordinator:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
Tel: 01142267890

Or the hospital complaints co-ordinator:

Mrs Linda Towers  
Patient Advice and Liaison Co-ordinator  
Sheffield Children's Hospital NHS Foundation Trust  
Tel: 01142717594

## **Harm**

If you are harmed by taking part in this research project, there are no special compensation arrangements. If you are harmed due to someone else's fault, then you may have grounds for a legal action – but you may have to pay for it.

### **16. Will taking part in this study be kept confidential?**

All information which is collected about you during the course of the research will be kept strictly confidential. Any information about you which leaves the hospital will have your name and address removed so that you cannot be recognised from it. Once the study is complete all information will either be destroyed or kept in your confidential notes.

Our procedures for handling, processing, storage and destruction of data are compliant with the Data Protection Act 1998.

Your transcript will be given a number; your name will be changed.

### **17. What happens to the results of the research study?**

When the study has finished we will present our findings to other doctors, nurses and therapists and we will put the results in medical magazines and websites that health professionals use. We would also like to put a brief summary on the hospital research website and on the Brittle Bone Society website, so that you will be able to read about our results too. This will be available at the end of the study, on [www.sheffieldchildrenscrf.nhs.uk](http://www.sheffieldchildrenscrf.nhs.uk). The results will also be included as part of the chief investigators educational qualification. The results will be anonymous, which means that you will not be identified from them.

### **18. Who is organising and funding the research?**

Researchers at Sheffield Children's NHS Foundation Trust are organising the study. They will not get any extra money for doing this.

### **19. Who has reviewed the study?**

This study was given a favourable ethical opinion for conduct in the NHS by Sheffield Research Ethics Committee.

It has also been checked by the research department at the Sheffield Children's NHS Foundation Trust.

**20. How can we find out more about research?**

The Clinical Research Support Unit at this hospital has an **Information for Families** section on its website [www.sheffieldchildrenscrf.nhs.uk](http://www.sheffieldchildrenscrf.nhs.uk) or you could contact the hospital Clinical Research Support Unit:

Mrs Tracy N'Diaye  
Directorate Manager of Research  
Sheffield Children's NHS Foundation Trust  
Tel: 01142267904

**Thank you for taking the time to read this – please ask any questions if you need to.**

**Contact Claire Hill 01142267890**



## **PARENT/LEGAL GUARDIAN INFORMATION SHEET**

Child/young people participation

PHASE 3 QOL

### **Study Title**

Development of a Quality of Life measure for children with Osteogenesis Imperfecta (OI)

#### **1. Invitation paragraph**

Your child is being asked to take part in a research study. This is an educational study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully. Talk to others about the study if you wish.

Ask us if there is anything that is not clear or if you would like more information (contact: Claire Hill on 01142267890). Take time to decide whether or not you want your child to take part.



#### **2. What is the purpose of the study?**

We have developed a Quality of Life measure to assess how children and young people feel about having Osteogenesis Imperfecta (Brittle Bone Disease). We now want to work out if it is a valid, reliable and useful tool. There are five sections in total (Phases 1a, 1b, 1c, 2 and 3), and by random selection you or your child may be invited to take part in three of the five sections. This is Phase 3 and you may also have been invited to take part in Phase 1 or 2. This research is part of an educational qualification.

#### **3. Why has my child been chosen?**

Your child has been chosen because they have Osteogenesis Imperfecta (Brittle Bone Disease), and they attend Sheffield Children's Hospital for treatment or review. We are asking up to 150 children and young people to take part in this phase.

Osteogenesis Imperfecta (OI) is Brittle Bone Disease. It means that their bones can break easier and that their joints may be bendier than their friends, brothers and sisters.

To further develop a useful quality of life measure for children and young people with Osteogenesis Imperfecta we need to find out what living with the condition is really like. We have already developed the Quality of Life measure by asking children, young people with OI and their parents/carers what they think should be included. This stage of the research will tell us if the newly developed Quality of Life measure is valid, reliable and useful.

#### **4. Does my child have to take part?**

No. It is entirely up to you and your child (wherever possible) to decide whether or not to take part. You are both free to withdraw from the research at any time without giving a reason. Your decisions about this will not affect the standard of care your child will receive.

If you are happy for your child to take part, and are happy with the explanations from the research team, you will be asked to sign a consent form. If your child is able to understand the research and is happy to take part and can write their name, they will be asked to sign an assent form with you, if they want to. You will be given a copy of the information sheet and the signed consent/assent forms to keep for your records.

You can agree to your child taking part in this section of the research alone if you prefer, or agree to them taking part in more than one section as they arise. Completing the reply slip enclosed will let the researchers know what you would like your child to be included in.

#### **5. What will happen to my child if we agree to take part?**

If you agree to take part we will arrange a date and time convenient for your child to come to Sheffield Children's Hospital to coincide with their routine appointment or inpatient admission.

We would like your child, with your help if necessary, to undertake the newly developed Quality of Life assessment and two other well known assessments that measure Quality of Life. We will then contact them one week later by post, and 3 months later during a routine visit to Sheffield, to repeat the assessments.

We will use the information to further develop the Quality of Life measure for children and young people with Brittle Bone Disease. When the Quality of Life measure is developed we will send them a copy.

There will be no extra blood tests or x-rays. You can stay with them during the assessment if they would prefer that.

## **6. What will we be asked to do?**

We would like your child, with your help if necessary, to repeat three Quality of Life assessments on three separate occasions.

- Firstly, we would like them (with your help if necessary) to undertake the newly developed Quality of Life assessment and two other well known assessments that measure Quality of Life, during a routine visit to Sheffield Children's Hospital.
- We would then like to contact them by post one week later and ask them (with your help if necessary) to repeat the three Quality of Life assessments at home. We will also ask them if their health has changed over the last week.
- Three months later during a routine visit to Sheffield Children's Hospital we will then ask them (with your help if necessary) to repeat the three assessments again.

## **7. What are the possible disadvantages and risks of taking part?**

None. We want to further develop a Quality of Life measure to enable us to assess how children and young people with Brittle Bone Disease feel about their daily life. We hope this new quality of life measure will help us care for children and young people better.

If we find out something that we think is important about your child's Brittle Bone Disease, we will talk to you and ask if you want to come back and have your child checked again at the hospital.

## **8. What are the possible benefits of taking part?**

Your child will not benefit from being part of this study. However, the information we collect will help us to further develop the Quality of Life measure. We hope the new Quality of Life measure will improve the care of other children and young people with Brittle Bone Disease (OI).

## **9. What happened when the research study stops?**

We will collate everyone's assessments and use the information to calculate how valid and reliable the newly developed Quality of Life measure is for children and young people with Brittle Bone Disease. If your child has also taken part in the functional assessment tool section of this study we will compare the scores to give us more information about assessing children and young people with Brittle Bones.

**10. What if there is a problem?**

Any complaint about the way you or your child have been dealt with during the study or any possible harm you or your child might suffer will be addressed. If you have any cause to complain about any aspect of the way in which you have been approached or treated during the course of this study, the normal National Health Service complaints mechanisms are available to you and you are not compromised in any way because you have taken part in a research study.

**11. Will my child's taking part in the research project be confidential?**

Yes. We will follow ethical and legal practice and all information about your child will be handled in confidence. All information which is collected about your child during the course of the research will be kept strictly confidential. Any information about your child which leaves the hospital will have their name and address removed so that they cannot be recognised from it. Once the study is complete all information will be destroyed.

**12. Contact for any further information**

If you would like any further information about this study you could contact:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
01142267890



**13. What if new information becomes available?**

Sometimes during the course of a research project, new information becomes available about Osteogenesis Imperfecta. If this happens, someone from the research team will tell you and your child about it and discuss whether you want your child to continue the study. If you change your mind this will not affect any care your child receives whilst in hospital. If you decide to continue in the study you and your child will be asked to sign an updated consent/assent form.

**14. What will happen if we don't want to carry on with the research?**

If you withdraw from the study we will destroy all your child's identifiable samples if you wish, but we will need to use the data collected up to their withdrawal.

**15. What if there is a problem?**

**Complaints**

If you have any cause to complain about any aspect of the way in which you or your child has been approached or treated during the course of this study, the

normal National Health Service complaints mechanisms are available to you and you are not compromised in any way because you have taken part in a research study. If you have any complaints or concerns please contact either the project co-ordinator:

Claire Hill  
Clinical Specialist Physiotherapist  
Metabolic Bone Disease Team  
Sheffield Children's Hospital  
Tel: 01142267890



Or the hospital complaints co-ordinator:

Mrs Linda Towers  
Patient Advice and Liaison Co-ordinator  
Sheffield Children's Hospital NHS Foundation Trust  
Tel: 01142717594

## **Harm**

If your child is harmed by taking part in this research project, there are no special compensation arrangements. If your child is harmed due to someone else's fault, then you may have grounds for a legal action – but you may have to pay for it.

### **16. Will taking part in this study be kept confidential?**

All information which is collected about your child during the course of the research will be kept strictly confidential. Any information about your child which leaves the hospital will have their name and address removed so that your child cannot be recognised from it. Once the study is complete all information will either be destroyed or kept in your child's confidential notes.

Our procedures for handling, processing, storage and destruction of data are compliant with the Data Protection Act 1998.

Your child's transcript will be given a number; their name will be changed. Your child's medical notes may also be looked at by other people within the hospital involved in the running and supervision of the study to check that it is being carried out correctly.

### **17. What happens to the results of the research study?**

When the study has finished we will present our findings to other doctors, nurses and therapists and we will put the results in medical magazines and websites that health professionals use. We would also like to put a brief summary on the hospital research website and on the Brittle Bone Society website, so that you will be able to read about our results too. This will be

available at the end of the study, on [www.sheffieldchildrenscrf.nhs.uk](http://www.sheffieldchildrenscrf.nhs.uk). The results will also be included as part of the chief investigators educational qualification. The results will be anonymous, which means that your child will not be identified from them.

**18. Who is organising and funding the research?**

Researchers at Sheffield Children's NHS Foundation Trust are organising the study. They will not get any extra money for doing this.

**19. Who has reviewed the study?**

This study was given a favourable ethical opinion for conduct in the NHS by Sheffield Research Ethics Committee.

It has also been checked by the research department at the Sheffield Children's NHS Foundation Trust.

**20. How can we find out more about research?**

The Clinical Research Support Unit at this hospital has an **Information for Families** section on its website [www.sheffieldchildrenscrf.nhs.uk](http://www.sheffieldchildrenscrf.nhs.uk) or you could contact the hospital Clinical Research Support Unit:

Mrs Tracy N'Diaye  
Directorate Manager of Research  
Sheffield Children's NHS Foundation Trust  
Tel: 01142267904

**Thank you for taking the time to read this – please ask any questions if you need to.**

**Contact Claire Hill 01142267890**





Patient study number:

**CONSENT FORM FOR YOUNG ADULTS 16-18 YEARS**

**Title of project:** Development of an Osteogenesis Imperfecta (OI) quality of life measure and validation and reliability of the OI specific assessment tool.

**Phase (delete as appropriate)**

- Phase 1 – Interview
- Phase 1 – Focus Group 1
- Phase 1 – Focus Group 2
- Phase 2 – Pilot Study
- Phase 3 – Quality of life section

Names of researchers:

- |  |   |
|--|---|
|  | <b>Please initial<br/>box</b>                           |
| 1. I confirm that I have read and understand the information sheet dated 12/03/10 (version 3.0) for the above study and have had the opportunity to ask questions.   | <input style="width: 80px; height: 30px;" type="text"/> |
| 2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected.  | <input style="width: 80px; height: 30px;" type="text"/> |
| 3. I understand that my interview/focus group/assessment will be recorded and I give my permission for this.   | <input style="width: 80px; height: 30px;" type="text"/> |
| 4. I understand that sections of any of my clinical record may be looked at by researchers and those involved in the running and supervision of the study from Sheffield Children's NHS Foundation Trust where it is relevant to my taking part in research. I give permission for these individuals to have access to my records. | <input style="width: 80px; height: 30px;" type="text"/> |
| 5. I understand that relevant sections of my data collected during the study, may be looked at by individuals from regulatory authorities or from the NHS Trust, where it is relevant to my taking part in this research. I give my permission for these individuals to have access to my records.                                 | <input style="width: 80px; height: 30px;" type="text"/> |
| 6. I agree to take part in the above study.  | <input style="width: 80px; height: 30px;" type="text"/> |

Name of Patient	Date	Signature
Name of Person taking consent (if different from researcher)	Date	Signature
Researcher	Date	Signature

1 copy for patient; 1 copy for researcher; 1 copy to be kept with hospital notes



Patient study number:

**PARENT/LEGAL GUARDIAN/HEALTH PROFESSIONAL CONSENT FORM**

**Title of project:** Development of an Osteogenesis Imperfecta (OI) quality of life measure and validation and reliability of the OI specific assessment tool.

**Phase (delete as appropriate)**

- Phase 1 – Interview
- Phase 1 – Focus Group 1
- Phase 1 – Focus Group 2
- Phase 2 – Pilot Study
- Phase 3 – Quality of life section

Names of researchers:

- |  | <b>Please initial<br/>box</b>                           |
|--|---|
| 1. I confirm that I have read and understand the information sheet dated 12/03/10 (version 3.0) for the above study and have had the opportunity to ask questions.   | <input style="width: 80px; height: 30px;" type="text"/> |
| 3. I understand that my/my child's participation is voluntary and that I am free to withdraw myself/my child at any time, without giving any reason, without my child's medical care or legal rights being affected.   | <input style="width: 80px; height: 30px;" type="text"/> |
| 3. I understand that my/my child's interview/focus group/assessment will be recorded and I give my permission for this.  | <input style="width: 80px; height: 30px;" type="text"/> |
| 4. I understand that sections of any of my child's clinical record may be looked at by researchers and those involved in the running and supervision of the study from Sheffield Children's NHS Foundation Trust where it is relevant to my child taking part in research. I give permission for these individuals to have access to my child's records. | <input style="width: 80px; height: 30px;" type="text"/> |
| 5. I understand that relevant sections of my/my child's data collected during the study, may be looked at by individuals from regulatory authorities or from the NHS Trust, where it is relevant to my/my child taking part in this research. I give my permission for these individuals to have access to my/my child's records.                        | <input style="width: 80px; height: 30px;" type="text"/> |
| 6. I agree to my/my child taking part in the above study.  | <input style="width: 80px; height: 30px;" type="text"/> |

Name of Parent/Guardian/AHP	Date	Signature
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Name of Person taking consent (if different from researcher)	Date	Signature
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Researcher	Date	Signature
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1 copy for parent/AHP; 1 copy for researcher; 1 copy to be kept with hospital notes

## Appendix 6

### Interview Schedule

#### Interview Schedule

##### Introduction

This study is being performed to find out about the quality of life of children and adolescents with Osteogenesis Imperfecta (OI).

We will be doing interviews and also some focus groups with parents, children, young people and health professionals.

The study is for an educational qualification and no funding has been sought for this section of the study. We have been given a small amount of funding for the later sections of this study which incorporates an assessment tool, and you might find you are invited to that at some point, but you don't have to take part in part 2.

The aim of today is to have an informal chat/discussion to get an idea about your views and opinions of what it is like to parent a child with OI, and how it affects their health and quality of life.

There are no right or wrong answers, we just want your views and experience.

If any questions arise during the interview about your child's' health or care, we can discuss them at the end of the interview. If we discuss anything during the interview which could put in place to improve your child's care or well being, we will again chat about this after the interview has finished.

I know you know me as a Physiotherapist in the Metabolic Bone Disease Team here in Sheffield, but for the purpose of this interview I will be just a researcher. I may ask some questions that you think I should already know the answers to, but this information is for the tape, and will help me with the analysis.

I would like to make you aware that I will be using a Dictaphone to record the interview to help the analysis. The information will remain anonymous and any reports will have names altered, this will prevent you being identified from your comments and opinions.

Have you had a copy of the information sheet and do you have any questions before we start?

Have you had a chance to sign the consent form?

I know we already know each other, but could you tell me about yourself:

your age

where you live

whose in your family

do you work

do you have hobbies or interests outside of the family

holidays etc

Does OI impact on any of these?

Could you describe yours and your child's day from getting up to going to bed

Who helps

What do you have to do differently?

What is it like to have a child with OI?

How do you think having a child with OI compares to parenting a child with another condition?

What are the positives or negatives?

If you have other children, how does parenting them differ, or doesn't it?

Do you think your child has the same opportunities as their siblings or peers?

Why do you think it differs

Can they access the same hobbies, schools, extra curricular stuff?

How does this make them/you feel?

Your child is doing well at the minute.....

Why do you think that is?

How does that make them feel?

How does it make you feel?

What does the rest of the family think?

How do their friends act about it?

Your child has had a run of fractures recently.....

Why do you think that is?

How does that make them feel?

How does it make you feel?

What does the rest of the family think?

How do their friends act about it?

What is it like when your child has a fracture?

How do they feel?

How do you feel?

How does it affect their life?

Does it affect family life?

Do you have to do things differently?

What do you think about coming into hospital?

Is it easy?

What could be better?

LAST QUESTION

We can't get rid of your child's OI, but if there was one thing we could change or improve, what would it be?

SUMMERISE THE DISCUSSION

DURING THIS INTERVIEW I THINK WE TALKED ABOUT.....

THANKS ETC.....

## **Interview Schedule small children**

### Introduction

This study is being done to see what children think about having Brittle Bones.

We will be doing interviews and some group chats with parents, children, and medical people. You might find you are invited to other sections of the study at some point, but you don't have to take part if you don't want to.

The aim of today is to have a chat to find out what you think about having brittle bones, and if you have to do things differently because of it.

There are no right or wrong answers, we just want to find out what you think.

If you have any questions about your brittle bones or your care we can chat about those once the interview has finished.

I know you know me as a Physiotherapist, but during this interview I will be a researcher. I may ask some questions that you think I should already know the answers to, but this information is for the tape, and will help me write it up.

I would like to let you know that I am recording this interview, so that I can type it up later. I will give you a different name when I type it up, so you cannot be identified from what you say.

Have you read the information sheet and do you have any questions before we start?

Have you had a chance to sign the assent form?

Has your mummy/daddy/carer signed the consent form?

I know we already know each other, but could you tell me about yourself:

your age

where you live

whose in your family

do you work

do you have hobbies or interests outside of the family

holidays etc

Does your brittle bones mean you have to do things differently?

Could you describe your day from getting up to going to bed

Who helps

What do you have to do differently?

What is it like to have brittle bones?

What are the good and bad parts of having brittle bones?

Can you do the same things your friends and brothers/sister do?

Why do you think it's different?

Can you do the same hobbies, schools, extra curricular stuff?

How does this make you feel?

You are doing well at the minute.....

Why do you think that is?

How does that make you feel?

What does the rest of the family think?

How do your friends act about it?

You have had a run of fractures recently.....

Why do you think that is?

How does that make you feel?

What does the rest of the family think?

How do your friends act about it?

What is it like when you have a fracture?

How do you feel?

How does it affect your life?

Do you have to do things differently?

What do you think about coming into hospital?

Is it easy?

What could be better?

LAST QUESTION

We can't get rid of your brittle bones, but if there was one thing we could change or improve, what would it be?

SUMMERISE THE DISCUSSION

DURING THIS INTERVIEW I THINK WE TALKED ABOUT.....Thanks etc.

## **Interview Schedule CHILDREN/ADOLESCENTS**

### Introduction

This study is being performed to find out about the quality of life of children and adolescents with Osteogenesis Imperfecta (OI).

We will be doing interviews and also some focus groups with parents, children, young people and health professionals.

The study is for an educational qualification and no funding has been sought for this section of the study. We have been given a small amount of funding for the later sections of this study which incorporates an assessment tool, and you might find you are invited to that at some point, but you don't have to take part in part 2.

The aim of today is to have an informal chat/discussion to get an idea about your views and opinions of what it is like to have OI, and how it affects your health and quality of life.

There are no right or wrong answers, we just want your views and experience.

If any questions arise during the interview about your health or care, we can discuss them at the end of the interview. If we discuss anything during the interview which could put in place to improve your care or well being, we will again chat about this after the interview has finished.

I know you know me as a Physiotherapist in the Metabolic Bone Disease Team here in Sheffield, but for the purpose of this interview I will be just a researcher. I may ask some questions that you think I should already know the answers to, but this information is for the tape, and will help me with the analysis.

I would like to make you aware that I will be using a Dictaphone to record the interview to help the analysis. The information will remain anonymous and any reports will have names altered, this will prevent you being identified from your comments and opinions.

Have you had a copy of the information sheet and do you have any questions before we start?

Have you had a chance to sign the consent form?

I know we already know each other, but could you tell me about yourself:

your age

where you live

whose in your family

do you go to school or work

do you have hobbies or interests outside of the family

holidays etc

Does having OI effect any of these?

Could you describe your day from getting up to going to bed?

Who helps

What do you have to do differently?

What is it like to have OI?

How do you think having OI compares to your friends or siblings who don't have it?

What are the positives or negatives?

Do you think you have had the same opportunities as your siblings or peers?

Can you access the same hobbies, schools, extra curricular stuff?

How does this make you feel?

You are doing well at the minute.....

Why do you think that is?

How does that make you feel?

What does the rest of the family think?

How do your friends act about it?

You have had a run of fractures recently.....

Why do you think that is?

How does that make you feel?

What does the rest of the family think?

How do your friends act about it?

What is it like when you have a fracture?

How do you feel?

How does it affect your life?

Does it affect family life?

Do you have to do things differently?

What do you think about coming into hospital?

Is it easy?

What could be better?

LAST QUESTION

We can't get rid of your OI, but if there was one thing we could change or improve, what would it be?

SUMMERISE THE DISCUSSION

DURING THIS INTERVIEW I THINK WE TALKED ABOUT.....

THANKS ETC.....

## **Interview Schedule HP**

### Introduction

This study is being performed to find out about the quality of life of children and adolescents with Osteogenesis Imperfecta (OI).

We will be doing interviews and also some focus groups with parents, children, young people and health professionals.

The study is for an educational qualification and no funding has been sought for this section of the study. We have been given a small amount of funding for the later sections of this study which incorporates an assessment tool, and you might find you are invited to that at some point, but you don't have to take part in part 2.

The aim of today is to have an informal chat/discussion to get an idea about your views and opinions of what it is like to work with children with OI, and how OI affects their health and quality of life.

There are no right or wrong answers, we just want your views and experience.

I know you know me as a Physiotherapist in the Metabolic Bone Disease Team here in Sheffield, but for the purpose of this interview I will be just a researcher. I may ask some questions that you think I should already know the answers to, but this information is for the tape, and will help me with the analysis.

I would like to make you aware that I will be using a Dictaphone to record the interview to help the analysis. The information will remain anonymous and any reports will have names altered, this will prevent you being identified from your comments and opinions.

Have you had a copy of the information sheet and do you have any questions before we start?

Have you had a chance to sign the consent form?

I know we already know each other, but could you tell me about yourself:

your age

Where you work and for how long have you worked there

What is your experience of children with OI

What does your job entail?

How do you think your job helps the child and their family with OI?

What in your view are the main problems that arise for children with OI and their families?

How do you think OI impacts on the life of a child with OI?

How do you think fractures impact on the life of a child with OI and their family?

What are the positives and negatives for a child with OI and their family?

Do you think a child with OI has the same opportunities as their siblings or peers?

Why do you think it differs?

Can they access the same hobbies, schools, extra curricular stuff?

How does this make them/you feel?

What do you understand by quality of life?

What do think quality of life means to children and families with OI?

LAST QUESTION

If there is one thing we could change or improve for a child with OI what would it be?

SUMMERISE THE DISCUSSION

DURING THIS INTERVIEW I THINK WE TALKED ABOUT.....

THANKS ETC.....

## Interview Schedule

### Phase 2

#### Pilot Study

#### Young People/Young Adults

This study is being performed to find out about the quality of life of children and adolescents with Osteogenesis Imperfecta (OI).

Thank you for agreeing to take part and completing the Quality of Life questionnaire. We now want to get some information from you regarding what you thought of the questionnaire. We will be interviewing 30 children and young people in total, to find out what they thought about the questionnaire.

There are no right or wrong answers, we just want your thoughts and opinions.

If any questions arise during the interview about your health or care, we can discuss them at the end of the interview. If we discuss anything during the interview which could put in place to improve your care or well being, we will again chat about this after the interview has finished.

I know you know me as a Physiotherapist in the Metabolic Bone Disease Team here in Sheffield, but for the purpose of this interview I will be just a researcher. I may ask some questions that you think I should already know the answers to, but this information is for the tape, and will help me with the analysis.

I would like to make you aware that I will be using a Dictaphone to record the interview to help the analysis. The information will remain anonymous and any reports will have names altered, this will prevent you being identified from your comments and opinions.

Have you had a copy of the information sheet and do you have any questions before we start?

Have you had a chance to sign the consent form?

Could you tell me your name and age for the tape?

What did you think about the questionnaire?

Was it easy to answer?

Were there any questions that you didn't understand?

Were there any questions that didn't make sense?

Were there any questions that you didn't like or didn't want to answer?

Did any questions upset you?

What did you think to the scoring?

Always      Most of the time      Sometimes      Not much      Never

Did you understand all of the words?

Such as:      Freedom  
                 Handling  
                 The need for equipment

Did you like that format?

And the last question....

Could we make it better?

Ok, to sum up.....

## Appendix 7

### Early versions and thoughts around item development

#### Themes – Dimensions

##### Dimension 1

##### Being safe and careful

Items validated from FG

Thinking about your last week.....

Does someone give you extra help at school to keep you safe?

Always      Almost Always      Sometimes      Almost Never      Never

Or

Always                                  Sometimes                                  Never

Do you avoid busy areas to keep safe? Focus group 1

Do you keep away from busy areas to keep safe?

Do you keep away from crowds to keep safe?

Do you leave lessons early to avoid crowds at school? Focus group 1

Do you try to keep safe to avoid breaking a bone?

Do you avoid some activities to stop you having a broken bone?

Do you keep away from some activities to avoid having a broken bone?

Do you keep away from some activities to stop you having a fracture?

Do you think before playing sports to avoid having a fracture?

Do you think before playing with your friends to stop you having a broken bone?

## Dimension 2

### Reduced Function

#### Items

Thinking about your last week.....

Are you tired in the day?

Always Almost Always Sometimes Almost Never Never

Or

Always Sometimes Never

Have you felt tired in the day? Focus group 2

Have you felt tired by the end of the day?

Do you have to rest in the day? Focus group 2

Do you have to take rests in the day?

Do you find it hard to get out of bed in the morning? Focus group 1

Has having a broken bone stopped you doing things?

Does having a fracture stop you doing things?

Are things more difficult because you have had a fracture?

Is it more difficult to move around because of a fracture?

Have you had to do things differently because of a fracture?

Have you had to do things differently because of a broken bone? Focus group 1

Has having a fracture stopped you going to school?

Has having a broken bone stopped you going to school?

Do you have to use equipment to move around? **“Did” or “Do”?**

Does equipment help you to move around?

Do you have to use equipment to help at school?

Do you have to use equipment to help at home?

Do you have extra help from someone at home?



## Dimension 4

### Fear

#### Items

Thinking about your last week.....

Have you been worried about breaking a bone?

Always      Almost Always      Sometimes      Almost Never      Never

Or

Always                      Sometimes                      Never

Are you worried about breaking a bone?

Do you get scared about breaking a bone?

Did you get scared you might have broken a bone when you heard a click? FG  
1

Do you get scared about doing activities which might lead to fracture?

Do you get scared about doing something that might make you break a bone?

Did you get scared about what would happen if you did break a bone? Bit  
vague, from FG 1/2

Are you worried about coming into hospital?

Do you worry about coming into hospital?

Do you get scared about needles?

Are you scared about needles?

Do you get scared about having a blood test?

Struggling with wording around this one....

Did you trust people to handle you well?

I worry about new people handling me?

Did you worry someone would handle you wrong and cause a fracture?



## Dimension 6

### Independence

#### Items

Thinking about your last week.....

Do you like to do things for yourself?

Did you like to do things for yourself?

Always            Almost Always            Sometimes            Almost Never            Never

Or

Always                            Sometimes                            Never

Do you like to be independent?

Were you independent?

Do your family encourage you to do things for yourself?

Did your family encourage you to do things for yourself?

Have you as much independence as your friends?

Are you as independent as your friends?

Do you have as much freedom as your friends?

Do you have as much freedom as your friends at school?

Do your family let you make your own decision about what is safe?

Do your family over protect you?     Do young children understand over protection

Do the teachers at school over protect you?     FG1

Do the staff at school over protect you?     FG1

Do your family let you choose your own activities?

Do your family allow you to decide what is safe?     Lola FG 1

## Early version

### Being safe and careful

Thinking about your last week.....

Does someone give you extra help to keep you safe?

Always	Almost Always	Sometimes	Almost Never	Never
<i>Always</i>	<i>Most of the time</i>	<i>Sometimes</i>	<i>Not much</i>	<i>Never</i>

Do you keep away from busy areas to keep safe?

Always	Almost Always	Sometimes	Almost Never	Never
--------	---------------	-----------	--------------	-------

Do you keep away from crowds to keep safe?

Always	Almost Always	Sometimes	Almost Never	Never
--------	---------------	-----------	--------------	-------

Do you try to keep safe to stop you breaking a bone?

Always	Almost Always	Sometimes	Almost Never	Never
--------	---------------	-----------	--------------	-------

Do you keep away from some activities to stop you having a broken bone?

Always	Almost Always	Sometimes	Almost Never	Never
--------	---------------	-----------	--------------	-------

Do you think before playing sports to avoid having a broken bone?

Always	Almost Always	Sometimes	Almost Never	Never
--------	---------------	-----------	--------------	-------

Amelia's suggestion on new 5 pt scale

**Reduced Function**

Thinking about your last week.....

Have you felt tired in the day?

Always      Almost Always      Sometimes      Almost Never      Never

Have you felt tired by the end of the day?

Always      Almost Always      Sometimes      Almost Never      Never

Do you have to take rests in the day?

Always      Almost Always      Sometimes      Almost Never      Never

Has having a broken bone stopped you doing things?

Always      Almost Always      Sometimes      Almost Never      Never

Has it been more difficult to move around because of a broken bone?

Always      Almost Always      Sometimes      Almost Never      Never

Have you had to do things differently because of a broken bone?

Always      Almost Always      Sometimes      Almost Never      Never

Do you use equipment to help you move around?

Always      Almost Always      Sometimes      Almost Never      Never

Do you have to use special equipment to help at school or home?

Always      Almost Always      Sometimes      Almost Never      Never

## **Pain**

Thinking about your last week.....

Have you had pain in your back?

Always      Almost Always      Sometimes      Almost Never      Never

Have you had pain in your legs or arms?

Always      Almost Always      Sometimes      Almost Never      Never

Have you had to take medicine for pain?

Always      Almost Always      Sometimes      Almost Never      Never

Have you had to take medicine because you broke a bone?

Always      Almost Always      Sometimes      Almost Never      Never

Did you have pain because you had a broken bone?

Always      Almost Always      Sometimes      Almost Never      Never

Have you missed meeting up with your friends because you had pain?

Always      Almost Always      Sometimes      Almost Never      Never

### **Fear**

Thinking about your last week.....

Have you been worried about breaking a bone?

Always      Almost Always      Sometimes      Almost Never      Never

Do you get scared about doing something that might make you break a bone?

Always      Almost Always      Sometimes      Almost Never      Never

Do you worry about coming into hospital?

Always      Almost Always      Sometimes      Almost Never      Never

Do you get scared about needles?

Always      Almost Always      Sometimes      Almost Never      Never

Did you worry that someone might move you wrong and cause a broken bone?

Always      Almost Always      Sometimes      Almost Never      Never

Have you worried about new people handling you?

Always      Almost Always      Sometimes      Almost Never      Never

**Isolation**      Note scoring system reversed.....always is good!

Thinking about your last week.....

Did you see your friends outside of school?

Always      Almost Always      Sometimes      Almost Never      Never

Are you able to do everything your friends do?

Always      Almost Always      Sometimes      Almost Never      Never

Did you get to do lots of different activities?

Always      Almost Always      Sometimes      Almost Never      Never

Did you do PE at school?

Always      Almost Always      Sometimes      Almost Never      Never

Do you feel different because you have to be more careful than your friends?

Always      Almost Always      Sometimes      Almost Never      Never

Have people treated you differently because you have brittle bones?

Always      Almost Always      Sometimes      Almost Never      Never

**Independence**      Note scoring system reversed.....always is good!

Thinking about your last week.....

Did you like to do things for yourself?

Always      Almost Always      Sometimes      Almost Never      Never

Did your family encourage you to do things for yourself?

Always      Almost Always      Sometimes      Almost Never      Never

Do you have as much freedom as your friends?

Always      Almost Always      Sometimes      Almost Never      Never

Do your family **let you** make your own decision about what is safe?

Always      Almost Always      Sometimes      Almost Never      Never

Do the teachers at school over protect you?

Do the teachers at school allow you as much freedom as you would like?

Always

Almost Always

Sometimes

Almost Never

Never

Do your family let you choose your own activities?

Always

Almost Always

Sometimes

Almost Never

Never

New suggestion by Primary school teacher LJ.

Appendix 8  
PedsQL

# PedsQL<sup>TM</sup>

## Paediatric Quality of Life Inventory

Version 4.0 – UK English

### YOUNG CHILD REPORT (ages 5-7)

Instructions for interviewer:

***I am going to ask you some questions about things that might be a problem for some children. I want to know how much of a problem any of these things might be for you.***

Show the child the template and point to the responses as you read.

***If it is not at all a problem for you, point to the smiling face.***

***If it is sometimes a problem for you, point to the middle face.***

***If it is a problem for you a lot, point to the frowning face.***

***I will read each question. Point to the pictures to show me how much of a problem it is for you. Let's try a practice one first.***

	Not at all	Sometimes	A lot
Is it hard for you to click your fingers?			

Ask the child to demonstrate clicking his or her fingers to determine whether or not the question was answered correctly. Repeat the question if the child demonstrates a response that is different from his or her action.

***Think about how you have been doing for the last few weeks. Please listen carefully to each sentence and tell me how much of a problem this is for you.***

After reading the item, gesture to the template. If the child hesitates or does not seem to understand how to answer, read the response options while pointing at the faces.

<b>PHYSICAL FUNCTIONING (problems with...)</b>	<b>Not at all</b>	<b>Sometimes</b>	<b>A lot</b>
1. Is it hard for you to walk?	0	2	4
2. Is it hard for you to run?	0	2	4
3. Is it hard for you to play sports or exercise?	0	2	4
4. Is it hard for you to lift big things?	0	2	4
5. Is it hard for you to have a bath or shower?	0	2	4
6. Is it hard for you to help in the home (like picking up your toys)?	0	2	4
7. Do you have aches and pains? (Where? _____)	0	2	4
8. Do you ever feel too tired to play?	0	2	4

**Remember, tell me how much of a problem this has been for you for the last few weeks.**

<b>EMOTIONAL FUNCTIONING (problems with...)</b>	<b>Not at all</b>	<b>Sometimes</b>	<b>A lot</b>
1. Do you feel scared?	0	2	4
2. Do you feel sad?	0	2	4
3. Do you feel angry?	0	2	4
4. Do you have trouble sleeping?	0	2	4
5. Do you worry about what will happen to you?	0	2	4

<b>SOCIAL FUNCTIONING (problems with...)</b>	<b>Not at all</b>	<b>Sometimes</b>	<b>A lot</b>
1. Do you have trouble getting on with other children?	0	2	4
2. Do other children say they do not want to play with you?	0	2	4
3. Do other children tease you?	0	2	4
4. Can other children do things you cannot do?	0	2	4
5. Is it hard for you to keep up when you play with other children?	0	2	4

<b>SCHOOL FUNCTIONING (problems with...)</b>	<b>Not at all</b>	<b>Sometimes</b>	<b>A lot</b>
1. Is it hard for you to pay attention in school?	0	2	4
2. Do you forget things?	0	2	4
3. Do you have trouble keeping up with schoolwork?	0	2	4
4. Do you miss school because of not feeling well?	0	2	4
5. Do you miss school to go to the doctor or hospital?	0	2	4

**How much of a problem is this for you?**

Not at all



Sometimes



A lot



# PedsQL™

## Paediatric Quality of Life Inventory

Version 4.0 – UK English

### CHILD REPORT (ages 8-12)

#### DIRECTIONS

On the following page is a list of things that might be a problem for you. Please tell us **how much of a problem** each one has been for you during the **PAST MONTH** by circling:

- 0** if it is **never** a problem
- 1** if it is **almost never** a problem
- 2** if it is **sometimes** a problem
- 3** if it is **often** a problem
- 4** if it is **almost always** a problem

There are no right or wrong answers.  
If you do not understand a question, please ask for help.

In the **PAST MONTH**, how much of a **problem** has this been for you ...

<b>ABOUT MY HEALTH AND ACTIVITIES (problems with...)</b>	<b>Never</b>	<b>Almost Never</b>	<b>Sometimes</b>	<b>Often</b>	<b>Almost Always</b>
1. It is hard for me to walk more than a couple of streets (about 100 metres)	0	1	2	3	4
2. It is hard for me to run	0	1	2	3	4
3. It is hard for me to do sports activities or exercise	0	1	2	3	4
4. It is hard for me to lift heavy things	0	1	2	3	4
5. It is hard for me to have a bath or shower by myself	0	1	2	3	4
6. It is hard for me to do chores around the house	0	1	2	3	4
7. I have aches and pains	0	1	2	3	4
8. I feel tired	0	1	2	3	4

<b>ABOUT MY FEELINGS (problems with...)</b>	<b>Never</b>	<b>Almost Never</b>	<b>Sometimes</b>	<b>Often</b>	<b>Almost Always</b>
1. I feel afraid or scared	0	1	2	3	4
2. I feel sad	0	1	2	3	4
3. I feel angry	0	1	2	3	4
4. I have trouble sleeping	0	1	2	3	4
5. I worry about what will happen to me	0	1	2	3	4

<b>HOW I GET ON WITH OTHERS (problems with...)</b>	<b>Never</b>	<b>Almost Never</b>	<b>Sometimes</b>	<b>Often</b>	<b>Almost Always</b>
1. I have trouble getting on with other children	0	1	2	3	4
2. Other children do not want to be my friend	0	1	2	3	4
3. Other children tease me	0	1	2	3	4
4. I cannot do things that other children my age can do	0	1	2	3	4
5. It is hard to keep up when I play with other children	0	1	2	3	4

<b>ABOUT SCHOOL (problems with...)</b>	<b>Never</b>	<b>Almost Never</b>	<b>Sometimes</b>	<b>Often</b>	<b>Almost Always</b>
1. It is hard to pay attention in class	0	1	2	3	4
2. I forget things	0	1	2	3	4
3. I have trouble keeping up with my schoolwork	0	1	2	3	4
4. I miss school because of not feeling well	0	1	2	3	4
5. I miss school to go to the doctor or hospital	0	1	2	3	4

# PedsQL™

## Paediatric Quality of Life Inventory

Version 4.0 – UK English

### TEENAGER REPORT (ages 13-18)

#### DIRECTIONS

On the following page is a list of things that might be a problem for you. Please tell us **how much of a problem** each one has been for you during the **PAST MONTH** by circling:

- 0** if it is **never** a problem
- 1** if it is **almost never** a problem
- 2** if it is **sometimes** a problem
- 3** if it is **often** a problem
- 4** if it is **almost always** a problem

There are no right or wrong answers.  
If you do not understand a question, please ask for help.

In the **PAST MONTH**, how much of a **problem** has this been for you ...

<b>ABOUT MY HEALTH AND ACTIVITIES (problems with...)</b>	<b>Never</b>	<b>Almost Never</b>	<b>Some-times</b>	<b>Often</b>	<b>Almost Always</b>
1. It is hard for me to walk more than a couple of streets (about 100 metres)	0	1	2	3	4
2. It is hard for me to run	0	1	2	3	4
3. It is hard for me to do sports activities or exercise	0	1	2	3	4
4. It is hard for me to lift heavy things	0	1	2	3	4
5. It is hard for me to have a bath or shower by myself	0	1	2	3	4
6. It is hard for me to do chores around the house	0	1	2	3	4
7. I have aches and pains	0	1	2	3	4
8. I feel tired	0	1	2	3	4

<b>ABOUT MY FEELINGS (problems with...)</b>	<b>Never</b>	<b>Almost Never</b>	<b>Some-times</b>	<b>Often</b>	<b>Almost Always</b>
1. I feel afraid or scared	0	1	2	3	4
2. I feel sad	0	1	2	3	4
3. I feel angry	0	1	2	3	4
4. I have trouble sleeping	0	1	2	3	4
5. I worry about what will happen to me	0	1	2	3	4

<b>HOW I GET ON WITH OTHERS (problems with...)</b>	<b>Never</b>	<b>Almost Never</b>	<b>Some-times</b>	<b>Often</b>	<b>Almost Always</b>
1. I have trouble getting on with other teenagers	0	1	2	3	4
2. Other teenagers do not want to be my friend	0	1	2	3	4
3. Other teenagers tease me	0	1	2	3	4
4. I cannot do things that other teenagers my age can do	0	1	2	3	4
5. It is hard to keep up with other teenagers my age	0	1	2	3	4

<b>ABOUT SCHOOL / COLLEGE (problems with...)</b>	<b>Never</b>	<b>Almost Never</b>	<b>Some-times</b>	<b>Often</b>	<b>Almost Always</b>
1. It is hard to pay attention in class	0	1	2	3	4
2. I forget things	0	1	2	3	4
3. I have trouble keeping up with my school / college work	0	1	2	3	4
4. I miss school / college because of not feeling well	0	1	2	3	4
5. I miss school / college to go to the doctor or hospital	0	1	2	3	4

**Appendix 9**  
**EQ5D**



**Health Questionnaire**

*English version for the UK*  
*(validated for Ireland)*

By placing a tick in one box in each group below, please indicate which statements best describe your own health state today.

**Mobility**

- I have no problems in walking about
- I have some problems in walking about
- I am confined to bed

**Self-Care**

- I have no problems with self-care
- I have some problems washing or dressing myself
- I am unable to wash or dress myself

**Usual Activities** (*e.g. work, study, housework, family or leisure activities*)

- I have no problems with performing my usual activities
- I have some problems with performing my usual activities
- I am unable to perform my usual activities

**Pain/Discomfort**

- I have no pain or discomfort
- I have moderate pain or discomfort
- I have extreme pain or discomfort

### Anxiety/Depression

I am not anxious or depressed

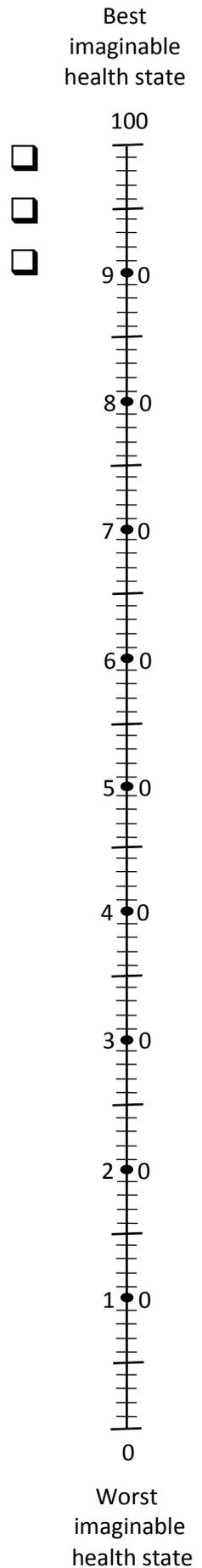
I am moderately anxious or depressed

I am extremely anxious or depressed

To help people say how good or bad a health state is, we have drawn a scale (rather like a thermometer) on which the best health state you can imagine is marked 100 and the worst state you can imagine is marked 0.

We would like you to indicate on this scale how good or bad your own health is today, in your opinion. Please do this by drawing a line from the box below to whichever point on the scale indicates how good or bad your health state is today.

**Your own  
health state  
today**



**Appendix 10**

**Global rating of health at 1 week and 3 months.**

**Has your health changed?**

**Since last week, has there been any change in your health or quality of life?**

**Has your health been:**

*(Please circle one only)*

**Worse**

**About the same**

**Better**

**Now please complete the questions on the next page.**

## Has your health changed?

Since your last visit to Sheffield, has there been any change in your health or quality of life?

Has your health been:

*(Please circle one only)*

Worse

About the same

Better

**Now please complete the questions on the next page.**

## Appendix 11

### SPSS Syntax for Being safe and careful dimension Transforming to 0-100 scores

- \* Being safe and careful dimension.
- \* Six items.
- \* No recoding required.
- \* A higher score is good and means less worry about being safe and careful.

\* Computing scale scores by summing across items in the same scale.

\* Calculating raw scale scores.

```
COMPUTE raw_safe=roiQ1+ roiQ2+ roiQ3+ roiQ4+ roiQ5+ roiQ6 .
```

\* Transforming raw scale scores to a 0-100 scale.

\* Transformed Scale = [(Actual raw score-lowest possible raw score)/Possible raw score range]\*100.

\* Calculating transformed scale scores.

```
COMPUTE Tsafe=((raw_safe-6)/24)*100.
```

```
VARIABLE LABELS raw_safe 'Raw OI PROM Being safe and careful dimension score'/
```

```
tsafe 'OI Being safe and careful dimension (0-100)'.  
Execute.
```

```
FREQUENCIES VARIABLES=Tsafe
```

```
/ORDER=ANALYSIS
```

## Appendix 12

Appendix 12: Item-item correlation for the 39-item OIQoL

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30	Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39		
Q1	1.00																																								
Q2	0.42**	1.00																																							
Q3	0.40**	0.72**	1.00																																						
Q4	0.60**	0.62**	0.58**	1.00																																					
Q5	0.33**	0.38**	0.32**	0.51**	1.00																																				
Q6	0.42**	0.32**	0.32**	0.46**	0.59**	1.00																																			
Q7	0.01	0.14	0.11	0.13	0.16	0.13	1.00																																		
Q8	0.07	0.12	0.12	0.04	0.22*	0.22*	0.49**	1.00																																	
Q9	0.17	0.06	0.12	0.15	0.27**	0.20	0.45**	0.42**	1.00																																
Q10	0.19	0.32**	0.17	0.25*	0.19	0.23*	-0.05	0.02	-0.11	1.00																															
Q11	0.19	0.27**	0.19	0.15	0.26*	0.24*	-0.04	0.10	0.10	0.73**	1.00																														
Q12	0.28**	0.34**	0.26**	0.20	0.20*	0.27**	-0.07	0.01	0.05	0.75**	0.86**	1.00																													
Q13	0.12	0.31**	0.18	0.18	0.08	-0.05	0.11	0.16	0.19	0.34**	0.35**	0.29**	1.00																												
Q14	0.18	0.41**	0.29**	0.38**	0.24*	0.10	0.27**	0.09	0.22*	0.12	0.21*	0.15	0.56**	1.00																											
Q15	-0.06	0.00	0.04	0.12	0.08	0.11	0.37**	0.34**	0.42**	-0.07	0.03	0.01	0.06	0.15	1.00																										
Q16	0.13	0.18	0.26**	0.11	0.08	0.22*	0.34**	0.36**	0.46**	-0.01	0.16	0.13	0.18	0.24*	0.41**	1.00																									
Q17	0.08	0.27**	0.25*	0.18	0.21*	0.27**	0.30**	0.15	0.37**	-0.01	0.16	0.09	0.20	0.36**	0.42**	0.53**	1.00																								
Q18	0.09	0.30**	0.33**	0.07	0.07	0.08	-0.05	0.01	0.04	0.56**	0.52**	0.66**	0.29**	0.17	-0.04	0.23*	0.23*	1.00																							
Q19	0.13	0.25*	0.25*	0.09	0.05	0.13	0.04	0.06	0.14	0.54**	0.59**	0.71**	0.26**	0.11	0.12	0.29**	.248*	0.78**	1.00																						
Q20	0.02	0.26*	0.09	0.06	0.20	0.10	0.13	0.14	0.14	0.37**	0.34**	0.33**	0.33**	0.31**	0.24*	0.31**	0.39**	0.38**	0.47**	1.00																					
Q21	0.29**	0.22*	0.18	0.33**	0.34**	0.36**	0.13	0.27**	0.31**	0.27**	0.36**	0.26*	0.16	0.15	0.29**	0.24*	0.16	0.17	0.29**	0.28**	1.00																				
Q22	0.14	0.14	0.04	0.14	0.34**	0.32**	0.21*	0.29**	0.25*	0.20*	0.33**	0.30**	0.14	0.17	0.25*	0.29**	0.25*	0.11	0.21*	0.34**	0.64**	1.00																			
Q23	0.01	0.01	0.01	0.15	0.27**	0.02	0.16	0.00	0.23*	-0.09	-0.01	-0.03	0.10	0.12	0.22*	0.11	0.11	-0.07	-0.06	0.18	0.17	0.32**	1.00																		
Q24	-0.05	-0.05	-0.17	-0.05	0.15	-0.11	0.16	-0.10	0.11	-0.08	-0.14	-0.10	0.15	0.10	0.09	-0.11	0.00	-0.15	-0.26*	0.12	0.09	0.22*	0.46**	1.00																	
Q25	0.15	0.05	-0.02	0.13	0.31**	0.27**	0.08	0.14	0.24*	0.28**	0.39**	0.34**	0.11	0.08	0.19	0.16	0.13	0.09	0.27**	0.29**	0.63**	0.65**	0.20	0.13	1.00																
Q26	0.29**	0.19	0.27**	0.22*	0.21*	0.12	-0.04	0.08	0.18	0.37**	0.47**	0.49**	0.15	0.17	0.07	0.17	0.03	0.31**	0.29**	0.20	0.41**	0.48**	0.18	0.12	0.57**	1.00															
Q27	0.14	0.17	0.26**	0.20*	0.25*	0.22*	0.04	-0.09	0.09	0.06	0.12	0.13	0.00	0.05	0.14	0.01	0.14	0.02	0.12	0.08	0.06	0.00	0.05	0.00	-0.01	0.02	1.00														
Q28	-0.21*	-0.08	-0.04	-0.19	-0.15	0.01	-0.10	-0.05	0.02	0.05	0.05	0.08	-0.15	-0.30**	0.15	0.12	0.06	0.10	0.16	-0.06	-0.14	-0.07	-0.12	-0.11	-0.01	0.17	-0.06	1.00													
Q29	0.08	0.25*	0.22*	0.15	0.33**	0.26*	0.13	0.23*	0.20*	0.21*	0.31**	0.23*	0.32**	0.29**	0.15	0.36**	0.29**	0.17	0.16	0.26*	0.29**	0.23*	0.18	0.22*	0.25*	0.10	0.14	0.11	1.00												
Q30	-0.17	0.02	0.00	-0.07	0.06	0.00	-0.07	-0.09	-0.02	0.06	0.13	0.05	0.00	-0.16	0.11	0.11	0.09	-0.02	0.06	0.19	0.12	0.22*	0.27**	0.19	0.20	0.10	0.21*	0.29**	0.39**	1.00											
Q31	0.12	-0.02	-0.08	-0.08	0.05	0.03	0.10	0.13	0.00	0.21*	-0.01	0.09	0.14	0.02	-0.05	0.03	-0.02	0.19	0.15	0.22*	0.07	0.10	0.04	0.14	0.14	-0.06	-0.13	-0.12	0.06	-0.15	1.00										
Q32	0.04	-0.01	0.04	-0.05	-0.07	-0.04	0.16	0.19	0.02	0.17	-0.05	-0.02	0.21*	0.10	0.06	0.09	-0.05	0.13	0.11	0.10	0.13	0.07	0.04	-0.06	0.07	0.00	0.02	-0.03	0.12	-0.10	0.43**	1.00									
Q33	-0.08	-0.12	-0.19	-0.13	-0.03	0.01	-0.05	-0.04	-0.05	0.03	-0.11	-0.14	-0.09	-0.22*	0.09	0.04	0.02	-0.06	-0.06	0.02	0.07	0.12	0.09	0.24*	0.02	0.02	0.02	0.37**	0.22*	0.52**	-0.11	-0.02	1.00								
Q34	0.08	0.14	0.24*	0.06	0.09	-0.01	-0.13	0.11	0.02	0.02	0.08	0.02	0.15	0.04	0.07	0.15	0.07	0.04	0.03	-0.08	-0.06	-0.03	0.04	-0.07	-0.14	0.03	0.13	0.00	0.24*	0.01	-0.10	-0.06	0.03	1.00							
Q35	0.12	0.24*	0.25*	0.27**	0.31**	0.18	0.19	0.17	0.21*	0.15	0.17	0.16	0.22*	0.31**	0.20	0.23*	0.18	0.09	0.11	0.09	0.07	0.18	0.28**	0.22*	0.07	0.18	0.24*	0.18	0.60**	0.24*	-0.08	0.15	0.11	0.41**	1.00						
Q36	0.01	0.06	0.07	0.05	0.11	0.06	0.14	0.14	0.11	-0.01	0.14	0.14	0.13	0.06	0.25*	0.22*	0.13	-0.13	-0.01	0.03	0.14	0.29**	0.18	0.20	0.14	0.19	0.00	0.15	0.36**	0.24*	-0.24*	-0.04	0.24*	0.19	0.45**	1.00					
Q37	0.21*	0.24*	0.18	0.28**	0.39**	0.44**	0.24*	0.32**	0.22*	0.21*	0.27**	0.16	0.08	0.22*	0.14	0.25*	0.18	0.06	0.09	0.33**	0.48**	0.49**	0.18	0.13	0.33**	0.25*	0.20	-0.05	0.40**	0.20	0.06	0.07	0.13	0.04	0.35**	0.19	1.00				
Q38	0.17	0.19	0.13	0.13	0.24*	0.24*	0.25*	0.24*	0.25*	0.25*	0.27**	0.16	0.16	0.27**	0.12	0.25*	0.25*	0.17	0.15	0.24*	0.23*	0.25*	0.10	0.11	0.13	0.07	0.10	0.18	0.40**	0.04	0.23*	0.33**	0.23*	0.07	0.42**	0.13	0.54**	1.00			
Q39	-0.12	-0.03	-0.02	-0.08	0.03	0.05	0.09	0.13	0.18	-0.13	0.04	0.09	-0.08	-0.06	0.32**	0.23*	0.17	-0.06	0.05	-0.03	-0.01	0.13	-0.06	-0.16	0.08	0.07	0.07	0.06	-0.01	-0.12	-0.19	-0.03	-0.05	0.13	-0.03	0.28**	-0.14	-0.21*	1.00		

\*\* Correlation is significant at the 0.01 level (2-tailed).

\* Correlation is significant at the 0.05 level (2-tailed).

**Appendix 13**  
**Version 3. OIQoL**

**Being safe and careful**

<b>Q1.</b> <i>In the last week did</i> someone give you extra help to keep you safe?	Always	Most of the time	Sometimes	Not much	Never
<b>Q2.</b> <i>In the last week did</i> you keep away from busy areas to keep safe?	Always	Most of the time	Sometimes	Not much	Never
<b>Q3.</b> <i>In the last week did</i> you keep away from crowds to keep safe?	Always	Most of the time	Sometimes	Not much	Never
<b>Q4.</b> <i>In the last week did</i> you try to keep safe to stop you breaking a bone?	Always	Most of the time	Sometimes	Not much	Never
<b>Q5.</b> <i>In the last week did</i> you keep away from some activities to stop you having a broken bone?	Always	Most of the time	Sometimes	Not much	Never
<b>Q6.</b> <i>In the last week did</i> you think before playing sports to avoid having a broken bone?	Always	Most of the time	Sometimes	Not much	Never

## Fatigue

<b>Q7.</b> <i>In the last week</i> have you felt tired in the day?	Always	Most of the time	Sometimes	Not much	Never
<b>Q8.</b> <i>In the last week</i> have you felt tired by the end of the day?	Always	Most of the time	Sometimes	Not much	Never
<b>Q9.</b> <i>In the last week did</i> you have to take rests in the day?	Always	Most of the time	Sometimes	Not much	Never

## Reduced Function

<b>Q10.</b> <i>In the last week</i> has having OI stopped you doing things?	Always	Most of the time	Sometimes	Not much	Never
<b>Q11.</b> <i>In the last week</i> has it been more difficult to move around?	Always	Most of the time	Sometimes	Not much	Never
<b>Q12.</b> <i>In the last week</i> have you had to do things differently because of a OI?	Always	Most of the time	Sometimes	Not much	Never
<b>Q13.</b> <i>In the last week did</i> you use equipment to help you to move around?	Always	Most of the time	Sometimes	Not much	Never
<b>Q14.</b> <i>In the last week did</i> you have to use equipment to help at school or home?	Always	Most of the time	Sometimes	Not much	Never

## Pain

<b>Q15.</b> <i>In the last week</i> have you had pain in your back?	Always	Most of the time	Sometimes	Not much	Never
<b>Q16.</b> <i>In the last week</i> have you had pain in your legs or arms?	Always	Most of the time	Sometimes	Not much	Never
<b>Q17.</b> <i>In the last week</i> have you had to take medicine for pain?	Always	Most of the time	Sometimes	Not much	Never
<b>Q19.</b> <i>In the last week did</i> you have pain because you had a OI?	Always	Most of the time	Sometimes	Not much	Never
<b>Q20.</b> <i>In the last week</i> have you missed meeting up with your friends?	Always	Most of the time	Sometimes	Not much	Never

## Fear

<b>Q21.</b> <i>In the last week</i> have you been worried about breaking a bone?	Always	Most of the time	Sometimes	Not much	Never
<b>Q22.</b> <i>In the last week did</i> you get scared about doing something that might make you break a bone?	Always	Most of the time	Sometimes	Not much	Never
<b>Q23.</b> <i>In the last week did</i> you worry about coming into hospital?	Always	Most of the time	Sometimes	Not much	Never
<b>Q24.</b> <i>In the last week did</i> you get scared about needles?	Always	Most of the time	Sometimes	Not much	Never
<b>Q25.</b> <i>In the last week did</i> you worry that someone might move you wrong and cause a broken bone?	Always	Most of the time	Sometimes	Not much	Never
<b>Q26.</b> <i>In the last week</i> have you worried about new people handling you?	Always	Most of the time	Sometimes	Not much	Never

## Life Skills

Q29. <i>In the last week did</i> you have as much freedom as your friends?	Always	Most of the time	Sometimes	Not much	Never
Q30. <i>In the last week did</i> your family <b>let you</b> make your own decision about what is safe?	Always	Most of the time	Sometimes	Not much	Never
Q33. <i>In the last week did</i> your family let you choose your own activities?	Always	Most of the time	Sometimes	Not much	Never
Q34. <i>In the last week did</i> you see your friends outside of school?	Always	Most of the time	Sometimes	Not much	Never
Q35. <i>In the last week were</i> you able to do everything your friends do?	Always	Most of the time	Sometimes	Not much	Never
Q36. <i>In the last week did</i> you get to do lots of different activities?	Always	Most of the time	Sometimes	Not much	Never
Q37. <i>In the last week did</i> you feel different because you have to be more careful than your friends?	Always	Most of the time	Sometimes	Not much	Never
Q38. <i>In the last week</i> have people treated you differently because you have brittle bones?	Always	Most of the time	Sometimes	Not much	Never

