Understanding and measuring the impact of in-hospital stress on post-hospital outcomes

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Intellectual Property and Publication Statements

This thesis is an alternative style doctoral thesis and comprises jointly authored published manuscripts; the contribution of the candidate and the other authors to this work has been explicitly indicated below. The candidate confirms that appropriate credit has been given within the thesis where reference has been made to the work of others.

Chapter 2 contains the manuscript, "In-hospital stress and patient outcomes: A systematic review and meta-analysis" by Ford, D. M., Budworth, L., Lawton, R., Teale, E., & O'Connor, D. B., published in *PLOS ONE* (2023). This systematic review and meta-analysis was jointly conceived by Daryl O'Connor, Rebecca Lawton, and myself. The screening process was performed by myself and Luke Budworth. I conducted the data analysis under the supervision of Luke Budworth, Daryl O'Connor, and Rebecca Lawton. I composed the written publication, and each of the four other authors provided comments.

Chapter 3 contains the manuscript, "Development and initial validation of a hospital stress questionnaire" by Ford, D. M., Lawton, R., Travis, E., Teale, E., & O'Connor, D. B., published in *Health Psychology and Behavioral Medicine* (Ford et al., 2024a). This measure development study was jointly conceived by Daryl O'Connor, Rebecca Lawton, Elizabeth Teale, and myself. I conducted the data analysis under the supervision of Daryl O'Connor and Rebecca Lawton; Elizabeth Travis assisted in the data analysis by second coding half of the interview transcripts. I composed the written publication, and each of the four other authors provided comments.

Chapter 4 contains the manuscript, "Psychometric validation of the Hospital Stress Questionnaire" by Ford, D. M., Lawton, R., Teale, E., & O'Connor, D. B., preprinted by *PsyArXiv* (Ford et al., 2024b). We intend to submit this work for publication soon. This measure validation study was jointly conceived by Daryl O'Connor, Rebecca Lawton,

Elizabeth Teale, and myself. I conducted the data analysis under the supervision of Daryl O'Connor and Rebecca Lawton. I composed the written publication, and each of the three other authors provided comments.

Chapter 5 contains the manuscript, "In-hospital psychological stress and post-hospital outcomes" by Ford, D. M., Lawton, R., Teale, E., & O'Connor, D. B., which has received an offer to revise and resubmit with *Stress & Health*. This study was jointly conceived by Daryl O'Connor, Rebecca Lawton, Elizabeth Teale, and myself. I conducted the data analysis under the supervision of Daryl O'Connor and Rebecca Lawton. I composed the written publication, and each of the three other authors provided comments.

Chapter 6 contains the protocol, "Does in-hospital stress predict post-hospital outcomes? A pilot feasibility study" by Ford, D. M., Lawton, R., Teale, E., & O'Connor, D. B., submitted to the NHS Health Research Authority for ethical approval. This pilot feasibility study was jointly conceived by Daryl O'Connor, Rebecca Lawton, Elizabeth Teale, and myself. I composed the written protocol, and each of the three other authors provided comments. This study is outside of the scope of this PhD, and will be passed on to another researcher(s) for recruitment/data analysis/writing.

The candidate confirms the material submitted in this thesis complies with the University of Leeds "submission of doctoral thesis by alternative format" guidelines and satisfies the criteria for this submission route therein. The candidate confirms that he is the first author on each of the publications included in this thesis and that each derived from original research undertaken whilst registered as a doctoral student at The University of Leeds.

The thesis has been constructed in this format to provide the examiners with a clearer view of how the work from this thesis has contributed to the academic literature. This thesis is comprised of seven chapters: Chapter 1) Background, Rationale, and Aims of the Thesis;

Chapter 2) Study 1: In-hospital stress and patient outcomes: A systematic review and meta-analysis; Chapter 3) Study 2: Development and initial validation of a hospital stress questionnaire; Chapter 4) Study 3: Psychometric validation of the Hospital Stress Questionnaire; Chapter 5) Study 4: In-hospital psychological stress and post-hospital outcomes; Chapter 6) Future study: Does in-hospital stress predict post-hospital outcomes? A pilot feasibility study; and finally, Chapter 7) General Discussion and Conclusions.

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Lastly, I thank my God. I thank you that you are a God who cares, that you provide for and sustain me, and that you will be with me always. To Him, I dedicate this work in its entirety, and all who I am, for the glory and praise of His great name.

"*Even to your old age and grey hairs*

I am he, I am he who will sustain you.

I have made you and I will carry you;

I will sustain you and I will rescue you."

Isaiah 46:4

Abstract

Inpatients are exposed to high levels of psychological stress during hospitalisation that may increase susceptibility to major adverse health events post-hospitalisation (a phenomenon known as post-hospital syndrome). Despite a large body of literature linking stress to negative health outcomes, little is known of this relationship within a hospital context. To further our understanding, we ought to identify and measure the hospital-related stressors inpatients experience. Therefore, the aim of this thesis was to develop and validate a tool to assess in-hospital stress.

To begin, a systematic review was conducted (Chapter 2) to synthesise existing evidence and determine the strength of the relationship between in-hospital stress and patient outcomes. Meta-analysis of 10 studies revealed a small-to-medium correlation between the two variables. Next, a patient-reported outcome measure was developed to assess the hospital-related stress perceived by inpatients (Chapter 3). The Hospital Stress Questionnaire (HSQ) lists 67 hospital-related stressors, identified from previous literature and qualitative interviews with recent patients. The HSQ was administered to 200 recent patients to provide initial validation, this yielded excellent internal consistency and construct validity. This was bolstered by a full validation of 670 recent patients (Chapter 4), which informed item reduction to produce long, medium, and short versions of the HSQ, each with excellent psychometric properties. The final study (Chapter 5), provides evidence that the HSQ is capable of predicting a range of post-hospital health outcomes. The thesis concludes with a protocol for a future study (Chapter 6).

Findings support the theory of post-hospital syndrome, and offer a valid and reliable measure of in-hospital stress. The HSQ may be used in interventions to reduce in-hospital stress, or to identify patients most at risk of post-hospital syndrome. However, the measure is

yet to be tested on current inpatients, and further research is required to support the tool's predictive ability.

Table of Contents

List of Tables

List of Figures

List of Abbreviations

Abbreviation	Explanation
CFA	Confirmatory Factor Analysis
EFA	Exploratory Factor Analysis
EQ-5D	EuroQol 5-Dimension Health Questionnaire
EQ VAS	EuroQol Visual Analog Scale
FRES	Flesch Reading Ease Score
HPA	Hypothalamic-Pituitary-Adrenal
HRSQ-EP	Hospitalisation-Related Stressors Questionnaire for Elderly Patients
HSI	Hospital Stress Index
HSQ	Hospital Stress Questionnaire
HSRS	Hospital Stress Rating Scale
ICU	Intensive Care Unit
LSNS	Lubben Social Network Scale
NHS	National Health Trust
PACT-M	Partners at Care Transitions Measure
PHS	Post-hospital syndrome
PROM	Patient-Reported Outcome Measure
PSS	Perceived Stress Scale
QCA	Qualitative Content Analysis
SAM	Sympathetic-Adrenal-Medullary
SSI	Semi-Structured Interview
UCLA-LS	University of California, Los Angeles – Loneliness Scale
UK	United Kingdom
YQSR	Yorkshire Quality and Safety Research Group

Chapter 1

Introduction: Background, Rationale, and Aims of the Thesis

1.1 Chapter Summary

The first chapter of this doctoral thesis lays the theoretical groundwork exploring the postulation that hospitalisation-induced allostatic overload is the aetiology behind a phenomenon known as post-hospital syndrome. In simpler terms, is the psychological stress an inpatient experiences while in hospital associated with their recovery? Additionally, this chapter explores how the psychological stress an inpatient experiences is measured. To address these questions, the broader relationship between stress and health is covered, hospital-related stressors are identified from the academic literature, and previous attempts at measuring hospital stress are reviewed. The chapter concludes with a statement of the aims of this thesis, and outlines how each of the subsequent six chapters will contribute to this body of work.

1.2 Allostasis, Allostatic Load, and Allostatic Overload

An established literature exists linking psychological stress to negative health outcomes (see O'Connor et al., 2021). *Allostasis* refers to the bodily process of achieving stability through change; the body must adapt its physiological parameters, veering from its homeostatic state, in response to an environmental change (McEwen & Wingfield, 2003). As part of this process, the sympathetic–adrenal–medullary (SAM) system facilitates the rapid, short-term release of adrenaline (epinephrine) and noradrenaline (norepinephrine), activating the "fight-or-flight" response (Cannon, 1939). Under acute stress, this response increases the body's chance of

survival by increasing blood flow and oxygen availability, resulting in heightened alertness and readiness for action (McCarty, 2016). However, under chronic stress, repeated activation of the hypothalamic-pituitary-adrenal (HPA) axis triggers an increased output of cortisol, the so-called “stress hormone”, leading to a slower and more sustained stress response (McEwen, 1998).

This allostatic state is necessary for survival, however, over time it exacts a cost on the body due to an inefficient management of a host of stress mediators (such as cortisol); this has been likened to a “wear and tear” effect, and has been labelled as *allostatic load* (McEwen, 1998, 2000). Most recently, the concept of *allostatic overload* has been discussed (McEwen, 2018), a condition when the wear and tear is at its strongest, when environmental challenges exceed the individual ability to cope. To demonstrate the detrimental effects of allostatic load and overload, a recent systematic review sought to highlight its impact on health (Guidi et al, 2020). Allostatic load was shown to be associated with high systolic and diastolic blood pressure, musculoskeletal disorders, neurological disorders, periodontal diseases, chronic fatigue, fibromyalgia, and breast and ovarian cancer, as well as a decreased self-rated health and an increased risk for cardiovascular diseases and adverse pregnancy and birth outcomes (e.g. preeclampsia). The same review also highlighted the association between allostatic load and a number of mental health conditions.

These associations do not impact everyone equally, sociodemographic variables are also known correlates of allostatic load; a relationship which may partially explain the health inequalities faced by health services (see Arcaya et al., 2015). For example, low socioeconomic status has been associated with higher levels of allostatic load, compared to those in a higher socioeconomic position (e.g., Präg & Richards, 2019; Robertson & Watts, 2015; Rodriguez et al., 2019). Those with a lower socioeconomic status experience unique stressors, such as renting their home, low income, and smoking, all of which have been shown to be mediators

of the relationship with allostatic load (Robertson et al., 2015). Other factors, such as ethnicity and sexual orientation are also relevant, Black (Tobin et al., 2019) and bisexual (Mays et al., 2018) individuals displayed higher levels of allostatic load than their White and heterosexual counterparts. In addition, older adults are disproportionately affected by allostatic load, which has been shown to predict functional decline (Karlamangla et al., 2002) and frailty in later life (Gruenewald et al., 2009).

Allostatic overload may occur over long periods of time, such as in the above examples, due to largely uncontrollable life stressors. However, it may also be brought on during short but acutely stressful periods, such as during hospitalisation (see Goldwater et al., 2018).

1.3 Post-Hospital Syndrome

Allostatic overload, brought on by the chronic stress of hospitalisation, has been theorised to be the aetiology behind a phenomenon known as *post-hospital syndrome*; an acquired period of generalised vulnerability to adverse events (e.g., post-operative wound infection) following hospitalisation (Krumholz, 2013). Put simply, the stressors a patient experiences in hospital may be putting them at risk of poorer post-hospital outcomes. The effects of post-hospital syndrome were initially evidenced in that, amongst patients admitted for treatment for heart failure, pneumonia, or chronic obstructive pulmonary disease (COPD), the cause of readmission was the same as that of the index admission for only 37%, 29%, and 36% of cases, respectively (Jencks et al., 2009). Since these readmissions were not for the original condition, then other explanations must be explored for why these patients required a readmission – the stress of hospitalisation (triggering a case of allostatic overload and leading to post-hospital syndrome) is one possible explanation. The finding from Jencks and colleagues was later bolstered by a study using hospital data from 1,330,157 hospitalisations, where

approximately one quarter of cases resulted in a readmission within 30 days of the initial hospitalisation – of these readmissions, 35% (for heart failure), 10% (for acute myocardial infarction), and 22% (for pneumonia) were for the same condition as the index admission (Dharmarajan et al., 2013). In the same dataset, young and middle-aged patients, treated for the same three conditions, had similar readmission rates to older adults, demonstrating that this period of generalised risk is present regardless of age (Ranasinghe et al., 2014).

The length of time that patients are affected by post-hospital syndrome remains uncertain. Dharmarajan and colleagues (2015) reported that the risk of readmission declined 95% by day 45 after the initial hospitalisation, and risk of death declined by 95% after 21 days. Despite this, effects have been documented lasting up to one year; hospitalisations in the year preceding major oncologic surgery were associated with an increased risk for adverse postoperative events, even when accounting for comorbidities and other related factors (Sharoky et al., 2017). However, this is an extreme example, and most studies within the post-hospital syndrome literature employ a time period of either 30 or 90 days post-discharge, and are accomplished using one of the two following designs. The first design aims to measure the "trauma of hospitalisation", typically characterised by patient-reported disturbance in sleep, mobility, nutrition, and mood (see Goldwater et al., 2018 for why these stressors were chosen), and then determines how this trauma is associated with unplanned readmissions, emergency department visits, or mortality rates within 30 days (e.g., Rawal et al., 2019) or 90 days (e.g., Raghuveer et al., 2021) of the hospital stay. The second design is more complex, patients are presumed to have post-hospital syndrome if they have had an inpatient admission or emergency department visit up to 30 days (e.g., Lim et al., 2019), 90 days (e.g., Bieganowski et al., 2023; Brownlee et al., 2017; Canizares et al., 2023; Creager et al., 2022; Hart et al., 2020; Johnson et al., 2019; Johnson et al., 2020; Kirshenbaum et al., 2019; Ronan et al., 2023; Swiatek et al., 2018), or one year (e.g., Hinman et al., 2023; Kiskaddon et al., 2022) prior to an elective

surgery. It is then determined whether or not those with a pre-operative healthcare utilisation are more at risk of experiencing adverse events related to the elective surgery – such as postoperative complications or an unplanned readmission – than those patients who did not have a pre-operative hospital exposure.

From the above studies, all but one (Raghuveer et al., 2021) found a significant effect, indicating that the stress of hospitalisation is associated with poorer post-hospital outcomes. Indeed, the effect of post-hospital syndrome was observed across a number of conditions, treatments, and outcomes. Treatments shown to be susceptible to the effects of post-hospital syndrome include abdominal surgery (Johnson et al., 2019; Lim et al., 2019; Swiatek et al., 2018), hernia repair (Brownlee et al., 2017), oncologic surgery (Sharoky et al., 2017), osteoarthritis surgery (Canizares et al., 2023), penile prosthesis (Kirshenbaum et al., 2019), total hip arthroplasty (Bieganowski et al., 2023; Creager et al., 2022; Hinman et al., 2023; Johnson et al., 2020), total knee arthroplasty (Creager et al., 2022; Hinman et al., 2023; Kiskaddon et al., 2022; Ronan et al., 2023), transvaginal midurethral sling placement (Hart et al., 2020), as well as a range of medical treatments (Rawal et al., 2019).

However, it could be argued that this body of evidence is flawed. A large majority of research adopted the second design mentioned above, which relies on the assumption that an inpatient admission is equivalent to an exposure to post-hospital syndrome. If the cause behind this phenomenon is the stress of hospitalisation, then a key attribute of stress has been overlooked: that it is subjective. Of the 16 examples given, only two studies measured the "trauma of hospitalisation", while the rest relied on the potentially flawed assumption; and between those two there were conflicting results, one finding a significant effect (Rawal et al., 2019) and one not (Raghuveer et al., 2021). Studies failing to measure stress do not consider Lazarus' Transactional Model of Stress (Lazarus & Folkman, 1984), which states that psychological stress occurs when the individual's primary appraisal (evaluation of the risks of

a situation) outweighs their secondary appraisal (availability of perceived resources to cope) – meaning that two patients could be exposed to the same stressor, and one appraises it as stressful while the other does not. To strengthen the reliability of future studies in this area, we must first expand our knowledge of in-hospital stress, and then turn our efforts to producing a valid and reliable way to measure such a concept, all while considering the subjective nature of psychological stress.

1.4 Hospital-Related Stressors

Hospitals are widely regarded to be a stressful environment, and previous research has characterised hospitalisation as a traumatic event (Detsky & Krumholz, 2014; Rawal et al., 2019), even resembling interrogation (Mishark et al., 2020). In their seminal work, linking allostatic overload and post-hospital syndrome, Goldwater and colleagues (2018) identified five *hospital-related stressors* that are likely contributors to an occurrence of hospitalisation-induced allostatic overload: sleep disruption (e.g., loud, unpredictable noises), malnourishment and dehydration (e.g., no food by mouth orders), mobility restriction (e.g., physical restraints including intravenous lines and urinary catheters), pain (e.g., poorly controlled postoperative pain), and distressing environment or events (e.g., unknown wardmates). In fact, measurement of these stressors has since been used to quantify the "trauma of hospitalisation" in studies observing the impact of post-hospital syndrome (e.g., Raghuveer et al., 2021; Rawal et al., 2019).

Although these five stressors are pertinent examples, this list is by no means comprehensive, and there exists an unknown (and likely vast) number of these stressors. For example, loss of control (Taylor, 1979), mental distress (Aass et al., 1997), equipment visibility (Tanja-Dijkstra, 2011), lack of light and nature (Jamshidi et al., 2020), and, perhaps the most

salient of all, relationships with staff (Koenig et al., 1995; Volicer & Bohannon, 1975). To demonstrate the vast number of these stressors, a recent systematic review extracted 137 examples from previous research related to the intensive care unit (ICU) (Krampe et al., 2021). These stressors were grouped into four categories: "Physical, treatment and disease-related stressors" (46 items), "Mental health stressors" (55 items), "Communication stressors" (21 items), and "Environmental stressors" (15 items), where the highest scoring items within each category were "Being in pain", "Fear of death", "Not being able to talk", and "Hearing other patients cry out", respectively.

Despite this research being specific to the ICU, many of the stressors are applicable to other hospital wards. However, the stressors associated with some treatment areas are too different to be grouped with the stressors associated with other treatment areas. For example, within maternity care, the patient's stressors are largely focussed on the wellbeing of their baby (e.g., Pichler-Stachl et al., 2016); within psychiatric care, the patients are less likely to experience physical stressors due to the nature of their treatment (Akpınar & Buldukoğlu, 2009) and have been shown to perceive stress differently to non-clinical samples (Lavoie, 2013); and within paediatric care, patients report different stressors to adults, such as nightlights and being scared of the staff wearing uniforms (Chitra & Jeenu, 2016).

1.5 Measures of Hospital Stress

It is clear that hospitalisation is a stressful experience, and that hospitals are hosts to potentially hundreds of stressors. And yet, studies within the post-hospital syndrome literature measure this construct using only a handful of stressors, if any at all (using the implicit assumption covered earlier, that hospitalisation is equally stressful for all participants). Taken together, there is an immediate need to develop and validate a tool to measure the hospital

stress experienced by inpatients, while also accounting for the subjective nature of psychological stress. Should a measure of this kind be developed, then it could be used to identify and measure hospital-related stressors, allowing future research to develop targeted interventions. To date, several measures have been developed to address this gap, although some are specific to a certain age group (e.g., Hospitalisation-Related Stressors Questionnaire for Elderly Patients; Musavi et al., 2016), treatment type (e.g., Antepartum Hospital Stressors Inventory; White, 1981), or hospital setting (e.g., Intensive Care Unit Environmental Stressor Scale; Ballard, 1981).

1.5.1 The Hospital Stress Rating Scale

The first measure of this kind was developed by Beverly Volicer, as part of her pioneering body of work on hospital stress, and was labelled the Hospital Stress Rating Scale (HSRS; Volicer & Bohannon, 1975). To develop the HSRS, Volicer began by informally interviewing patients, laypersons, nurses, and physicians; from which 45 stress-inducing events were compiled relating to the experience of hospitalisation, such as "Emergency admission" and "Anticipated bad experience with medications" (Volicer, 1973). The HSRS was inspired by the Social Readjustment Rating Scale (SRRS; Holmes & Rahe, 1967), a tool used to measure the impact of life events on stress levels, and like the SRRS, the HSRS ratings were determined by asking a convenience sample to attach scores reflecting the relative amount of readjustment required for each event. The highest scoring event was "Possibility of loss of function of senses (e.g., eyesight or hearing)", with an arbitrary rating of 96.3, and the lowest scoring event was "Acquaintance with someone else with the same medical problem", with an arbitrary rating of 29.4 (Volicer, 1973). In 1974, this rating technique was repeated with a sample of 47 patients who were hospitalised on cancer, medical, or surgical wards; the order of ratings was found to highly correlate with the order of ratings found in the previous study, which used a sample of 216 non-hospitalised participants (Volicer, 1974).

The measure was then revised and finalised in 1975. Respondents from the previous two studies (Volicer, 1973, 1974) indicated that some items were worded too vaguely to give an accurate rating. To address this, some of the original items were reworded, and some were expanded into several items, producing a new total of 77 items (Volicer & Bohannon, 1975). The new list of items was trialled on a sample of 56 patients, who were asked to sort the items into four groups: “high stress”, “medium stress”, “low stress”, and “reject” – the latter category was designed to house items which were poorly worded, did not seem relevant, or were too rare of an occurrence. Items rejected by five or more patients were not included in the final list, leaving a total of 49 items. The sorting task was then repeated on a sample of 261 general medical or surgical patients, this time without the option to reject an item. Final rankings of the 49 events were calculated, where the highest scoring was “Thinking you might lose your sight” and the lowest “Having strangers sleep in the same room with you”, with arbitrary ratings of 40.6 and 13.9, respectively (Volicer & Bohannon, 1975). Events were assigned to one of nine factors by a cohort of 30 graduate nurses, the largest of which was “Loss of independence”:

- Factor 1. Unfamiliarity of surroundings (8 items)
- Factor 2. Loss of independence (10 items)
- Factor 3. Separation from spouse (2 items)
- Factor 4. Financial problems (2 items)
- Factor 5. Isolation from other people (6 items)
- Factor 6. Lack of information (7 items)
- Factor 7. Threat of severe illness (7 items)
- Factor 8. Separation from family (3 items)
- Factor 9. Problems with medications (4 items)

Since its development, the HSRS has been used to progress our understanding of in-hospital stress and its relationships with other variables. The first variable to be explored was the difference in how medical and surgical patients perceive stress during hospitalisation; medical patients scored higher on dimensions of stress due to financial problems and lack of information, while surgical patients scored higher on dimensions of unfamiliarity of surroundings, loss of independence, and threat of severe illness (Volicer et al., 1977). Next came a study on pre-existing correlates of hospital stress, which found that female patients were more stressed than male patients, and that hospital stress increased with life stress and seriousness of illness, and decreased with age (Volicer & Burns, 1977). Volicer then went on to test associations between hospital stress and patient outcomes; patients scoring higher in hospital stress were shown to report more pain and lower physical status while in hospital, and took longer to return to their usual activities after being discharged (Volicer, 1978). Additionally, higher hospital stress was associated with cardiovascular changes, such as increases in heart rate, as well as systolic and diastolic blood pressure (Volicer & Volicer, 1978).

Despite the measure's commendable development process, which heard the views of hundreds of patients and healthcare professionals, the HSRS was never psychometrically validated. This is a significant issue in contemporary measurement theory, which requires strict evidence that a tool is both valid and reliable (see Tsang et al., 2017). A second flaw of the measure is that its items are outdated or irrelevant – questions concern newspaper and radio, rather than phones and tablets, and some questions are not applicable to the vast majority of patients (e.g., the highest ranking stressor, "Thinking you might lose your sight"). And finally, perhaps the most notable inadequacy of the measure, is that it does not allow for individual differences in perceived stress. As mentioned earlier, a fundamental property of psychological stress is that it is subjective, and scoring each item using a preassigned rank (as in the HSRS)

assumes that every participant would perceive and appraise a stressor equally. This is obviously not the case; for example, the lowest ranking item, “Having strangers sleep in the same room with you”, would be far more stressful to an introverted patient than some of the higher ranking items, such as “Not having family visit you”.

Overall, the HSRS is a creditable first attempt at measuring hospital stress, and Volicer’s work has provided a solid groundwork for further study in this field. However, as the measure approaches 50 years old, new research is required which considers modern day stressors and adheres to the latest theory and standards of stress and measurement.

1.5.2 The Hospital Stress Index

The Hospital Stress Index (HSI) is a measure of hospital-related stressors experienced by elderly medical inpatients, and is available in long (40 items) and short (15 items) versions (Koenig et al., 1995). To develop the HSI, Koenig and colleagues interviewed 76 elderly patients (over 60 years old), who had been hospitalised for medical treatments for at least 48 hours; eligible participants were asked an open-ended question exploring what they found most stressful about being in hospital. The most commonly reported stressor was “Sleep disturbed by frequent tests, blood draws, or medications”. Forty stressors were extracted from the interviews and phrased as questionnaire items, which were then split into seven factors (the authors do not disclose how these factors were identified), the largest of which was relationship issues with physicians and nursing staff:

- Factor 1. Adverse effects/complications related to diagnostic evaluation or treatment (4 items)
- Factor 2. Life-style Changes (3 items)
- Factor 3. Relationship Issues (15 items overall)
  - 3a. Physician-Patient (8 items)

  - 3b. Nurse-Patient (7 items)
- Factor 4. Psychiatric Issues (5 items)
- Factor 5. Understanding of diagnosis and prognosis (4 items)
- Factor 6. Family Issues (4 items)
- Factor 7. Hospital Environment (5 items)

The second phase of the study saw 92 patients – age sixty or over and admitted to a general medicine, cardiology, or neurology ward – complete the HSI, along with a battery of other questionnaires. Although the authors rarely use vocabulary such as "validity" or "reliability" throughout the article, this phase of the study is similar to an initial validation. Each of the 40 items had response options of "yes" (scored as 1), "no", or "unsure" (both scored as 0), where the maximum number of stressors reported by any patient was 23 and the mean was nine. The three most commonly reported hospital stressors were: "The need to depend on others so much" (reported by 50% of the sample), "Being away from home" (49%), and "Doctor imposed limitations on diet, health habits, or physical activity" (47%).

Unlike the HSRS, total scores on the HSI were not associated with age or sex, but were associated with ethnicity. White patients (n = 77) were significantly more stressed than Black patients (n = 15); however, the sample size for the latter group was small, and so this finding is potentially unreliable. Hospital stress was also associated with depression (measured by the CES-D; Center for Epidemiologic Studies – Depression Scale), dysfunctional attitudes (measured by the DAS; Dysfunctional Attitudes Scale), and physical disability (measured by the Impaired ADL; Impaired Activities of Daily Living) – each presenting a small to medium sized positive correlation with the HSI.

To conclude the study, a shortened fifteen-item version of the index was developed. This was accomplished by removing items with "a very low frequency of responses" (although this process was neither defined nor justified by the authors), or that were deemed redundant by having a chi-square coefficient that is too high (again, neither defined nor justified). Amongst the sample of 92 patients, the highest score on this version of the HSI was 11, with a mean and median of four. The authors state that internal consistency reliability coefficients were not calculated for either version of the scale, as there is no theoretical reason to believe that the stressors would be interrelated.

The HSI has scarcely been used in other research articles since its development, almost thirty years ago. This may be for a number of reasons, for example, 89% of the sample were patients hospitalised for cardiovascular conditions, limiting the generalisability of the measure. Additionally, like the HSRS, the HSI does not allow for individual differences in perceived levels of stress; the total score relies solely on the number of stressors a patient reports, and pays no attention to how stressful that patient would appraise each stressor to be. In fact, the HSI is even less effective than the HSRS, which at least assigned each stressor with an average score of perceived stressfulness. Finally, despite including a study phase which trialled the measure, the HSI has not been validated by contemporary standards (see Tsang et al., 2017). Overall, the measure is not fit for purpose.

1.5.3 The Hospitalisation-Related Stressors Questionnaire

The Hospitalisation-Related Stressors Questionnaire for Elderly Patients (HRSQ-EP), similar to the HSI, is a self-report tool for older inpatients. The measure was developed and initially validated in Iran (Musavi et al., 2016), and then later translated into Turkish and psychometrically evaluated (Yildirim & Işik, 2021). The authors of the former study acknowledge the similar work conducted twenty years prior by Koenig and colleagues (1995),

and go on to state that the HSI is not a "comprehensive tool for examining stressors associated with hospitalisation in elderly" (but give no reason as to why they believe this to be the case), and that a culturally sensitive measure is needed in Iran. To develop this new measure, an item pool was generated, informed by a literature review of 30 articles between the year 2000 to 2015, and seven semi-structured interviews with elderly patients and their caregivers. From this, 119 items were identified, which were used to inform 36 questions rated on a five-point Likert scale. No information is given as to what conditions the participants were hospitalised for, how the data was analysed, or how item reduction was conducted.

Once the initial 36 item questionnaire was established, ten expert panel members evaluated the face and content validity of the instrument, which, after rephrasing of any ambiguously worded items, was deemed acceptable. The final stage of development involved piloting the measure on 30 hospitalised elderly patients, whereby seven items were excluded (reasons for which are not given), leaving 29 items. For the second phase of the study, Musavi and colleagues went on to administer the newly developed HRSQ-EP on 200 hospitalised elderly patients. Principal Component Analysis was then utilised, by which a further three items were excluded – leaving the final 26 items – and seven scale dimensions were identified (see below). Internal consistency reliability of the final version of the measure was good, boasting an overall Cronbach's alpha coefficient of 0.83, and values of between 0.67 and 0.78 for each of the domains. The authors do not record which stressors were most commonly reported, nor do they disclose which items were rated as most stressful using the Likert scale.

- Physical stressors (4 items)
- Stressors related to low knowledge (3 items)
- Stressors related to care and treatment staff (6 items)
- Environmental stressors (3 items)
- Stressors related to changes in personal and social lifestyle (4 items)

- Psychological stressors (3 items)
- Disease related stressors (3 items)

Several years later, the HRSQ-EP was adapted to produce a shorter version available in Turkish (Yildirim & Işik, 2021). In this study, four linguists independently translated the HRSQ-EP from English to Turkish; five experts and 30 elderly patients assessed the face and content validity of the adapted scale, finding it to be acceptable. The measure was then completed by a further 203 elderly patients (aged over 60 years) and data were analysed using both an exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). Informed by the factor analyses, 11 items were excluded for either not loading onto any factor, or being too similar to other items. A Cronbach's alpha coefficient of 0.91 was calculated for the final 15-item version of the scale, which consisted of three factors: "Stressors related to changes in psychological and social lifestyle" (9 items), "Stressors related to lack of knowledge" (3 items), and "Stressors related to care and treatment staff" (3 items).

Overall, the HSRQ-EP has some positive features; for example, both the development and validation of the measure were conducted using multi-site studies, the items and factors are concurrent with previous similar measures (e.g., the HSRS and HSI), and the Likert scale makes it the only hospital stress measure to date which allows respondents to appraise how stressful they found each event. However, the measure cannot be described as a suitable tool for research, due to its poor quality development (Musavi et al., 2016). Seven interviews cannot adequately capture the range of stressors experienced by this demographic of patients; the authors do not disclose the reasons for which the participants were hospitalised, and so we cannot determine if the various samples were representative; and, finally, the scale is relatively

short, especially considering the vast number of stressors a patient may experience, and no reasons are given as to why almost one third of the items were excluded.

1.5.4 Differences in culture and healthcare systems

The first two measures mentioned (the HSRS and HSI) were both developed in the United States of America (USA), while the third measure (the HRSQ-EP) was first developed in Iran, and later validated in Turkey. To my knowledge, no measure currently exists which is capable of measuring the stress experienced by inpatients, specifically in the context of general hospitals within the United Kingdom (UK). In order to develop such a measure, it is important that differences across healthcare systems and cultures are considered.

In the UK, the largest healthcare system is the National Health Service (NHS), which is publicly funded via taxation, meaning that patients do not directly pay for their treatment. Therefore, one of the largest differences between the UK and many other country's healthcare systems (e.g., the USA), is that patients are not met with insurmountable healthcare costs following a hospital stay. Although this is likely to relieve a great load of stress, this does not mean that there are no financial stressors experienced in a UK hospital context; those patients who partake in work that is paid by the hour will face losses in hours not worked. Likewise, small business owners will likely experience a decrease in revenue.

Another important cultural difference is the involvement of family members in caring for adult inpatients. Family involvement in hospital care is common practice in some African (e.g., Phiri et al., 2017; Yakubu et al., 2018), Middle Eastern (Mobeireek et al., 2008), and Asian (Ito et al., 2010) countries. However, this practice is less commonplace in the UK, as family presence is limited to within visitation hours, which may be particularly distressing for non-native inpatients (Bezmez et al., 2021). These patients may also experience language barriers and less affective doctor-patient relationships, making them less likely to verbally

assert themselves, and therefore not receive the best care possible (Schouten & Meeuwesen, 2006). Taken together, these cultural differences, and their associated impacts, emphasise the importance of developing culturally sensitive measures, and provide further justification for a UK hospital stress questionnaire.

1.6 Thesis Aims

Taken together, the evidence in this chapter presents an immediate need for us to better our understanding of the relationship between allostatic overload and post-hospital syndrome, which can be accomplished by identifying and measuring stressors associated with the hospital environment. Once an appropriate tool for measuring hospital-related stressors has been established, it can be used to test the strength of the association between stress and health in the context of hospitalisation. Should this association be significant, the tool would have potential to be used to predict post-hospital outcomes, measure the effectiveness of stress reducing interventions in hospital, and influence future decisions of hospital managers and clinical staff.

For the above aims to manifest, a robust series of studies must be conducted to develop and validate an appropriate tool to measure hospital stress. This tool must be informed by the existing literature (including the three measures outlined in *Section 1.5*) and a diverse and representative sample of patients; allow for respondents to perceive and appraise each stressor, according to whether or not the patient experienced that stressor and, if so, how stressful they perceived it to be; and the tool must be psychometrically valid and reliable, adhering to the strict contemporary standards of measurement theory (see Tsang et al., 2017).

Therefore, the aims of this thesis were to:

1. Chapter 2: Synthesise the existing evidence-based in order to quantify the strength of the association between hospitalisation-induced allostatic overload and patient outcomes (i.e., the theory of post-hospital syndrome).
2. Chapter 3: Develop a comprehensive tool to measure the hospital stress experienced by inpatients, specific to UK hospitals.
3. Chapter 4: Psychometrically evaluate that the tool is a valid and reliable measure of hospital stress.
4. Chapter 5: Explore if the hospital stress measured by our tool:
    (i) Differs by patient demographic,
    (ii) Is associated with post-hospital outcomes.
5. Chapter 6: Establish plans for future study, testing if hospital stress can predict post-hospital outcomes.

1.7 Impacts of the COVID-pandemic

The COVID-pandemic had significant impacts on the planning and conduct of the works within this doctoral thesis. This PhD was proposed pre-COVID, and so upon its commencement in October 2020, the project had to be reimagined to account for the fact that hospital-based research would be strictly infeasible for the foreseeable future. Therefore, the approach taken in this thesis was to recruit participants that were recent inpatients, and to conduct the majority of the research online to abide by restriction laws and avoid the risk of infecting both the researchers and participants.

The authors acknowledge that the findings of this research have likely been impacted by the COVID-pandemic and the subsequent methodological decisions taken. Therefore, the authors have highlighted in Chapter 7 ways in which the findings may have been impacted. In

addition to this, Chapter 6 offers a proposal of how this research can be continued in hospitals, now that the COVID-pandemic no longer poses methodological limitations.

1.8 Thesis Outline

1.7.1 Chapter 2

This chapter presents the manuscript "In-hospital stress and patient outcomes: A systematic review and meta-analysis", published in *PLOS ONE* (Ford et al., 2023). This systematic review and meta-analysis was preregistered (PROSPERO: CRD42021237017); including studies which had both a measure of perceived and appraised stress while in hospital, and at least one patient outcome, in order to observe the relationship between these two variables. A systematic search of MEDLINE, EMBASE, PsychINFO, CINAHL, and Web of Science was conducted, from inception to February 2023.

1.7.2 Chapter 3

This chapter presents the manuscript "Development and initial validation of a hospital stress questionnaire", published in *Health Psychology and Behavioral Medicine* (Ford et al., 2024a). The study aimed to identify hospital-related stressors, and to develop and provide initial validation for a new measure of in-hospital stress. Measure development occurred in three stages: (i) semi-structured interviews, (ii) item generation, and (iii) pilot testing.

1.7.3 Chapter 4

This chapter presents the manuscript "Psychometric validation of the Hospital Stress Questionnaire", which has been preprinted (Ford et al., 2024b) and will soon be submitted to a peer-reviewed journal. This study aimed to psychometrically validate the HSQ, identify latent

factors, reduce the number of items within the HSQ, and explore the psychometric properties of longer and shorter versions of the scale.

1.7.4 Chapter 5

This chapter presents the manuscript "In-hospital psychological stress and post-hospital outcomes", which is under review with *Stress & Health*. The study aimed to explore further the nature and type of hospital-related stressors (measured using the HSQ) and their relationships with four post-hospital outcomes (feelings of vulnerability, time to return to usual activities, health-related quality of life, and adverse events such as falls and infections). The study also aimed to explore whether these relationships varied by demographic and patient factors.

1.7.5 Chapter 6

This chapter presents the manuscript "Does in-hospital stress predict post-hospital outcomes? A pilot feasibility study", which is the protocol for a future study (outside of the scope of this PhD) which requires ethical approval from the NHS Health Research Authority. This study intends to build on the work presented in this thesis by testing the feasibility of administering the HSQ to current inpatients, done so with an inclusive approach, accounting for barriers commonly encountered in hospitals such as delirium, language, and sight/hearing impairments. There will then be a follow-up survey administered to participants three months later, asking about their post-hospital recovery. This pilot feasibility study is intended as a precursor to a full-scale study, which will aim to test the ability of the HSQ to predict post-hospital outcomes (such as health-related quality of life, unplanned readmissions, and more). A further aim of the pilot feasibility study is to inform an appropriate sample size and estimate the attrition rate for the full-scale study.

1.7.6 Chapter 7

This chapter provides an overview and discussion of the findings from the pieces of work recorded in the preceding chapters, and interprets these findings in light of the thesis aims. Strengths and limitations of the thesis as a whole are offered, and potential fruitful lines of enquiry are suggested for future studies, such as the one presented in Chapter 6. In addition to this, implications for future research, health care policy, and practice are discussed, as well as the potential impacts of the COVID-pandemic on the findings of this body of work.

Chapter 2

In-hospital stress and patient outcomes: A systematic review and meta-analysis

2.1 Introduction

2.1.1 Background

Psychological stress is known to adversely influence health and wellbeing by causing negative changes in mental health outcomes and multiple physiological processes (O'Connor, Thayer & Vedhara, 2021). More specifically, stress has been shown to play a detrimental role in immune system dysfunction (Glaser & Kiecolt-Glaser, 2005; Segerstrom & Miller, 2004), cardiovascular disease, coronary heart disease, and stroke (Kivimäki & Steptoe, 2018). In response to stressful encounters ('stressors'), the body veers from its homeostatic state, adjusting physiological parameters and releasing endocrinological mediators such as cortisol (the so-called "stress hormone"). This process of adapting is necessary for survival and is known as *allostasis* ("remaining stable by being variable"; see Sterling & Eyer, 1988). However, with prolonged exposure to stress, the body experiences excessive "wear and tear" from an inefficient management of stress mediators; a concept known as *allostatic load* (McEwen, 1998; O'Connor, Thayer, & Vedhara, 2021). When this load becomes too great, the body experiences deleterious effects; a concept known as *allostatic overload* (McEwen, 2018; see Guidi et al., 2021).

Allostatic overload is theorised to be the cause of *post-hospital syndrome* (PHS); an acquired period of generalised vulnerability to adverse events (e.g., post-operative wound

infection) following hospitalisation (Krumholz, 2013). Indeed, in some prominent conditions, only a third of all post-discharge readmissions (a proxy for poor post-hospital outcomes) were the same as that of the index admission (Jencks et al., 2009). This is even lower still for some conditions: the 30-day readmission for patients hospitalised due to acute myocardial infarction is approximately one in six (Khera et al., 2018), where only 10% of those readmissions were for the index event (Dharmarajan et al., 2013). Consequently, Krumholz (2013) suggests that we should view the post-discharge period as a generalised syndrome of physiological impairment, rather than a routine recovery specific to the initial ailment.

More recently, the theorised, causal relationship between allostatic overload and PHS has been elaborated on by Goldwater and colleagues (2018). These authors have outlined several "hospital-related stressors" that are likely catalysts of allostatic overload: sleep disruption, malnourishment and dehydration, mobility restriction, and pain. However, this list is by-no-means comprehensive, there exists an unknown (and likely vast) number of these stressors, for example: loss of control (Taylor, 1979), mental distress (Aass et al., 1997), equipment visibility (Tanja-Dijkstra, 2011), lack of light and nature (Jamshidi et al., 2020), and, perhaps the most salient of all, relationships with staff (Koenig et al., 1995; Volicer & Bohannon, 1975). The combination of these stressors may make for an unpleasant experience for inpatients in their already vulnerable states (e.g., Caraballo et al., 2019).

Indeed, it follows that, if stress causes deleterious effects, and if hospital stays expose patients to an assortment of stressors, then hospitalisation may be contributing to these adverse patient outcomes (this is the essence of PHS). Previous research has characterised hospitalisation as a traumatic event (e.g., Detsky & Krumholz, 2014; Rawal et al., 2019), even resembling interrogation (Mishark et al., 2020), and has recorded that patient-reported hospital experiences are potentially associated with patient outcomes (Dong et al., 2019; McAlister et al., 2019; Raghuveer et al., 2021; Rawal et al., 2019; Wang et al., 2016). In fact, regardless of

stress, hospitalisation may be damaging for patients (particularly older adults), being a likely risk factor for cognitive decline (Chinnappa-Quinn, 2020; Wilson et al., 2012), functional decline (Boyd et al., 2009; Covinsky et al., 2003; Sager et al., 1996), decompensated frailty (Wray et al., 2021), and new iatrogenic disability (Covinsky et al., 2011; Volpato et al., 2007).

Therefore, taken together, there is an immediate need for us to improve our understanding of in-hospital stress, and its effects on in-hospital and post-hospital patient outcomes. At present, the literature has not identified the strength of the relationship between in-hospital stress and patient outcomes. The current systematic review and meta-analysis will aim to do this by synthesising the existing evidence base of studies that have investigated the relationship between in-hospital stress – whereby stress is perceived and appraised by the patient during their hospital stay – and an in-hospital and/or post-hospital patient outcome.

2.1.2 Research Aims

The current review aims to synthesise the existing evidence base to determine the strength of the relationship between in-hospital stress and patient outcomes – broad definitions of these two variables are offered below. Secondary aims are to uncover whether the magnitude of this relationship differs between groups of outcomes: (i) in-hospital vs post-hospital, (ii) subjective (patient-reported) vs objective, and (iii) by study quality.

2.1.3 In-hospital stress

O'Connor and Ferguson (2016) describe three approaches that have been used in studying stress: the stimulus-based approach; the response-based approach; and the psychological interactional-appraisal approach. The latter is also known as the transactional

model approach and has been defined as “a particular relationship between the person and the environment that is *appraised* by the person as taxing or exceeding his or her resources and endangering his or her well-being” (Lazarus & Folkman, 1984, p. 19). This appraisal is postulated to have two dimensions: a primary and secondary appraisal (Lazarus & Folkman, 1984). A primary appraisal evaluates the risks, demands, or challenges of a situation, while a secondary appraisal evaluates the availability of perceived resources and whether anything can be done to alter the outcome of the situation. Therefore, should two persons experience the same noxious event one person may appraise the situation as stressful (depending on the extent to which they perceive that they can meet its demands), while the other may not. Moreover, central to the transactional model approach is the notion that stress is a psychological construct that only arises when there is a mismatch between primary and secondary appraisal. Therefore, in the current review, in keeping with this approach, we will include any measure of stress that is perceived or appraised by a patient during their hospital stay.

2.1.4 Patient outcomes

Outcomes following hospitalisation are varied; individual, specialty measures alone are not sufficient to gauge a patient’s recovery. In their call for standardised patient outcomes, Porter and colleagues (2016) postulate that patients are most concerned with the health status achieved, time, complications, suffering involved, and sustainability of benefits. For this reason, the current review will conduct a holistic approach to measuring hospital-related outcomes, under the umbrella term of *patient outcomes*. These outcomes will be sorted into two categories: subjective (e.g., self-rated, such as quality of life or pain) and objective (e.g., patient records, such as length of stay or readmission).

2.2 Methods

The current review adhered to the PRISMA guidelines for the reporting of systematic reviews and meta-analyses (Moher et al., 2009).

2.2.1 Eligibility criteria

Eligible studies were quantitative and included a measure of both: (i) in-hospital stress, whereby psychological stress was perceived and appraised by the patient during their hospital stay, and (ii) in-hospital and/or post-hospital patient outcome(s). Distress, measures of stress that did not include a perceived appraisal (e.g., cortisol levels), and studies focussing exclusively on participants with a psychiatric disorder (e.g., PTSD) were not included. Patient outcomes included clinical assessments, Patient-Reported Outcome Measures (PROMs; as defined by the Cochrane Handbook, Chapter 18, Johnston et al., 2022), and patient records denoting quality of care (e.g., length of stay and readmission). Patient satisfaction, though classed as a Patient-Reported Experience Measure (PREM; e.g., see Weldering & Smith, 2013), was also included in the current review, as it has been included in previous systematic reviews measuring patient outcomes (e.g., Braithwaite et al., 2017; Recio-Saucedo et al., 2018), as well as the patient-reported outcomes chapter of the Cochrane Handbook, cited above. Routine in-hospital assessments (e.g., heart rate, body temperature, etc.), however, were not considered patient outcomes for the purpose of this review, as they are merely antecedents of poor health, and not an ailment in themselves. Participants in the eligible studies were adults (18 years or older) that were hospital inpatients at the time in-hospital stress was measured. If the period spanned by the stress measure (e.g., "indicate how much each item has applied to you over the *past week*") covered more of the pre-hospital period than in-hospital period, then it was not included.

2.2.2 Search strategy

Five databases were searched from inception to present: Medline, Embase, PsycINFO, CINAHL, and Web of Science. The search was first conducted on 5th July 2021 and updated on 5th July 2022; and was limited by (i) English language, (ii) human studies, (iii) adults (18+ years), and (iv) peer-reviewed articles. All titles and abstracts were screened by the first author (D.F.), 20% of which were independently screened again (L.B.); any discrepancies were resolved via discussion. This process was repeated for full texts, with a third reviewer (D.OC or R.L) consulted where there was ambiguity or lack of agreement. Details of the protocol for this review were preregistered on PROSPERO (CRD42021237017), which can be accessed at https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=237017.

2.2.3 Search terms

The method of formulating search terms was adapted from the PICO framework (Schardt et al., 2007) as shown in Table 2.1. Indexing terms were adapted as necessary for use in the databases searched (see Appendix A for a full list of search terms for each database).

Table 2.1. PICO framework used to formulate search terms

Population:	Adult inpatients
Intervention (Exposure):	In-hospital stress
Comparison:	Not applicable
Outcome:	Patient outcomes

Outcome search terms were informed by several recently published systematic reviews measuring patient outcomes and using the same databases as the current review (e.g., Braithwaite et al., 2017; Driscoll et al., 2018; Recio-Saucedo et al., 2018). These were amalgamated after the removal of unwanted terms: i.e., terms specific to these systematic reviews (e.g., "medication system errors") and those pertaining to routine in-hospital assessments (e.g., "blood pressure"). Post-hospital syndrome was considered a principal term to include as an outcome; however, there are currently no subject headings specifically for "post-hospital syndrome" in the thesauruses of the databases used. Therefore, the effects of PHS were captured in other search terms (e.g., "Postoperative Complications", "Hospital Readmissions", etc.) – this approach was supported in that no additional search results were retrieved when adding "post-hospital syndrome" as a keyword.

2.2.4 Data extraction

Data was extracted by D.F. and comprised: author, year, study design, recruitment method, country, sample size, age, sex, reason for treatment, length of stay, number of previous hospital stays, measure of in-hospital stress (including time frame of stress experienced, e.g., "in the past month"), and patient outcome measure (including length of follow-up). Where multiple patient outcome measures were present in a study, discussion between three of the reviewers (D.F., D.OC. R.L.) took place to determine which measure(s) was (were) most appropriate to include. For experimental studies, only control data was used. Where pre- and post-hospitalisation patient outcome measures were recorded, post-measures were chosen as these were more representative of the hospital period. In-hospital patient outcomes measured at the same time as in-hospital stress were not included, as the nature of the causal relationship was unclear (e.g., pain measure in Volicer, 1978).

2.2.5 Quality assessment

The Effective Public Health Practice Project (EPHPP) quality assessment tool for quantitative studies was employed. This tool was chosen over others as it is more appropriate for observational studies, while other options (e.g., Cochrane Risk of Bias tool) are more appropriate for randomised controlled trials. Each study was assessed on its design, method, and analysis, which informed an overall rating of the paper as "strong", "moderate", or "weak". Papers deemed as "weak" were not excluded from the overall analysis; rather, a subgroup analysis was conducted comparing the magnitude of association in these papers against those rated as “strong” or “moderate”. All eligible studies were assessed by D.F. and L.B. using the chosen tool.

2.2.6 Data analysis

Each study identified for inclusion in the review was inspected for research design, country, sample, stress measure, and patient outcome(s); these data were extracted and systematically recorded (Table 2.2).

Meta-analyses were conducted using R Studio (version 4.1.3) (R Core Team; all packages and code used are included in Appendix B), employing random-effects modelling via the *metafor* package (Viechtbauer, 2010). As we expected most of the eligible studies to employ a correlational design, we chose Pearson’s *r* as the pooled effect size metric (using Fisher *z* to *r* back-transformation method), where $r = 0.10$, 0.30, and 0.50 were considered small, medium, and large, respectively (Cohen, 1992). Unadjusted correlations were chosen

over adjusted if both were provided in the paper. Where other statistics were reported, *r* was estimated using the Campbell Collaboration Effect Size Calculator (Wilson, n.d.).

Three sub-group analyses were planned a priori to address the secondary research questions. Sub-groups were split by (i) strong and medium vs weak quality, (ii) in-hospital vs post-hospital outcomes, and (iii) subjective vs objective outcome measures. A meta-regression calculated whether the pooled effects of these sub-groups were significantly different. Meta-regression was also used to explore whether age and sex were significant covariates of the relationship between in-hospital stress and patient outcomes.

Heterogeneity was assessed with Cochran's *Q* statistic and related I^2 statistic. Funnel plots were generated, and Egger's regression (Egger et al., 1997) was calculated to test for asymmetry, which assessed the risk of small study bias: an indicator of publication bias (Sterne et al., 2000). A selection model (Heckman, 1979) was also calculated to directly assess the risk of publication bias. All analyses were subject to leave-one-out sensitivity analyses (Higgins et al., 2003) to observe how each study influenced the overall model. Any studies indicated as disproportionately influencing the model were excluded, with reason offered as to why the result of the study in question may be inaccurate.

2.3 Results

Initial systematic searching yielded 2,070 records, plus three records identified through other sources. Following the PRISMA screening process guidelines (Moher et al., 2009), 10 studies remained for inclusion in the systematic review (Ahmadi, 1985; Baharlooei et al., 2017; Chalageri et al., 2021; Edmondson et al., 2014; Karademas et al., 2009; Karaer & Ozsaker, 2021; Pati et al., 2016; Tully et al., 2008; Tully et al., 2011; Volicer, 1978), comprising 1,832

participants (Figure 2.1). All 10 studies were also suitable for meta-analysis; some studies did not record data for all variables we wished to extract (e.g., length of stay; see Table 2.2). There was 100% agreement between the two authors screening (D.F. and L.B.) on which studies to include and their quality assessment scores.

Studies were conducted in the following countries: four in the United States, two in Australia, one in Greece, one in India, one in Iran, and one in Turkey. Studies were of varied design: four cross-sectional, three cohort, one cohort analytic, one controlled clinical trial, and one randomised controlled trial. All studies used convenience sampling, recruiting sample sizes of 91 to 535 across nine cohorts. However, it is important to note, only five of these 10 studies sought explicitly to address our research question (Ahmadi, 1985; Karademas et al., 2009; Karaer & Ozsaker, 2021; Pati et al., 2016; Volicer, 1978); while the other five studies assessed stress while in hospital, though this was not the main aim of the study.

A variety of scales were used to measure stress while in hospital: three studies used the Depression, Anxiety and Stress Scale (DASS; Lovibond & Lovibond, 1995), two studies used the Hospital Stress Rating Scale (HSRS; Volicer & Bohannon, 1975), one used the Perceived Stress Scale (PSS; Cohen et al., 1983), one used the Stress Arousal Checklist (SACL; Mackay et al., 1978), one used the Intensive Care Unit Environmental Stressor Scale (ICUESS; Ballard, 1981), one used a single-item interview question, and one used a three-item questionnaire. Within the 10 studies, there were 16 patient outcomes. Similarly, these measures were varied; three measured length of hospital stay, two measured satisfaction of care (rated 1-10 in Ahmadi, 1985; ENCS, Thomas et al., 1996), two related to subjective health (rated 1-100 in Karademas, 2009; Recovery Inventory; Wolfer & Davis, 1970), two to quality of life (EQ-5D; Szende & Williams, 2004; WHOQOL-BREF; WHOQOL Group, 1998), two were self-rated pain measures (using numeric pain rating scales), two were incidence of readmission, one

focussed on return to usual activities (rated 0-5 in Volicer, 1978), one reported incidence of atrial fibrillation, and one used a spinal cord independence measure (SCIM; Catz et al., 1997).

Figure 2.1. PRISMA flow diagram presenting an overview of the selection process

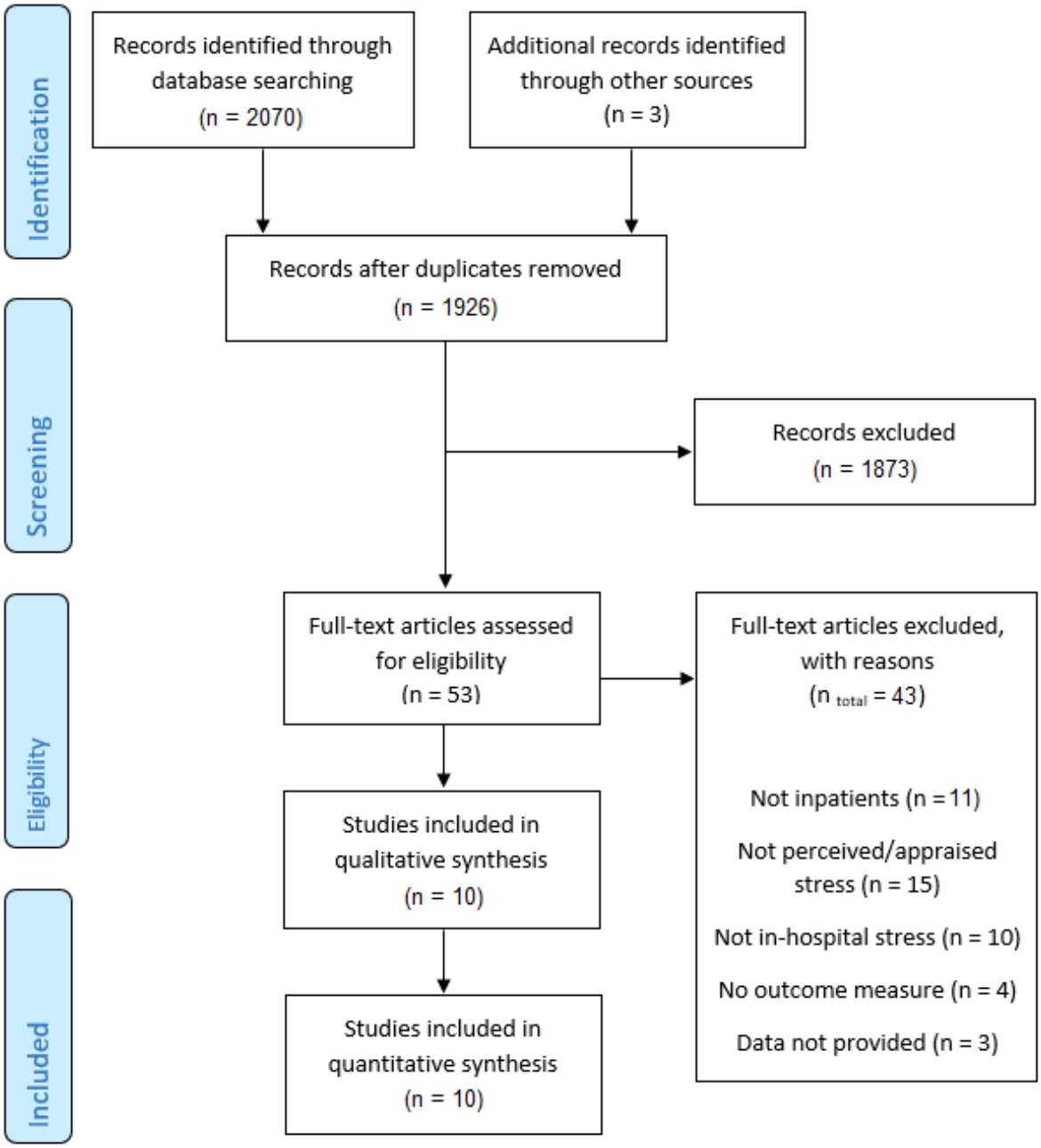


Table 2.2. Summary of studies included in the systematic review and meta-analysis

Author, year (Country)	**Sample**	**Quality Score**	**Stress Measure**	**Outcome Measure (Subjective/Objective)**	**Study Aim(s)**	**Summary Findings**
Ahmadi, 1985 (United States)	100 medical inpatients	Weak	HSRS	Patient Satisfaction (Scale 1-10) **(S)** Length of Stay **(O)**	To explore relationships among patient stress, social support, and satisfaction.	Stress correlated with satisfaction (r = -0.10, p = n.s.) and length of stay (r = 0.10, p = n.s.).
Baharlooei et al., 2017 (Iran)	150 diabetic older adults inpatients	Weak	DASS-21	Length of Stay **(O)**	To assess psychosocial factors predicting length of hospitalization among hospitalized elderly patients with diabetes.	Stress correlated with length of stay (r = 0.10, p = n.s.). Multiple regression using stress as a predictor of length of stay (females: β = 0.19, p = 0.09; males: β = 0.30, p = 0.04).
Chalageri et al., 2021 (India)	45 spinal cord injury inpatients (post-treatment control group only)	Weak	PSS-14	Quality of Life (WHOQOL-BREF) **(S)** Spinal Cord Independence Measure (SCIM) **(O)** Pain (NPRS) **(S)**	Evaluating the effect of easy *rāja yoga* on psychological and functional outcomes of patients with spinal cord injury.	Stress correlated with quality of life* (r = -0.84, p < 0.001), SCIM* (r = -0.30, p = 0.05), and pain* (r = 0.36, p = 0.02).
Edmondson et al., 2014 (United States)	225 acute coronary syndrome inpatients	Weak	Telephone interview: "During the past 2 weeks,	All-cause hospital readmission (within 30 days) **(O)**	To test the association of peri-hospitalization stress to 30-day readmission.	Odds ratio* comparing readmission rates between high versus low stress

			how often have you felt tense or wound up?"			groups (*OR* = 2.39, *p* = 0.11).
Karademas et al., 2009 (Greece)	128 inpatients with chronic conditions	Weak	Three statements; scored on a five-point Likert scale	HRQOL **(S)** Self-rated Health **(S)**	To examine the effects of illness acceptance on the subjective health of hospitalized chronic medical patients.	Stress correlated with HRQOL* (*r* = -0.39, *p* < 0.001) and self-rated health (*r* = -0.35, *p* < 0.001).
Karaer et al., 2021 (Turkey)	120 surgical intensive care inpatients	Weak	ICUESS	Satisfaction (ENCS) **(S)**	To determine environmental stressors perceived by patients in the surgical intensive care unit and their level of satisfaction with nursing care.	Stress correlated with satisfaction (*r* = -0.38, *p* < 0.001).
Pati et al., 2016 (United States)	81 (control only) general medical-surgical inpatients	Strong	SACL	Length of Stay **(O)** Pain **(S)**	To examine whether incorporation of simulated nature, in the form of ceiling mounted photographic sky compositions, influences patient outcomes.	Stress correlated with pain* (*r* = 0.299, *p* = 0.01), but not length of stay* (*r* = 0.05, *p* = 0.71).
Tully et al., 2008 (Australia)	222 coronary artery bypass graft inpatients	Moderate	DASS-42	Unplanned, treatment-related Readmission (within six months) **(O)**	To determine the association between depression, anxiety and general stress symptoms with hospital	No significant difference in postoperative stress between readmitted and not readmitted patients (*p* = 0.76). **

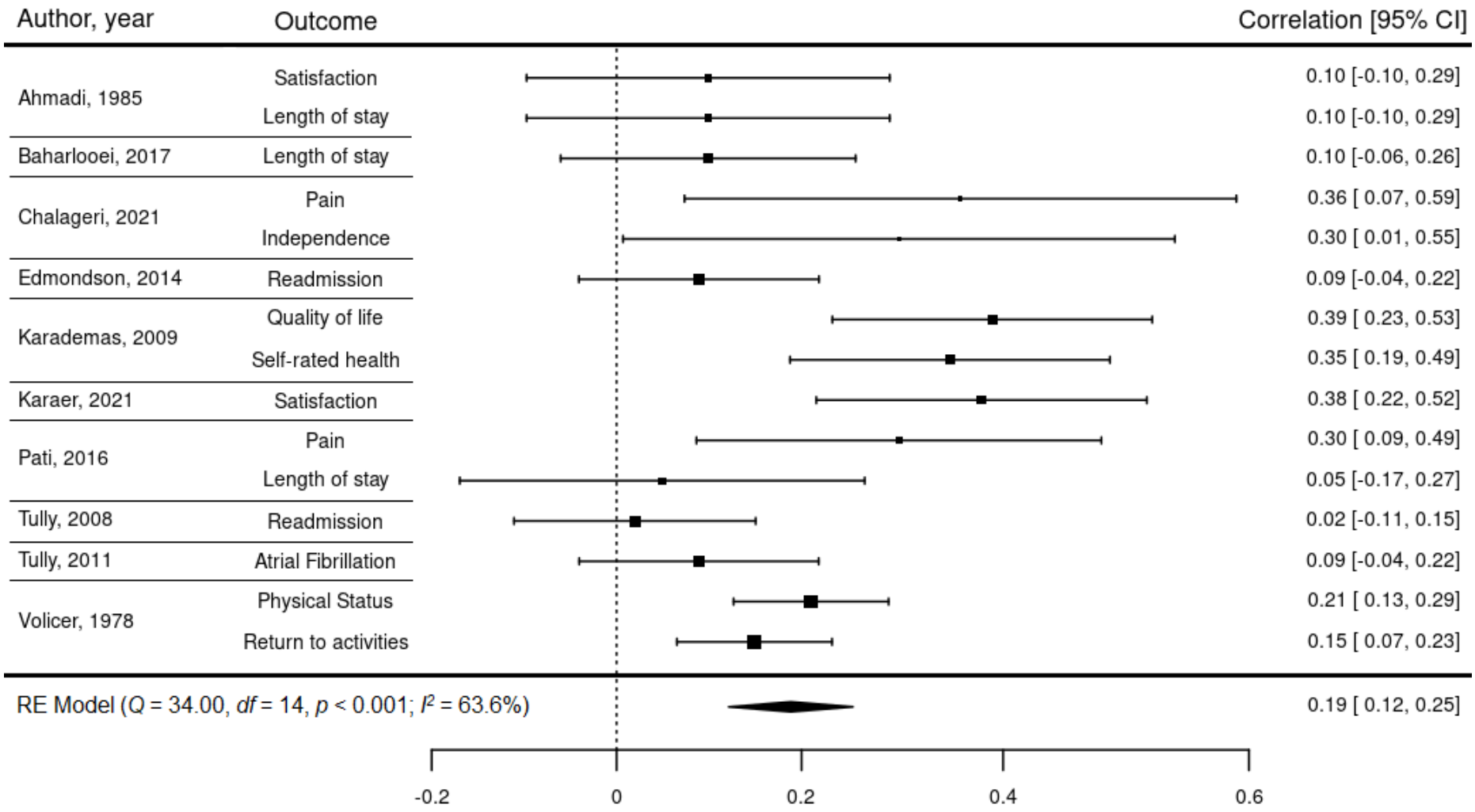
					readmissions after coronary artery bypass graft surgery.	
Tully et al., 2011 (Australia)	226 cardiac surgery inpatients	Moderate	DASS-42	Incidence of Atrial Fibrillation **(O)**	To determine whether preoperative and postoperative anxiety, depression, and stress symptoms were associated with atrial fibrillation (AF) after cardiac surgery.	No significant difference in postoperative stress between patients with and without incidence of postoperative atrial fibrillation ($p = 0.18$). **
Volicer, 1978 (United States)	535 medical and surgical inpatients with cardiovascular conditions	Moderate	HSRS	Subjective physical status post hospital (POST) **(S)** Return to usual activities (RETURN) **(S)**	To test for associations between hospital stress and cardiovascular changes observed during the course of hospitalization.	Stress correlated (by averaging*** unadjusted correlations) with POST ($r = -0.21$, $p < 0.001$) and RETURN scores ($r = -0.15$, $p < 0.001$).

*Figure calculated by D.F. using data provided by the study (either reported in the paper or attained by emailing the author); **Calculated via independent samples t-tests; ***See "A note on averaging correlations" (Alexander, 1990).

An unadjusted correlation was attained for each of the outcomes with their respective stress measures, with all 16 effects reporting in their predicted directions; nine of which reached statistical significance. As all effect sizes presented in their predicted directions (adverse outcomes correlated positively with stress; beneficial outcomes correlated negatively), it was possible to group both adverse and beneficial patient outcomes, temporarily ignoring the direction of the effect and focussing only on the magnitude. The random-effects model revealed a medium-sized, significant relationship between in-hospital stress and patient outcomes (r = 0.27; 95% confidence interval [CI], 0.12–0.41; n = 1,832; $p < 0.001$), with considerable heterogeneity (I^2 = 92.7%, $p < 0.001$). However, one effect size was identified as an influential outlier, disproportionately influencing heterogeneity (Viechtbauer & Cheung, 2010), and so was excluded from the remainder of the meta-analysis. The outlier was identified as quality of life in the study by Chalageri and colleagues (2021), which was a near-perfect correlation (r = 0.84). We suspect that this is due to the two correlated measures quantifying similar constructs.

The remaining 15 correlations were suitable to be included in the full meta-analysis. The second random-effects model (Figure 2.2) revealed a small-to-medium, statistically significant relationship (r = 0.19; 95% CI: 0.12–0.26; n = 1,832; $p < 0.001$), with moderate heterogeneity (I^2 = 63.6, $p < 0.01$). As meta-analyses assume effect size independence, the use of robust variance estimation (RVE; Hedges et al., 2010) was necessary to account for within-subject statistical dependencies of studies that reported multiple outcomes. No notable differences were identified between the RVE model (r = 0.19; 95% CI: 0.09–0.30; $p < 0.01$) and unadjusted model (Figure 2.2), indicating that effect size dependencies were not disproportionately influencing the model.

Figure 2.2. In-hospital stress on patient outcomes: a forest plot of correlation coefficients within the included studies



2.3.1 Sub-group analyses

Three pairs of models were produced, two of which addressed the secondary research questions, and the other observing the effect of study quality (Table 2.3). A statistically significant difference was reported for both of the relationships between in-hospital stress and (i) in-hospital versus post-hospital patient outcomes, and (ii) subjective verses objective outcome measures. In-hospital patient outcomes correlated more strongly with in-hospital stress than did those measured post-hospital ($QM = 4.23$, $p = 0.04$). Similarly, the effect was larger for subjectively measured patient outcomes than those measured objectively ($QM = 10.77$, $p < 0.001$). However, no significant difference was found in the effect sizes reported in strong and moderate studies versus weaker ones ($QM = 2.19$, $p = 0.14$).

Table 2.3. In-hospital stress on patient outcomes: random-effects models of sub-groups

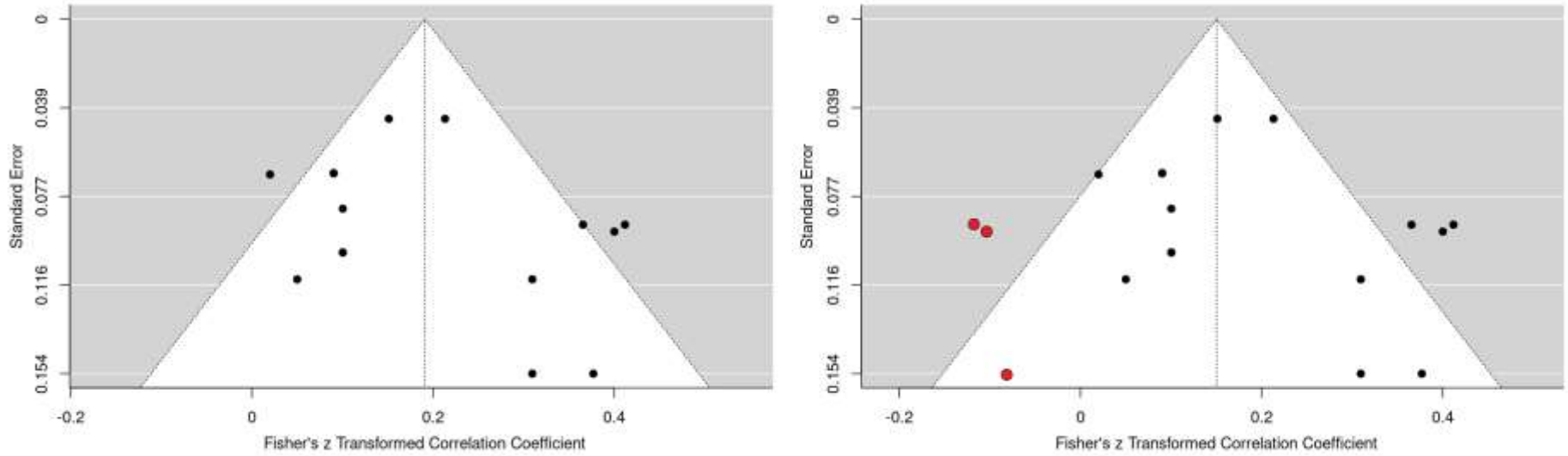
Sub-groups of patient outcomes	Correlation ($0 < r < 1$)	95% CI	Number of studies	*p* value	Heterogeneity	
					I^2	*p*
In-hospital	0.25	[0.15; 0.34]	10	< 0.001	54%	0.02
Post-hospital	0.13	[0.06; 0.19]	5	< 0.001	46%	0.13
$QM = 4.23$, $p = 0.04$						
Subjective	0.27	[0.19; 0.36]	8	< 0.001	60%	0.02
Objective	0.08	[0.02; 0.14]	7	< 0.01	0%	0.78
$QM = 10.77$, $p < 0.001$						
Strong/Moderate	0.14	[0.07; 0.21]	6	< 0.001	46%	0.09
Weak	0.24	[0.14; 0.34]	9	< 0.001	61%	< 0.01
$QM = 2.19$, $p = 0.14$						

A meta-regression was conducted to determine whether age and sex influenced the correlation between in-hospital stress and patient outcomes. Neither sex (β = -0.0003, p = 0.86) nor age (β = -0.008, p = 0.08) were identified as significant covariates. However, all but one of the studies reported mean age within a restricted range, between 52.0–68.0 years, and so this estimate may be inaccurate due to a lack of statistical power. It was not possible to test if length of stay (or other similar variables, such as number of previous hospital stays) was a significant covariate, as not enough studies reported this value, and some studies included length of stay as an outcome.

2.3.2 Sensitivity Analyses

The presence of publication bias was investigated. Egger's regression test was not statistically significant (p = 0.176), suggesting that there was no presence of small-study bias. However, a funnel plot of standard errors (Figure 2.3) showed that three studies may be missing to the left of the mean; this was supported by a Trim and Fill analysis (Duval & Tweedie, 2000), which shifted the x-intercept to the left by 0.041 (i.e., the pooled effect size decreased from: r = 0.191 to r = 0.150).

Figure 2.3. Funnel plot (left) with trim and fill applied (right)



A selection model was calculated to directly address publication bias by giving more weight to effect sizes that were not statistically significant. A Likelihood Ratio test was then conducted, which indicated that the selection model (r = 0.20; 95% CI, 0.10–0.30; n = 1,832; $p < 0.001$) was not significantly different to the unadjusted model, suggesting that there was no evidence of publication bias ($X^2 = 0.054$, $p = 0.816$).

Systematically removing one of the 15 correlations at a time, via leave-one-out analysis, indicated that no single effect size was disproportionately contributing to the model. The pooled effect size ranged from: r = 0.173 (-0.018) to r = 0.205 (+0.014), with each model remaining significant ($p < 0.001$).

2.4. Discussion

The current review synthesised findings from 10 diverse studies that reported a measure of in-hospital stress and at least one patient outcome. A statistically significant association was identified between the two variables, consistent with previous systematic reviews observing the association between stress and health outcomes – including wound healing (Walburn et al., 2009), cardiovascular disease (Backé, 2012), and poorer health outcomes generally (Garfin et al., 2018; Guidi et al., 2021; Turner et al., 2020). However, the current systematic review is the first of its kind to look at patients' psychological stress specific to the in-hospital period; where the stressors are more numerous, and the body more vulnerable.

A small-to-medium negative association was found, suggesting that as in-hospital stress increased, patient outcomes deteriorated, though causality is unclear. The association was significantly stronger for subjective than objective outcome measures. This difference may be due to sources of information bias within the subjective measures, such as self-report bias and confirmation bias (Althubaiti, 2016). Indeed, these biases may also be compounded by

common method variance (Lindell & Whitney, 2001). Additionally, the observed differences are likely, in part, a result of the disparate nature of the two groups of measures. Subjective and objective measures in these studies tended to assess different types of outcomes; while subjective measures pertained to more complex and dynamic outcomes such as quality of life and subjective health, objective measures pertained more to outcomes associated with healthcare resource use such as length of stay and readmission. Nevertheless, the association between in-hospital stress and patient outcomes, albeit small, gives credence to Goldwater and colleagues' (2018) theory that hospital-related allostatic overload may be a plausible aetiology of PHS (Krumholz, 2013).

Similarly, the association was significantly stronger for in-hospital patient outcomes than those measured post-hospital. Patients assessed in the post-hospital period are no longer exposed to in-hospital stressors, and so may not be experiencing the effects of PHS as acutely as their in-hospital counterparts as time has elapsed since the initial stressor exposure. However, perhaps another explanation for this difference in strength is the presence of case-mix (i.e., the differing types of patients treated) and confounding variables within the included studies. This may then be aggregated, again, by the disparate nature of the measures used to assess patient outcomes at the in-hospital versus post-hospital periods.

Meta-regression identified that neither sex nor age were statistically significant covariates; although, it is important to note that statistical power was too weak to draw any concrete conclusions. Other potential covariates, such as length of stay and number of previous hospital stays, were similarly not calculated on account of the limited number of studies. Previous literature would suggest that age is a significant covariate, where the association between in-hospital stress and patient outcomes increases with age. In their recent systematic review, Guidi and colleagues (2021) outlined that allostatic overload, in older adults, is associated with frailty (Gruenewald et al., 2009), declines in cognitive and physical functioning

(e.g., Read & Grundy, 2014; Seeman et al., 1997; 2001), delirium (Rigney, 2010), risk of mortality (Karlamangla et al., 2006), and more. Therefore, it is important that the role of age, in the context of in-hospital stress and patient outcome relations, is further investigated.

The results of the current systematic review and meta-analysis indicate that patient outcomes may be, in part, a function of the stress experienced by patients during their hospital stay. This highlights the need for (i) an increased focus on reducing the need for hospital admissions and (ii) greater attention to reducing the stress experienced by patients during their hospital stay. These actions must be culturally sensitive, and address healthcare at the individual and system levels (Wade et al., 2022). If causation were to be established, reducing in-hospital stress could be a cost-effective strategy for healthcare providers, given the association with longer stays and readmissions. The first logical step in this process would be to identify the specific aspects of hospitalisation that cause patients the most stress, such as the *hospital-related stressors* outlined by Goldwater and colleagues (2018). With this knowledge, appropriate policies and interventions can be implemented to reduce in-hospital stress, which may then lead to less adverse patient outcomes.

2.4.1 Strengths and Limitations

Our findings must be interpreted within the context of the limited academic literature. Consequently, the current review included relatively few articles, and reported on a variety of patient conditions, in-hospital stress measures, and patient outcome measures, which complicated attempts to make fair comparisons between studies. Despite this, heterogeneity values were only moderate, and every association within the included studies presented in their predicted directions – as in-hospital stress increased: beneficial patient outcomes (e.g., physical

status, quality of life, etc.) deteriorated; and adverse patient outcomes (e.g., pain, readmission, etc.) increased.

Within the included studies, only half sought to address the research question of the current review, while the remaining articles were not specific to stress attributable to hospitalisation (though they did measure stress during the patients' hospital stays). Further, most of the included studies were deemed of weak quality, and only one was deemed strong. Most of the studies were cross-sectional and utilised either a correlational or non-randomised cohort design. Samples within the included studies were also limited in their ability to represent the wider population; all studies employed convenience sampling, most of which were limited to one-to-two wards within a single hospital. Evidently, more high-quality studies are essential to draw conclusions with sufficient confidence; these studies would ideally be large-scale, longitudinal, and randomised, using an agreed upon measure (e.g., HSRS) across multiple wards and hospitals.

Finally, despite only including studies where in-hospital stress was measured before the patient outcome, the presence of bidirectional causation is entirely conceivable. For example, a patient may have had high levels of pain at the beginning of their hospital stay – at the time stress was measured – which would likely inflate the stress score, this pain would then be measured later, and assumed to be high due to an inflated stress score. In essence, in-hospital stress could be argued to be, at least in part, a proxy measure for a host of (undoubtedly stressful) factors that are antecedents to poorer patient outcomes, or even patient outcomes themselves. This ambiguity in causation could have been partially accounted for by controlling for potential confounding variables (e.g., severity of illness), of which, few of the included studies measured.

2.4.2 Conclusion

This systematic review and meta-analysis found a small-to-medium relationship between in-hospital stress and a variety of patient outcomes. The association was stronger for in-hospital than post-hospital outcomes, and subjective than objective outcome measures. Our findings are comparable to other systematic reviews exploring the relationship between stress and health outcomes. Future research ought to aim to conduct high quality, larger scale studies in order to make any conclusions with sufficient confidence. These studies must account for confounding variables and employ a standardised measure of in-hospital stress.

Chapter 3

Development and initial validation of a hospital stress questionnaire

3.1 Introduction

3.1.1 Background

Hospitals are widely considered to be a stressful environment, such that the experience has been described as 'the trauma of hospitalisation' (Detsky & Krumholz, 2014). In their paper, Detsky and Krumholz (2014) suggest that the traumatic nature of hospitalisation could be reduced by addressing a range of psychological (e.g., depersonalisation and uncertainty) and physiological (e.g., poor nourishment and rest) hospital-related stressors (see also Goldwater et al., 2018). These stressors are considered to be a significant factor in the aetiology of a phenomenon known as post-hospital syndrome (PHS): an acquired period of generalised vulnerability to major adverse events following hospitalisation (Krumholz, 2013).

This theorised relationship between hospital-related stressors and health has been bolstered by recent reviews highlighting the cumulative science linking psychological stress to negative health outcomes (O'Connor et al., 2021), and more specifically, in-hospital stress and patient outcomes (Ford et al., 2023). If a robust measure of hospital-related stress were developed and validated, it would facilitate evaluation of stress-reducing interventions of inpatients, inform policy decisions in hospitals, and could potentially be used as a predictor of patient outcomes.

3.1.2 Existing measures of hospital stress

Several measures of hospital stress have previously been developed, the first of which was the Hospital Stress Rating Scale (HSRS; Volicer, 1973, 1974; Volicer & Bohannon, 1975). The HSRS is a 49-item questionnaire, where each item details a stressful hospital-related event; items each have a pre-assigned rating of how stressful they are, and are presented from least ('Having strangers sleep in the same room with you') to most ('Thinking you might lose your sight') stressful. Participants respond by selecting which events they have experienced during their hospital stay, and the pre-assigned ratings of each item selected are summed to create a total score. This approach is potentially flawed when measuring subjective concepts such as stress: the preassigned rating of items does not allow for individual differences in perceived stress amongst patients. Additionally, some of the ratings are questionable, as higher ranking events (e.g., "Thinking you might have cancer", rated 39.2) are likely to be more than just 2–3x as stressful as lower ranking events (e.g., "Having to eat at different times than you usually do", rated 15.4). Although the measure was developed 50 years ago, many of the stressors included are still relevant for current inpatients. However, some questions are outdated or not relevant to the UK (e.g., health insurance), and the measure has not been sufficiently validated by contemporary standards (see Tsang et al., 2017).

Subsequent measures have been developed to identify and measure the stressors of specific groups of patients. The Intensive Care Unit Environmental Stressor Scale (ICUESS) is an adaptation of the HSRS for postoperative surgical ICU patients (Ballard, 1981), later extended upon and renamed the Environmental Stressor Questionnaire (ESQ; Cochran & Ganong, 1989). The Hospital Stress Index (HSI) is a list of 40 hospital-related experiences perceived as stressful, split into seven categories, designed specifically for elderly medical inpatients (Koenig et al., 1995). Participants respond to each item by selecting either "yes" (scored as 1), "no", or "unsure" (both scores as 0) – however, this approach assumes that each

event is equally stressful and, like the HSRS, does not accommodate for individual differences in perceived stress amongst patients. Moreover, the HSI has not been validated and lacks generalisability to other conditions as 89% of the patients in the sample informing the items were hospitalised with cardiovascular pathologies.

The most recent development sought to measure the hospital-related stress of elderly inpatients in an Iranian population (Hospitalisation-Related Stressors Questionnaire for Elderly Patients, HRSQ-EP; Musavi et al., 2016), later adapted and validated in Turkish (Yildirim & Işik, 2021). The importance of culturally sensitive health measures such as these has been emphasised (Rosa et al., 2010) in order to maintain the content validity of the instrument across different cultures (Beaton et al., 2002). This scale improves on previous measures as it utilises a 5-point Likert scale, allowing for individual differences in perceived stress. However, the development of the measure is poorly reported, which questions the reliability of the results; only seven patients were interviewed to inform the items, and no details are given regarding the interview participants, procedure, or results.

3.1.3 Aims of the current study

The aim of the current study was to identify hospital-related stressors experienced by inpatients, and to collate these findings with previous questionnaire items to develop a self-report questionnaire measuring in-hospital stress. This measure will be specific to the United Kingdom, generalisable across age groups and treatments (excluding paediatric, maternity, and psychiatric), and allow for individual differences in perceived stress. We then aim to provide initial validation for this novel questionnaire.

3.2 Method

Ethical approval was granted by the University of Leeds, School of Psychology Research Ethics Committee (development: PSYC-282; validation: PSYC-737). Development and initial validation of the questionnaire consisted of three stages – (i) qualitative interviews, (ii) item generation, and (iii) pilot testing to provide initial validation.

3.2.1 Stage 1: Qualitative interviews

3.2.1.1 Participants

Twenty-one participants were recruited via social media platforms, word of mouth, snowball sampling, and Care Opinion (careopinion.org.uk). An invitation poster was uploaded to social media, detailing the inclusion criteria of the study, the most important of which was a recent hospital stay of 48 hours or more within the past 12 months. Each participant received a £20 gift voucher to compensate for their time. We sought to hear from all age groups, sexes, and ethnicities, and so purposive sampling was used to recruit from a diverse range of communities. Recruitment was terminated when a sufficiently diverse sample was achieved, and no new stressors were attained by interviewing further participants. A panel of lay leaders – independent representatives of patients and members of the public, with differing areas of expertise – were consulted to review the appropriateness of the recruitment material, and for assistance with contacting diverse and under-represented communities.

Participants were required to be over 18 years old and must have been an inpatient in a UK hospital for at least 48 consecutive hours in the 12 months prior to recruitment. This was to ensure ample time to experience a broad range of hospital-related stressors and is in keeping with previous work (Koenig et al., 1995). Participants that had been an inpatient for paediatric,

maternity, or psychiatric care were excluded on the basis that the stressors associated with these settings would be vastly different to those associated with other conditions (e.g., Pichler-Stachl et al., 2016). Patients' recollections of stressful hospital experiences have been shown to be reliable at 12 months following discharge (Löf et al., 2006), and so this length of time was chosen as the cut-off for recruitment. Two participants were inpatients more than 12 months prior to the interview but had materials to aid their memory (e.g., had taken notes during their hospital stay), and so were allowed to participate.

3.2.1.2 Procedure

Using the framework set out by Kallio and colleagues (2016), semi-structured interviews were performed to identify the hospital-related stressors experienced by the participants during their hospital stays. An interview schedule was produced (see Appendix A), written using language suitable for a layperson and was rated as 'easy to read', according to the Flesch Reading Ease Score (FRES = 82.0). The schedule consisted of an introduction and 17 questions: 10 background questions and seven open-ended questions. Background questions were used to ensure a diverse sample of age, sex (Male, Female, Prefer not to say), education (No qualifications; GCSE/O-Level or vocational level 2 and equivalents; A-Level or vocational level 3 and equivalents; Undergraduate degree; Postgraduate degree; Prefer not to say), ethnicity (White; Mixed or Multiple ethnic groups; Asian or Asian British; Black, African, Caribbean, or Black British; Other ethnic groups; Prefer not to say), and reasons for hospitalisation. The open-ended questions began by asking participants to describe their experience of being an inpatient; this was intended to give the interviewer an understanding of the participant's hospital stay, as well as an opportunity to follow up on any stressors that the participant identified in their account. Subsequent questions were designed to identify any

further stressors that the participant omitted in their initial description. After the participant had spontaneously reported all of the stressors they recalled experiencing during their hospital stay, they were then prompted with known hospital-related stressors from previous academic literature – for example, Goldwater and colleagues' (2018) stressors: sleep disruption, malnourishment, dehydration, mobility restriction, and pain – and asked if they had experienced any of these stressors during their stay. Finally, the participants were asked to rank the top three most stressful events that had been discussed within the interview. Interviews were audio recorded and later transcribed verbatim, with anonymisation, by the interviewer (researcher DF) for the purpose of data analysis.

3.2.1.3 Data Analysis

Interview transcripts were imported to NVivo 20.1.6 (QSR International Pty Ltd. 2020) and coded using quantitative content analysis (Neuendorf, 2017), with a positivist manifest approach. This approach is typically taken for a quantitative content analysis; it assumes objectivity, observability, and measurability of the data, and allows the researcher to generate observed frequencies of the codes (Kleinheksel et al., 2020). The purpose of the analysis was to identify and quantify the hospital-related stressors experienced by the participants during their hospital stays. To identify these stressors, all 21 transcripts were coded by researcher DF, 10 of which were then independently double-coded by researcher E. Travis. When quantifying the codes, frequencies of stressors were counted per participant, rather than per mention, to assess which stressors are most commonly experienced by inpatients. Stressors discussed in the interview that were not experienced as an inpatient were excluded from the analysis (e.g., parking, A&E, and health-related issues leading up to hospitalisation).

3.2.2 Stage 2: Item generation

Questionnaire items were generated in four phases. The first phase involved compiling the stressors identified in the interviews with those listed in previous hospital stress measures (HSRS; Volicer & Bohannon, 1975; HSI; Koenig et al., 1995; HRSQ-EP; Musavi et al., 2016). Second, the research team reviewed each stressor for cultural and contemporary relevance, removing any irrelevant or duplicate stressors, and the remaining stressors were posed as questionnaire items. Third, to assess the content validity of the questionnaire items, the measure was presented to the Yorkshire Quality and Safety Research (YQSR) Group – an inter-disciplinary team with extensive knowledge of patient safety and the embedding of health research into practice – who assessed the relevance of the measure and suggested additional items. Lastly, seven laypersons and three health professionals were invited to review the questionnaire to assess face validity. Two questions were asked: (i) 'Did any of the questions not make sense to you? If so, which ones and why?' and (ii) 'Can you think of any stressful hospital experiences that were not on the list?'

3.2.3 Stage 3: Initial validation

3.2.3.1 Participants

A sample of 200 participants was recruited from Prolific (www.prolific.co). To achieve a spread of ages, 100 participants were recruited using an age filter in the range of 18-49, and 100 were recruited filtering to select participants that were 50 years or older. In addition to this, participants were required to have stayed in a UK hospital as an inpatient, this stay must have been in the past 12 months for at least 24 hours, and not for paediatric, maternity, or psychiatric care. The inclusion criteria for length of hospital stay was shorter for this phase of the study as

participants were no longer informing the items of the measure, and so were not required to have experienced as wide a range of stressors. For completing the survey, which took approximately 10 minutes, each participant was compensated with £1.50 via the Prolific payment system.

There are no absolute rules for the sample size required to validate a questionnaire (Osborne & Costello, 2004; Tsang et al., 2017); however, a widely-cited rule of thumb for psychometric theory is a subject to item ratio of 10:1 (Nunnally, 1967). Therefore, for a future companion study, researchers should aim to recruit 670 participants – this sample size is considered 'very good' (Comrey & Lee, 2013). While, for an initial validation, a sample size of 200 is recommended (Crocker & Algina, 1986; Frost et al., 2007) and so this number was adopted for the current study.

3.2.3.2 Procedure

A survey was created using Qualtrics (www.qualtrics.com), and began with five screening questions (e.g., 'Have you stayed in hospital in the UK?'), six demographic questions (e.g., age, sex, ethnicity, and education), and three questions relating to the post-hospital period: (i) 'How prepared did you feel to go home when you left hospital?', (ii) 'How long after leaving hospital did it take you to get back to the usual activities you did before going into hospital? (e.g., driving, work, cooking, housework, leisure, etc.)', and (iii) 'In the six weeks after leaving hospital, how vulnerable did you feel? E.g., feeling weak, unsafe, or that your health might get worse.' These three questions were designed by the research team to capture the effects of post-hospital syndrome, and were included to provide initial testing of the predictive validity of the questionnaire.

The above single item questions were followed by two questionnaires. First, the novel hospital stress questionnaire developed in stages 1 and 2, comprising of an introduction, 67 hospital-related stressors (rated 1 (not at all stressful) to 10 (extremely stressful) or 'N/A'), an 'Other' option to include any additional stressors (rated 1-10 or 'N/A'), an overall stress rating (rated 1-10), and an additional comments box. Three attention check questions (e.g., 'Please select '7' to show you are paying attention') were dispersed throughout the 67 items; participants failing more than one attention check were rejected, as per the Prolific Attention Check Policy. Second, the Perceived Stress Scale, 10-item version (PSS-10; Cohen et al., 1983), was included to assess convergent validity. Each of the 10 questions were reworded to begin with 'While in hospital…' rather than 'In the last month…' The PSS-10 was chosen as it is one of the most widely used measures of psychological stress, and has consistently been shown to be reliable and valid (Lee, 2012). The 10-item version was chosen over the 14-item version due to its shorter length, and chosen over the 4-item version due to its superior internal reliability (Cronbach's alpha: 0.78 vs 0.60; Cohen, 1988a).

3.2.3.3 Data Analysis

Data was analysed using R Statistical Software (v4.3.1; R Core Team 2023) (data and code can be accessed at: https://github.com/DMFord97/Initial-Validation). Descriptive statistics were used to analyse demographic data and responses to individual items. Cronbach's alpha was employed to assess internal consistency, where a value of 0.7 or above indicates adequate consistency between items (Nunnally, 1967). To assess convergent and predictive validities, correlation coefficients were calculated, where r = 0.10, 0.30, and 0.50 were considered small, medium, and large, respectively (Cohen, 1988b).

3.3 Results

3.3.1 Stages 1 and 2: Development

3.3.1.1 Descriptive statistics

Interviews ran from January to October 2022 and took place online (*n* = 19) or via telephone for those participants without access to the internet (*n* = 2). Each participant completed a one-to-one interview, lasting 32 minutes on average, ranging from 15 minutes to one hour. Participants were majority white and female, but overall the sample was diverse in age, sex, ethnicity, and education level (see Table 3.1). The median and mode lengths of stay were seven and five days, respectively, with stays ranging from two days to three months. On average, participants had been admitted to hospital six times in their life previous to the current stay, ranging from no previous stays to over 20. Participants had been hospitalised for surgical (*n* = 10) and medical (*n* = 11) treatments for a range of conditions: six patients were hospitalised for a gastroenterology condition, five for oncology, two for respiratory, two for COVID-19 related conditions, and one of each for cardiology, ear, nose, and throat, general surgery, nephrology, orthopaedics, and urology.

Table 3.1. Demographic data of semi-structured interview participants

Demographic	Female	Male	Total
Age (years)			
18–24	1	1	2
25–34	3	1	4
35–44	2	3	5
45–64	4	1	5
65+	4	1	5

Ethnicity			
Asian / Asian British	2	2	4
Black / African / Caribbean / Black British	2	2	4
White	10	3	13
Education			
GCSE (or equivalent)	2	0	2
A-Level (or equivalent)	3	2	5
Undergraduate degree	5	2	7
Postgraduate degree	4	3	7
Total	14	7	21

3.3.1.2 Quantitative content analysis

From the interview transcripts, 66 hospital-related stressors were identified. Table S3.1 (see Appendix B) records each of these stressors, the number of participants that reported experiencing them, and an illustrative quote. Of the 21 participants, 19 reported experiencing some level of sleep disruption. Other commonly reported stressors were ‘loss of control’, ‘pain’, and ‘noise’. Stressors such as ‘having to wear a hospital gown’, ‘being unfamiliar with the hospital rules’, and ‘missing small comforts’ were reported least frequently.

3.3.1.3 Item development

The hospital-related stressors identified from the interview transcripts were used to inform the items of the HSQ. Three codes were not developed into questions: ‘mental distress’ was considered to be a result of the stress, rather than a stressor in itself; ‘no visitor policy’ was specific to the COVID-19 pandemic; and ‘poor discharge’ was excluded as questionnaire

respondents will be inpatients, and so will not have experienced the discharge process at the time of completion. The stressors ‘mobility restriction’ and ‘confined to bed or ward’ were combined and captured by one question: ‘Feeling like you could not leave your bed or ward’.

The above processing of the interview data generated 62 questionnaire items, which were then compared against previous hospital stress measures. Three measures were deemed appropriate for comparison (HSRS: Volicer & Bohannon, 1975; HIS: Koenig et al., 1995; HRSQ-EP: Musavi et al., 2016; Yildirim & Işik, 2021) as they were not designed for treatment- or setting-specific populations (e.g., ICUESS: Ballard, 1981). Table S3.2 (see Appendix C) illustrates the comparison process of the three existing measures with the quantitative content analysis (QCA) from the current study: the QCA identified 12 new stressors and all but four of the combined 111 questions from these three existing measures, two of which were added (‘Needing help going to the bathroom’ and ‘Worrying that your appearance might change (e.g. scars)’), and two of which were excluded as they related to the pre-hospital period (HSRS: ‘24. Being put in the hospital because of an accident’ and ‘34. Having a sudden hospitalization you weren’t planning to have’). Two questions were then recommended by the YQSR Group, informed by their own hospital-related expertise (‘Being transferred between wards or hospitals’ and ‘The hospital not meeting your individual needs (e.g. disability)’), and a final question was added by the research team, informed by their own stress-related expertise (‘Not being able to smoke, drink alcohol, or use other substances’). Table S3.2 shows each of the 67 items included in the HSQ, along with the source(s) informing that item.

3.3.1.4 Questionnaire design

The total number of items in the questionnaire was 67, and concludes with two additional items: ‘Other (write in)’ and ‘Overall, how stressed did you feel during your hospital

stay?' For the complete HSQ, see Appendix D. A ten-point scale was chosen as it has been shown to be the most preferred scale length by respondents (Preston & Colman, 2000), and provides significantly higher reliability, validity, and discriminatory power than shorter scales (Preston & Colman, 2000). Laypersons reviewing the questionnaire requested that a 'Not Applicable' option be added to the scale, to distinguish between hospital-related stressors that were not experienced (rated 'N/A') and stressors that were experienced but not perceived as stressful (rated '1'). This request was met to improve usability; for the purpose of data analysis, 'N/A' responses will be coded as '1 (not at all stressful)' as both answers indicate no stress experienced. No further stressors were suggested in the review process, and no items were highlighted as being difficult to understand. This was supported by calculating the Flesch Reading Ease Score of the introduction and all questionnaire items, which yielded an overall rating of 'fairly easy to read' (FRES = 75.7).

3.3.2 Stage 3: Initial validation

3.3.2.1 Descriptive Statistics

To assess the suitability of our sample, demographics of participants that completed the survey were compared against NHS hospital admission data from 2019–20 (NHS Digital, 2020), data was chosen from this year as figures from later years were affected by the COVID-19 pandemic. Sample demographics were representative in sex and four of the five ethnic groups, but had fewer participants in the 'Black, Black British, Caribbean or African' group. Education levels were varied in the current sample but were more educated than the general population. Table 3.2 shows the NHS figures for age and ethnicity, desired figures adjusted for a sample size of 200, and figures from the recruited sample (18–19 year olds were included in

the 20–29 group). Ages within the recruited sample ranged from 18–84 (*M* = 45.83, *SD* = 15.74) but were younger overall compared to the NHS population, lacking in the >70 groups.

Table 3.2. Demographic data for NHS 2019–20 hospital admissions, with comparisons

Demographic	NHS 2019–20 data		Desired figures		Actual figures	
	n	%	*n*	%	*n*	%
Age groups						
20–29	1,628,416	8.9	18	8.9	49	24.5
30–39	1,956,878	10.7	21	10.7	34	17.0
40–49	1,688,799	9.2	18	9.2	26	13.0
50–59	2,629,680	14.4	29	14.4	50	25.0
60–69	2,946,248	16.1	32	16.1	29	14.5
70–79	3,735,458	20.4	41	20.4	11	5.5
80–89	2,876,195	15.7	31	15.7	1	0.5
>90	816,206	4.5	9	4.5	0	0
Ethnicity						
Asian or Asian British	978,586	6.5	13	6.5	11	5.5
Black, Black British, Caribbean or African	467,431	3.1	6	3.1	1	0.5
Mixed or Multiple ethnic groups	215,140	1.4	3	1.4	7	3.5
White	13,006,263	86.5	173	86.5	177	88.5
Other ethnic group	375,423	2.5	5	2.5	4	2.0

3.3.2.2 Initial Psychometric Validation

The HSQ total scores ranged from 69–567 out of 670 (*M* = 276.2, *SD* = 105.0). The top five highest and lowest rated stressors are reported in Table 3.3. None of the 67 items suffered from ceiling effects: for each item, percentages of respondents scoring the highest option (10) ranged from 0.5–16%. However, seven items had 50% or more of respondents scoring the lowest options (N/A or 1), indicating substantial floor effects, and these items could be considered for exclusion: these items were #59 (77%), #67 (70%), #66 (62.5%), #13 (60%), #48 (59.5), #30 (59%), and #65 (50%).

Table 3.3. Top five items with highest and lowest mean scores

Questionnaire item	*M* (*SD*)
12. Feeling bored	6.40 (2.64)
19. Missing loved ones	6.39 (2.88)
1. Not sleeping well	6.36 (2.51)
4. Staying in a noisy room	6.16 (2.79)
3. Having pain or discomfort from your treatment	6.04 (2.42)
13. The staff making a mistake that caused you harm	2.42 (2.39)
48. The staff not asking for consent before treating you	2.19 (2.03)
66. The hospital not meeting your individual needs (e.g. disability)	2.10 (1.99)
67. Not being able to smoke, drink alcohol, or use other substances	2.08 (2.14)
59. Not being able to pray or do other religious activities	1.58 (1.38)

Cronbach's alpha was calculated to assess the internal consistency of the 67 items in the measure, which was deemed as excellent ($\alpha = 0.97$). The mean inter-item correlation was also of an acceptable standard ($r = 0.34$), suggesting that items are reasonably homogenous while also sufficiently unique (Piedmont, 2014). The corrected item-total correlation of two

items indicated a weak association with the overall measure ($r < 0.3$), #59 ($r = 0.29$) and #67 ($r = 0.20$), and exclusion of these item should be considered (Nunnally, 1967). However, no items were removed from the measure at this stage, in order to accurately replicate the results in a full validation. The corrected item-total correlations of the other 67 items were acceptable ($r = 0.32–0.76$).

Construct validity was assessed via convergent validity, where the HSQ total score was correlated with the PSS-10 total score: a large, positive correlation was observed ($r = 0.77$, $p < 0.001$), indicating strong construct validity (Swank & Mullen, 2017). Initial predictive validity was assessed by correlating the HSQ with three single-item questions relating to the post-hospital period. The HSQ correlated moderately with the questions relating to feelings of vulnerability ($r = 0.36$, $p < 0.001$) and preparedness to go home ($r = -0.28$, $p < 0.001$), but did not correlate with the question regarding return to activities ($r = -0.04$, $p = 0.56$).

3.4 Discussion

The current study produced a comprehensive list of hospital-related stressors experienced by inpatients, this is evidenced by the fact that the QCA informing the items of the HSQ captured all of the in-hospital stressors included in previous (non-specific) hospital stress measures, plus 12 novel stressors. The resulting 67-item questionnaire has been deemed appropriate by academics, clinicians, and patients. The current measure is a self-report questionnaire, allows for individual differences in perceived saliency of stressors, and is generalisable across specialties (excluding paediatric, maternity, and psychiatric), hospital-settings, and age groups.

Initial validation of the measure returned promising results, which the authors aim to replicate on a larger scale. Convergent validity indicated that the measure is assessing a stress-

related construct, as a strong, positive correlation was observed between the HSQ and the PSS-10. Cronbach's alpha suggested that the measure is internally consistent, although some items may not be appropriate; a larger companion study should employ factor analysis to reduce the number of items and group the remaining items into subscales. Additionally, correlating the HSQ with questions relating to vulnerability and preparedness to go home suggested that the measure may be an appropriate predictive tool, but further work is needed to confirm this.

In future research, the measure has potential to be used to identify those patients most at risk of suffering the effects of post-hospital syndrome. The measure would also be an appropriate tool for measuring inpatient psychological stress in intervention studies relating to the in-hospital environment (e.g., Pati et al., 2016) and inpatient stress management (e.g., Chalageri et al., 2021).

3.4.1 Limitations and Future Study

Although the novel questionnaire improves upon previous hospital stress measures, and shows promising initial psychometric properties, there were a number of limitations within the current study. First, the sample recruited to provide initial validation of the measure was lacking in participants aged 70 and above; a demographic that accounted for approximately 40% of NHS inpatients in 2019-20. Should a full validation be conducted, researchers ought to rectify this lack of representativeness of older populations, as a matter of priority. Similarly, the validation sample was recruited entirely via an online recruitment platform (Prolific), and so is potentially not representative of the general population – a full validation study should recruit through various means, including offline methods (e.g., community groups and religious settings). Further, although the HSQ offers a comprehensive list of hospital-related stressors, completing a 67-item questionnaire is a burdensome task, and so a shorter version

will also be explored for future use in hospitals. Lastly, neither phase of the study invited current inpatients to participate, therefore, in order to effectively administer the current measure in hospitals, the authors recommend that it be trialled on a diverse sample of inpatients in a future study.

3.4.2 Conclusion

The current multi-phase study developed a measure of inpatient psychological stress: the Hospital Stress Questionnaire (HSQ). The measure was informed by patient interviews and previous similar questionnaires, resulting in a 67-item self-report tool, including 12 items not identified in previous related measures. The HSQ shows promising initial validation. Future research ought to investigate its psychometric properties further in larger and more diverse samples. Once validated, the HSQ has potential to be used in measuring stress-reducing interventions for inpatients, and monitoring patient risk of post-hospital syndrome.

Chapter 4

Psychometric validation of the Hospital Stress Questionnaire

4.1 Introduction

4.1.1 Background

While in hospital, patients are exposed to an abundance of hospital-related stressors, including those relating to physical, psychological, interpersonal, and environmental factors (see Krampe et al., 2021). For example, Goldwater et al (2018) identified a number of physical stressors, such as sleep, malnourishment, dehydration, mobility, and pain; while Detsky and Krumholz (2014) have proposed several psychological stressors, such as depersonalisation and uncertainty. Interpersonal stressors concern the patient's relationship with hospital staff and other patients (e.g., Zengin et al., 2020), and environmental stressors focus on aspects of the hospital room or ward, such as lighting and temperature (e.g. Andrade & Devlin, 2015).

Throughout the hospital stay, the psychological and physiological strain experienced in response to these stressors can lead the body into a state of allostatic overload (McEwen, 2018), causing deleterious effects on the patient's health and wellbeing (Guidi et al., 2020; O'Connor et al., 2021). In their review, Guidi and colleagues (2020) highlighted that allostatic load has been linked to an increased risk for cardiovascular disease, high systolic and diastolic blood pressure, and depressive symptoms. These effects may then follow the patient home, impeding their recovery, and potentially resulting in an unplanned readmission (Dharmarajan & Krumholz, 2014; Edmondson et al., 2014) or other poor post-hospital outcomes (Ford et al., 2023).

Taken together, the above series of events describe a phenomenon known as post-hospital syndrome (Krumholz, 2013): an acquired period of generalised vulnerability to adverse events (e.g. post-operative wound infection) following hospitalisation. A growing post-hospital syndrome literature is emerging that outlines associations between hospital-related stressors and patient outcomes (Ford et al., 2023; Rawal et al., 2019). For example, Rawal et al. (2019) showed that inpatients reporting more disturbances in sleep, mobility, nutrition, and mood – known hospital-related stressors (Goldwater et al., 2018) – had a significantly greater risk of unplanned readmission or emergency department visit than their less affected counterparts. This literature presents a clear need to reduce patients' exposure to in-hospital stressors, with the hopes of improving patient outcomes and saving health authorities both money and resources. However, in order to do this, we must first identify, understand, and measure the hospital-related stressors in question.

4.1.2 The Hospital Stress Questionnaire

The Hospital Stress Questionnaire (HSQ; Ford et al., 2024) is a newly developed self-report tool to measure the perceived psychological stress of inpatients in UK hospitals. It identifies 67 hospital-related stressors and allows respondents to rate how stressful they perceived each stressor to be during their hospital stay. The HSQ items were informed by interviewing recent hospital inpatients, who were asked what they found stressful about their hospital stay. The questionnaire builds on previous attempts to measure in-hospital stress, which are often outdated, do not allow for individual differences in perceived stress (Volicer & Bohannon, 1975), or are specific to certain populations (e.g. older adults; Koenig, 1995; Musavi et al., 2016).

4.1.3 Aims of the current study

In its current form, the HSQ has not yet been shown to be valid and reliable, and the length of the questionnaire may be burdensome for patients. Therefore, the aims of the current study were to: (i) test the psychometric properties of the HSQ, (ii) reduce the number of items, (iii) group the remaining items into factors, and (iv) produce medium and short versions of the measure.

4.2 Methods

4.2.1 Design

A cross-sectional online survey was conducted from March to December 2023. Within psychometric theory, a subject-to-item ratio of 10:1 is recommended for conducting an exploratory factor analysis (Costello & Osborne, 2005; Nunnally, 1967), therefore, we aimed to recruit a sample size of 670 participants. This study received ethical approval from the University of Leeds, School of Psychology Research Ethics Committee (PSYC-737), and was preregistered (AsPredicted #153763).

4.2.2 Participants

Six hundred and seventy-two completed responses were received, 12 of which were excluded for not meeting the below criteria, leaving a total of 660 participants. Inclusion criteria were the same as for the initial validation of the HSQ (see Ford et al., 2024 for justifications), which were as follows: (i) participants were required to be at least 18 years old, (ii) have stayed in a UK hospital as an inpatient, (iii) in the past 12 months, (iv) for at least 24

hours, (v) not for paediatric, maternity, or psychiatric care. A consultee was permitted to assist with or complete the survey on behalf of a relative/friend that was unable to participate themselves.

Participants were recruited from Prolific (www.prolific.com), Care Opinion (www.careopinion.org.uk), the University of Leeds, School of Psychology Successful Ageing Panel, social media, and word of mouth. Those participating via Prolific were compensated with £2 for completion of the study; those recruited via other methods were eligible to be entered into a prize draw to win a £100 gift voucher, or one of three £50 gift vouchers. From the 660 eligible responses, 32 participants were invited to complete the HSQ again, to assess test-retest reliability. For an intraclass correlation coefficient, a minimum sample of 30 participants has been recommended (Koo & Li, 2016). These participants were recruited via Prolific, 14 days after their initial response, and were compensated with a further £1.50.

As this study recruited primarily online, several measures were taken to identify bots (automated software misrepresenting as participants; Teitcher et al., 2015) and fraudulent responses – submissions made with fictional data, in an attempt to receive payment for participation (see Silversten et al., 2023). To identify such responses, screening questions were placed at the beginning of the survey, three attention checks were added within the survey (e.g., "Please select '7' to show you are paying attention"), and participants were asked for the name of the hospital at which they were admitted. Should a participant fail any screening or attention question, or name a hospital not based in the UK, that response was excluded.

4.2.3 Measures

The survey was conducted online and took approximately 15 minutes to complete via Qualtrics software (2023). Questions focused on the participant's most recent hospital

experience, and began with five screening questions to assess the respondent's eligibility to participate. These were followed by demographic questions including the participant's age, gender, ethnicity, level of education, and marital status. The survey then moved onto hospital-related information such as when their most recent hospital stay was, how long they were in hospital for, which hospital they stayed in, whether or not they had surgery, and whether their stay was planned or an emergency. The survey then presented the following questionnaires: the HSQ (with three attention checks), the Perceived Stress Scale (PSS), and the EuroQol 5-Dimension Health Questionnaire (EQ-5D). See Appendix A for the full survey.

4.2.3.1 The Hospital Stress Questionnaire

The HSQ (Ford et al., 2024) is a self-report measure of inpatient psychological stressors, consisting of 67 items measured between 1 (no stress) and 10 (extreme stress). The HSQ has been piloted on 10 laypersons, confirming face validity, and presented to the Yorkshire Quality and Safety Research Group, confirming content validity. Additionally, the measure was completed by 200 persons who had been in hospital in the past 12 months for at least 24 hours, in order to provide initial validation: both internal consistency ($\alpha = 0.97$) and convergent validity ($r = 0.77$ with PSS-10) were excellent.

4.2.3.2 Perceived Stress Scale

The PSS was included to assess convergent validity of the HSQ. Each item on the scale was reworded from "In the last month…" to "While in hospital…" The PSS-10 (Cohen et al., 1983) was chosen as it is one of the most widely used measures of psychological stress, and has consistently been shown to be reliable and valid (Lee, 2012). The 10-item version was chosen over the 14-item version due to its shorter length, and chosen over the 4-item version due to its superior internal reliability (Cronbach's alpha: 0.78 vs 0.60; Cohen, 1988).

4.2.3.3 EuroQol 5-Dimension Health Questionnaire

The EQ-5D was included to assess the predictive validity of the HSQ. It is a widely-used measure for describing and valuing health, composed of five dimensions: Mobility, Self-Care, Usual Activities, Pain/Discomfort, and Anxiety/Depression (Brooks & EuroQol Group, 1996). Each of these dimensions can be measured using a three-level (EQ-5D-3L) or five-level (EQ-5D-5L) Likert scale (Herdman et al., 2011), both of which have excellent psychometric properties but the five-level version is more sensitive to change (Feng et al., 2021). A participant's responses to the EQ-5D reveal their *health state* (e.g. 11111 is indicative of full health); a formula can be applied to this 5-digit code to derive an *index value,* which reflects how good or bad a health state is according to the preferences of the general population of a country/region. These preferences are determined using a *value set*; a representative sample from that country/region – the value set for England was used in the current study. The EQ-5D also includes a visual analogue scale (the EQ VAS): a thermometer where the respondent can indicate self-rated health between 0 (worst possible health) and 100 (best possible health).

4.2.4 Analysis

Data was analysed using R Statistical Software (v4.3.1; R Core Team 2023) (data and code can be accessed at: https://github.com/DMFord97/Validation). Descriptive statistics were conducted in order to assess the appropriateness of the sample. To identify the latent factor structure of the measure, exploratory factor analysis (EFA) was employed following Watkins' (2018) guide to best practice. Bartlett's test of sphericity (Bartlett, 1950) and the KMO statistic (Kaiser, 1974) were used to evaluate the suitability of EFA. To determine the number of factors to retain, parallel analysis (Horn, 1965), minimum average partial method (Velicer, 1976), visual scree test (Cattell, 1966), and Kaiser's criterion (Kaiser, 1960) were consulted. The oblimin rotation (Jennrich & Sampson, 1966) was chosen as it was assumed that factors would

be correlated. Due to the large sample size, factor loadings above 0.30 were retained (Hair et al., 2010).

Internal consistency reliability was assessed using Cronbach's alpha, it has been suggested that acceptable values range between 0.70 and 0.95 (Tavakol & Dennick, 2011). Test-retest reliability, convergent validity, and predictive validity were assessed using Pearson's correlations, where r = 0.10, 0.30, and 0.50 were considered small, medium, and large, respectively (Cohen, 1992). Known-groups validity was assessed using an independent samples t-test, exploring mean differences in hospital stress between patients with planned and emergency admissions.

4.3 Results

4.3.1 Descriptive Statistics

To assess the representativeness of our sample, demographics of participants that completed the survey were compared against the latest NHS hospital admission data (NHS Digital, 2023). Table 4.1 shows the NHS figures for age, sex, and ethnicity, desired figures adjusted for a sample size of 670, and actual figures from the recruited sample (18–19 year olds were included in the 20–29 group). Ages within the recruited sample ranged from 18–97 (M = 54.0, SD = 17.3) and were representative of NHS inpatients aged 18 to 80 years old, but were lacking in the >80 groups. Sample demographics were representative in sex and ethnicity. See Appendix B for more details of the current sample, such as education, marital status, and whether or not the patient had surgery.

Table 4.1. Demographic data for NHS 2022–23 hospital admissions, with comparisons

Demographic	NHS 2022–23 data	Desired sample	Actual sample

	n	%	*n*	%	*n*	%
Age groups						
18–29	1,434,124*	8.2	55	8.2	79	12.0
30–39	1,923,957	11.0	73	11.0	107	16.2
40–49	1,571,431	9.0	60	9.0	65	9.8
50–59	2,372,014	13.5	91	13.5	139	21.2
60–69	2,966,772	16.9	113	16.9	113	17.1
70–79	3,756,596	21.4	144	21.4	140	21.2
80–89	2,747,191	15.7	105	15.7	15	2.3
>90	760,619	4.3	29	4.3	2	0.3
Total	17,532,704	100	670	100	660	100
Sex						
Female	9,734,922	55.5	372	55.5	366	55.5
Male	7,797,782	44.5	298	44.5	292	44.2
Other	-	-	-	-	1	0.2
PNS	-	-	-	-	1	0.2
Total	17,532,704	100	670	100	660	100
Ethnicity						
Asian or Asian British	1,053,380	7.5	50	7.5	55	8.3
Black, Black British, Caribbean or African	488,714	3.5	23	3.5	30	4.5
Mixed or Multiple ethnic groups	230,442	1.6	11	1.6	20	3.0
White	11,926,307	84.9	569	84.9	548	83.0
Other ethnic group	353,232	2.5	17	2.5	6	0.9
PNS	-	-	-	-	1	0.2
Total	14,052,075	100	670	100	660	100

*NHS data for ages 20–29, not 18–29.

4.3.2 Hospital Stress Questionnaire

Total scores for the HSQ ranged from 67 to 609 out of maximum score of 670 (M = 250.3, SD = 112.6). The item rated as most stressful, on average, was "1. Not sleeping well", followed by "2. Feeling helpless or not in control" and "19. Missing loved ones" – see Appendix C for the mean and standard deviation of each item, sorted from most to least stressful. The items rated as least stressful were "59. Not being able to pray or do other religious activities", "67. Not being able to smoke, drink alcohol, or use other substances", and "66. The hospital not meeting your individual needs (e.g. disability)". However, this is likely to be explained due to their lack of applicability to the majority of respondents rather than their salience to a few; a large proportion of respondents selecting 1 (not at all stressful) or N/A (scored in the analysis as 1), lowering the mean scores substantially.

4.3.3 Exploratory Factor Analysis

The sampling adequacy was well above the acceptable standard (KMO = 0.97) and Bartlett's test of sphericity demonstrated that correlations between items were large enough to perform a factor analysis ($\chi^2(2211) = 28{,}724.73$, $p < 0.001$). Considering the number of factors to retain, Kaiser's criterion and the scree plot suggested four factors, minimum average partial (MAP) test suggested six factors, and parallel analysis suggested eight factors. All three suggestions were examined: the four- and six-factor solutions had inadequate model fit statistics (CFI < 0.90), the eight-factor solution was also inadequate as only two items loaded onto the eighth factor without cross-loading. Therefore, a seven-factor solution was examined, which was deemed appropriate.

Within the seven-factor model, seven items did not load onto any of the factors (items #22, #23, #26, #30, #50, #55, #65). These items were excluded (see Table 4.2 for a list of

excluded items, and reasons for doing so) and the model was re-run, one item did not load onto any factors in this second iteration of the model (item #35), and so it too was excluded. After observing inter-item correlations, three items (#5, #20, and #29) correlated very highly ($r \geq 0.70$) with one or more other items, where each pertained to a similar stressor (e.g., listening and communicating, or rude and unfriendly), and so were considered to be repetitive, leading to a decision to exclude the redundant items. Finally, the model was run without the 11 above listed items, and in this last iteration of the model, only one item (#49) did not load onto any factor. Once this item was removed, all 55 remaining items loaded onto one of the seven factors, and the resulting model had acceptable fit statistics (CFI = 0.93, TLI = 0.90, RMSR = 0.03, RMSEA = 0.05), and accounted for 53.0% of the total variance. See Table 4.3 for the seven factors and their respective items, variance, and Cronbach's alpha values.

Table 4.2. Excluded items and their reasons for exclusion

Item	**Reason for exclusion**
5. The staff not communicating well with you	High inter-item correlation ($r \geq 0.70$)
20. The staff being rude or unprofessional	High inter-item correlation ($r \geq 0.70$)
22. Having blood taken	Did not load onto any factors
23. Being disturbed by observations (e.g. blood pressure)	Did not load onto any factors
26. Worrying about the wellbeing of other patients	Did not load onto any factors
29. The staff not communicating well with each other	High inter-item correlation ($r \geq 0.70$)
30. Not being allowed access to your usual medication	Did not load onto any factors
35. Overhearing the staff having conversations	Did not load onto any factors
49. Not being able to do your usual activities	Did not load onto any factors
50. Fearing that you may pick up an illness from being in hospital	Did not load onto any factors
55. Having poor Wi-Fi or phone signal	Did not load onto any factors
65. Being transferred between wards or hospitals	Did not load onto any factors

Table 4.3. Final seven-factor solution of the Hospital Stress Questionnaire (HSQ), containing 55 items

Factor	Items	Loading
1. Quality of care		
Number of items = 11	16. Feeling like the staff were not listening to you	0.76
9.4% variance explained	7. The staff not being caring or friendly	0.75
$\alpha = 0.91$	52. Feeling like you were not being treated like a person	0.51
Average inter-item correlation = 0.52	21. The staff not being responsive to the buzzer	0.50
Test-retest: $r = 0.91$, $p < 0.001$	13. The staff making a mistake that caused you harm	0.49
	6. The staff being too busy	0.46
	27. The hospital not being organised	0.44
	9. The food being bad or not meeting your dietary requirements	0.37
	25. Not feeling safe	0.37
	8. Having to wait a lot	0.36
	10. Feeling like you could not leave your bed or ward	0.32
2. Away from home		
Number of items = 8	32. Feeling homesick	0.82
9.3% variance explained	19. Missing loved ones	0.78
$\alpha = 0.89$	18. Feeling lonely	0.61
Average inter-item correlation = 0.50	43. Worrying about loved ones	0.56

Test-retest: $r = 0.85$, $p < 0.001$	41. Being in an unfamiliar place	0.52
	12. Feeling bored	0.40
	58. Missing your usual small comforts (e.g. hot tea)	0.39
	54. Feeling like your life was on hold or you were missing out	0.38
3. Inconvenienced		
Number of items = 11	61. Not knowing the hospital rules	0.63
7.3% variance explained	66. The hospital not meeting your individual needs (e.g. disability)	0.52
$\alpha = 0.87$	59. Not being able to pray or do other religious activities	0.49
Average inter-item correlation = 0.38	60. Feeling like the staff focused on other patients more than you	0.48
Test-retest: $r = 0.87$, $p < 0.001$	62. Having to wear a hospital gown	0.44
	47. Being reminded of loved ones who passed away while in hospital	0.39
	31. Hearing or seeing emergencies	0.37
	48. The staff not asking for consent before treating you	0.37
	53. Worrying about money	0.37
	67. Not being able to smoke, drink alcohol, or use other substances	0.37
	44. Having to follow the hospital's schedule	0.31
4. Health anxiety		
Number of items = 7	15. Fearing your health will get worse	0.67
6.6% variance explained	56. Not being sure of your diagnosis	0.59
$\alpha = 0.88$	11. Not knowing what was going to happen to you	0.54

Average inter-item correlation = 0.51	39. Having to deal with the symptoms of your illness (e.g. sickness)	0.47
Test-retest: $r = 0.79$, $p < 0.001$	57. Worrying how you will cope once leaving hospital	0.45
	2. Feeling helpless or not in control	0.44
	14. Worrying that your treatment/medication will have side effects	0.44
5. Negative effects of treatment		
Number of items = 5	63. Needing help going to the bathroom	0.60
4.9% variance explained	3. Having pain or discomfort from your treatment	0.50
$\alpha = 0.73$	46. Having tubes in your nose, mouth, or other body parts	0.40
Average inter-item correlation = 0.35	24. Having to rely on others	0.36
Test-retest: $r = 0.81$, $p < 0.001$	64. Worrying that your appearance might change (e.g. scars)	0.36
6. Ward environment		
Number of items = 8	4. Staying in a noisy room	0.72
9.3% variance explained	28. Sharing a room with strangers	0.71
$\alpha = 0.89$	34. Being in an overcrowded ward	0.64
Average inter-item correlation = 0.49	17. The other patients being difficult	0.58
Test-retest: $r = 0.92$, $p < 0.001$	51. Feeling like you had no privacy	0.58
	40. Being in a room that was too hot or too cold	0.44
	45. Being in a room that was too bright or has no natural light	0.37
	1. Not sleeping well	0.36
7. Disrupted patient experience		

Number of items = 5	36. Medical procedure getting cancelled or delayed	0.70
6.1% variance explained	38. Equipment or supplies lacking	0.69
$\alpha = 0.84$	37. Not being involved in the treatment plan	0.50
Average inter-item correlation = 0.51	42. Being in an unclean room	0.42
Test-retest: $r = 0.78$, $p < 0.001$	33. Not getting enough to drink	0.34

4.3.4 Internal Consistency Reliability

For the resulting 55-item scale, a Cronbach's alpha value of 0.97 was obtained, this is above the accepted range of 0.70–0.95, likely due to the large number of items in the scale, which directly influences the value of alpha (Cronbach, 1951). The scale has an average inter-item correlation of 0.36, which is within the acceptable range of 0.15–0.5 (Briggs & Cheek, 1986; Clark & Watson, 1995). The corrected item-total correlation of each item was examined, where only one item (#67) had a correlation low enough ($r = 0.29$) to consider it for exclusion – recommendations of below 0.2 (Streiner et al., 2015) or 0.3 (Field, 2013) have been offered, since the correlation in question was on the upper end of these values, it was not excluded. Cronbach's alpha values for each factor were acceptable (0.73–0.91).

4.3.5 Convergent Validity

Convergent validity was assessed using Pearson's correlation coefficient. A large and significant correlation between the total scores of the PSS-10 and the final 55-item version of the HSQ ($r = 0.71$, $p < 0.001$) was found, suggesting that the HSQ is measuring the desired construct.

4.3.6 Known-groups Validity

Total scores on the HSQ-55 were compared between groups of participants. Mean differences were tested between those who had planned to stay in hospital (predicted to be subject to fewer stressors) (n = 223) versus those who were hospitalised in an emergency (n = 437). A t-test was performed (t (438.3) = –5.89, $p < 0.001$), indicating that those with planned stays ($M = 179.1$) were significantly less stressed than patients with unplanned admissions ($M = 223.3$). Additionally, HSQ-55 scores were correlated with length of stay – a small, positive effect size was found ($r = 0.08$, $p = 0.049$), indicating that patients who stay in hospital longer

are exposed to more stressors. However, we noted that this correlation was on the threshold of statistical significance.

4.3.7 Predictive Validity

A correlation was conducted between perceived in-hospital stress, using the HSQ-55, and both parts of the EQ-5D. The HSQ-55 asks questions pertaining to the in-hospital period ("during your hospital stay"), while the EQ-5D was adapted to pertain to the post-hospital period ("in the two weeks after being discharged from hospital"). A medium-sized, negative association was found between the HSQ-55 and both the EQ-5D-5L index values ($r = –0.35$, $p < 0.001$) and the EQ VAS ($r = –0.32$, $p < 0.001$), implying that as in-hospital stress increases, post-hospital health-related quality of life and self-rated health decrease.

4.3.8 Test-Retest Reliability

The retest period was 14 days after the initial test. Test-retest for the overall 55-item scale was $r = 0.90$ ($p < 0.001$). For individual factors, test-retest reliability ranged from 0.78–0.92, where each correlation was statistically significant (all $p < 0.001$). These results would be considered "excellent" for a psychological instrument (see Matheson, 2019, for a short review of standard thresholds).

4.3.9 Medium-length version (28 items)

It was deemed necessary to produce shorter versions of the HSQ, as a 55-item questionnaire may be burdensome for particularly vulnerable groups (e.g., older adults with dementia, delirium, etc., who make up a large proportion of NHS patients) or in surveys which

already include several other long measures. To produce a medium-length version of the HSQ, the four highest loading items within each factor were selected (see Table 4.4). Cronbach's alpha was good for the overall scale (α = 0.94), as well as for each of the seven factors (0.71–0.88). The HSQ-28 also showed acceptable convergent validity (r = 0.70), known-groups validity (planned (M = 89.2), unplanned (M = 113.2), t (449.6) = –6.28, p < 0.001), predictive validity (EQ-5D-5L: r = –0.35; EQ VAS: r = –0.32), and test-retest reliability (r = 0.88).

Table 4.4. HSQ-28: four highest loading items from each factor

Factor	Items
1. Quality of care	16. Feeling like the staff were not listening to you
α = 0.88	7. The staff not being caring or friendly
	52. Feeling like you were not being treated like a person
	21. The staff not being responsive to the buzzer
2. Away from	32. Feeling homesick
home	19. Missing loved ones
α = 0.84	18. Feeling lonely
	43. Worrying about loved ones
3. Inconvenienced	61. Not knowing the hospital rules
α = 0.80	66. The hospital not meeting your individual needs (e.g. disability)
	59. Not being able to pray or do other religious activities
	60. Feeling like the staff focused on other patients more than you
4. Health anxiety	15. Fearing your health will get worse
α = 0.82	56. Not being sure of your diagnosis
	11. Not knowing what was going to happen to you
	39. Having to deal with the symptoms of your illness (e.g. sickness)
5. Negative effects	63. Needing help going to the bathroom
of treatment	3. Having pain or discomfort from your treatment
α = 0.71	46. Having tubes in your nose, mouth, or other body parts
	24. Having to rely on others
6. Ward	4. Staying in a noisy room
environment	28. Sharing a room with strangers

α = 0.84	34. Being in an overcrowded ward
	17. The other patients being difficult
7. Disrupted	36. Medical procedure getting cancelled or delayed
patient experience	38. Equipment or supplies lacking
α = 0.82	37. Not being involved in the treatment plan
	42. Being in an unclean room

4.3.10 Short version (10 items)

A short version was also produced by selecting the ten items of the HSQ-55 with the highest corrected item-total correlations (see Louch et al., 2019; Marteau & Bekker, 1992). Within these ten items, all seven factors were represented (one item from each of factors 2–7, and four items from factor 1; see Table 4.5). The HSQ-10 showed acceptable internal consistency (α = 0.91), convergent validity (r = 0.68), known-groups validity (planned (M = 33.6), unplanned (M = 44.2), t (458.5) = –6.16, p < 0.001), predictive validity (EQ-5D-5L: r = –0.32; EQ VAS: r = –0.30), and test-retest reliability (r = 0.90).

Table 4.5. HSQ-10: items from the HSQ-55 with the highest corrected item-total correlation

Items	**Factor**
52. Not treated like a person	1. Quality of care
44. Having to follow hospital schedule	3. Inconvenienced
6. Staff busy	1. Quality of care
51. No privacy	6. Ward environment
27. Hospital unorganised	1. Quality of care
16. Staff not listening	1. Quality of care
11. Not knowing what will happen	4. Health anxiety
41. Unfamiliar place	2. Away from home
37. Not involved in treatment plan	7. Disrupted patient experience
24. Having to rely on others	5. Negative effects of treatment

4.4 Discussion

The current study explored the psychometric properties of the HSQ, including reliability, validity, and factor structure. This was accomplished via a retrospective survey, completed by a diverse and representative sample of 660 recent inpatients. Results show that the measure is a valid and reliable tool for quantifying in-hospital psychological stress and is ready for use in future research – although it is yet to be tested on current inpatients. Item reduction, from an exploratory factor analysis, led to three versions of the HSQ being developed (55-item long version; 28-item medium version; 10-item short version), where each has been shown to have good psychometric properties.

The EFA also identified seven latent factors, each with an acceptable level of internal consistency, forming the subscales of the HSQ: quality of care, away from home, inconvenienced, health anxiety, negative effects of treatment, ward environment, and disrupted patient experience. Previous, similar in-hospital stress measures (HSRS: Volicer & Bohannon, 1975; HSI: Koenig et al., 1995; HRSQ-EP: Musavi et al., 2016) have produced comparable factors. Most, if not all, have a factor relating to the hospital environment (HSQ: ward environment), a change in lifestyle (HSQ: away from home), health-related fears (HSQ: health anxiety), difficulties with treatment (HSQ: negative effects of treatment), and a factor relating to the care received from hospital staff (HSQ: quality of care). The current measure introduced two new factors: being inconvenienced, and having a disrupted patient experience. The individual items and factors within the HSQ are capable of identifying clear areas of focus for improvement within the hospital setting, paving the way for future studies and policy decisions to improve the experience of hospitalisation.

Individual items were also examined, the highest scoring of which was “Not sleeping well”. In a recent study, patients reported significant decline in sleep quality and quantity while in hospital, and these problems persisted for more than three months post-discharge (Willinger et al., 2023). Sleep disruptions in hospital such as early morning phlebotomy (Caraballo et al., 2023) and overnight NEWS observations (Hope et al., 2018) remain high, despite sleep loss in hospital being associated with cardio-metabolic derangements and an increased risk of delirium (Stewart & Arora, 2018). Other hospital-related stressors that were rated highly in the current study, such as pain (“Having pain or discomfort from your treatment”) and noise (“Staying in a noisy room”), can exacerbate the problem of sleep disruption, leading to the risk of deleterious effects in immune function, wound healing, and mental health (Kamdar et al., 2012; Stewart & Arora, 2021).

As seen above, Goldwater and colleagues (2018) predicted problems with sleep and pain in their list of five hospital-related stressors: sleep disruptions, malnourishment and dehydration, mobility restriction, pain, and distressing environment and events. However, items in the HSQ that were designed to capture malnourishment (HSQ: “The food being bad or not meeting your dietary requirements”), dehydration (HSQ: “Not getting enough to drink”), and mobility restriction (HSQ: “Feeling like you could not leave your bed or ward”) were reported as relatively low-ranking stressors in the current study. Goldwater’s list is heavily weighted towards physiological stressors, and so is lacking in psychological (HSQ: “Feeling helpless or not in control”) and environmental factors (HSQ: “Feeling like you had no privacy”). Such stressors comprised the majority of high-ranking items in the HSQ, and ought to be acknowledged more in the post-hospital syndrome literature. For example, feelings of helplessness and not being in control was the second highest ranking item, and yet there is a paucity of research on this topic (see Douglas & Douglas, 2005; Taylor, 1979; Williams et al., 2008).

It is clear that the hospital environment is acutely stressful, and aspects of the inpatient experience may not be conducive to a patient's recovery. Therefore, the authors recommend that interventions be designed to address the stressors rated most salient by patients in the current study, first and foremost of these is disrupted sleep, which leads to adverse effects both indirectly (via allostatic overload and post-hospital syndrome) and directly (see Hillman (2021) for effects of sleep loss on recovery, and steps recommended to improve sleep in hospitals). Secondly, the HSQ may be used in future studies or clinical practice as an indicator of which patients may be most susceptible to the effects of post-hospital syndrome.

4.4.1 Limitations

Several limitations were apparent within the current study. First, the representativeness of the sample is limited, due to the majority of the cohort being recruited via Prolific; a research participant platform. Notably, the current sample was more educated than the general public, and was lacking in participants aged over 80 years, a population which made up approximately 20% of NHS inpatients in 2022–23 (NHS Digital, 2023). Secondly, the retrospective nature of the current study raises concerns about the accuracy of the results, as it relies on the participant's ability to recall events from up to one year ago. Nevertheless, it is worth noting that issues relating to recall, if at play, are likely to have led to evidence of weaker psychometric properties than those observed here. Additionally, the predictive validity reported may be questioned by some, as the survey design was cross-sectional. Therefore, the authors suggest that future research addresses some of these limitations by employing the HSQ in hospitals to current inpatients, and adopting a longitudinal design to better assess the predictive validity of the measure with a battery of health outcomes.

4.4.2 Conclusion

The HSQ exhibits excellent reliability and validity, and an appropriate factor structure was identified. Three versions of the measure are available for use (short, medium, and long), each with acceptable psychometric properties. The HSQ may be used to justify and assess the effectiveness of interventions to reduce in-hospital stress, or to identify patients most at risk of experiencing post-hospital syndrome. However, the measure is yet to be tested on current inpatients, and further research is required to support the tool's ability to predict post-hospital adverse events and self-rated health.

Chapter 5

In-hospital psychological stress and post-hospital outcomes

5.1 Introduction

5.1.1 Background

Psychological stress has been repeatedly shown to have direct (via psychobiological processes) and indirect (via changes in health behaviours) impacts on health (O'Connor et al., 2021). This is particularly evident during hospitalisation; inpatients are exposed to a large variety of stressors, which have recently been linked to poorer health outcomes (Ford et al., 2023). Hospital-related stressors, such as disrupted sleep, feelings of helplessness, and missing loved ones, can cause psychological and physiological strains. Over the course of the hospital stay, these strains cause a "wear and tear" effect on the body (known as *allostatic overload*; McEwen, 2018), and have been associated with negative health outcomes, such as cardiovascular disease and depression (Guidi et al., 2020). This vulnerability to adverse events can follow the patient for weeks after being discharged, and is known as *post-hospital syndrome* (Krumholz, 2013).

Post-hospital syndrome can be costly to both patients and health services, due to an increased rate of unplanned readmissions and emergency department visits (Rawal et al., 2019). However, these costs may be avoidable if patients are exposed to less stress during hospitalisation (Goldwater et al., 2018). The Hospital Stress Questionnaire (HSQ) was developed (Ford et al., 2024a) and validated (Ford et al., 2024b, Preprint) with the aim of identifying and measuring these stressors. The HSQ is a patient-reported outcome measure

comprising seven dimensions of in-hospital stress: the patient's quality of care, being away from home, being inconvenienced, health anxiety, negative effects of treatment, the ward environment, and having a disrupted patient experience. Taken together, these domains make up a composite score of in-hospital stress, which indicates the stressors experienced by a patient, and the extent to which the patient perceived each one to be stressful. Should associations be found between the HSQ and health outcomes, this would highlight the significance of the relationship between stress and health within the hospital environment, and provide further rationale for policy makers to focus on reducing the stress of hospitalisation for future patients.

The HSQ has already been shown to have a negative association with health-related quality of life and self-rated health in the two weeks post-discharge (Ford et al., 2024b, Preprint), but has yet to be tested whether scores on the HSQ are associated with other post-hospital outcomes. However, before these predictive relationships can be tested, we must first consider the vast number of factors that may be influencing the complex relationship between stress and health. For example, there is a documented relationship between stress, health, and age (Piazza et al., 2010); it has long been known that stress and coping change with age (Folkman et al., 1987), and age has been shown to be negatively associated with hospital stress (Volicer et al., 1977), but little is known about which hospital-related stressors are more prevalent in younger and older groups. Similarly, sex differences have been noted in the relationship between stress and health (Bale & Epperson, 2015; Weekes et al., 2005) but it is not known how the sexes differ in their experiences of hospital-related stressors. Finally, social isolation has been observed to play a role in gene expression (and therefore health): individuals high in subjective loneliness are more likely to be characterised by increased inflammation and decreased protection from viral illness (Cole et al., 2007; O'Connor et al., 2021).

5.1.2 Study aims

The aims of the current study were to test for associations between hospital-related stress and post-hospital outcomes, and to explore whether these associations varied by stressor type, demographic, and other patient factors. The authors hypothesised a small-to-medium size negative association between hospital-related stress and post-hospital outcomes, as seen in Ford et al. (2023).

5.2 Methods

5.2.1 Design

A cross-sectional online survey was conducted from March to December 2023, as part of a wider validation study (see Ford et al., 2024b, Preprint). To conduct an exploratory factor analysis within the other study, the research team sought to recruit a sample size of 670 participants (a subject-to-item ratio of 10:1 is recommended, Costello & Osborne, 2005; Nunnally, 1967). The current study received ethical approval from the University of Leeds, School of Psychology Research Ethics Committee (PSYC-737), and was preregistered (AsPredicted #153763).

5.2.2 Participants

Six hundred and seventy-two completed responses were received, 12 of which were excluded for not meeting the below criteria, leaving a total of 660 participants. Inclusion criteria were as follows: (i) participants were required to be at least 18 years old, (ii) have stayed in a UK hospital as an inpatient, (iii) in the past 12 months, (iv) for at least 24 hours, (v)

not for paediatric, maternity, or psychiatric care. A consultee was permitted to assist with or complete the survey on behalf of a relative/friend that was unable to participate themselves.

Participants were recruited from Prolific (www.prolific.com), Care Opinion (www.careopinion.org.uk), the University of Leeds, School of Psychology Successful Ageing Panel, social media, and word of mouth. Those participating via Prolific were compensated with £2 for completion of the study; those recruited via other methods were eligible to be entered into a prize draw to win a £100 gift voucher, or one of three £50 gift vouchers.

As this study recruited primarily online, several measures were taken to identify bots and fraudulent responses – submissions made with fictional data, in an attempt to receive payment for participation (see Silversten et al., 2023). To identify such responses, screening questions were placed at the beginning of the survey, three attention checks were added within the survey (e.g., "Please select '7' to show you are paying attention"), and participants were asked for the name of the hospital at which they were admitted. Should a participant fail any screening or attention question, or name a hospital not based in the UK, that response was excluded.

5.2.3 Measures

The survey was conducted online and took approximately 15 minutes to complete via Qualtrics software (2023). Questions focused on the participant's most recent hospital experience, and began with five screening questions to assess the respondent's eligibility to participate. These were followed by demographic questions such as the participant's age, sex, ethnicity, level of education, and marital status. The survey then moved onto hospital-related questions: how many times the participant had been in hospital, when their most recent hospital stay was, how long they were in hospital for, which hospital they stayed in, whether or not they

had surgery, whether their stay was planned or an emergency. Further questions asked about the participant's recovery period after leaving hospital, such as: how long it took them to get back to their usual activities (adapted from a question on returning to work (see Petrie et al., 1995), to consider that a large proportion of inpatients are of retirement age), if they experienced any complications (using outcomes seen in the Partners at Care Transitions Measure (PACT-M; Oikonomou et al., 2020); occurrences of sores/wounds not healing, infections, falls, and unplanned contact with GP/A&E), and how vulnerable they felt (single-item question, scored from 1–10). The survey then presented the following questionnaires: the UCLA Loneliness Scale, the Lubben Social Network Scale (LSNS), the HSQ (with three attention checks), and the EuroQol 5-Dimension Health Questionnaire (EQ-5D). See Appendix A for the full survey.

5.2.3.1 The Hospital Stress Questionnaire

The HSQ (Ford et al., 2024a; 2024b – Preprint) is a patient-reported outcome measuring seven domains of inpatient psychological stress, consisting of 55 items scored between 1 (no stress) and 10 (extreme stress). Medium (28 items) and short (10 items) versions have also been validated. The HSQ-55 has excellent internal consistency (Cronbach's alpha for each factor ranges between 0.70–0.95), convergent validity (correlating highly with the Perceived Stress Scale (PSS-10), Cohen et al., 1983), known-groups validity (unplanned hospital stays shown to be significantly more stressful than planned stays), predictive validity (negative correlation with health-related quality of life measured by the EQ-5D and EQ VAS, in the two weeks post-hospital), and test-retest reliability (r = 0.90).

5.2.3.2 EuroQol 5-Dimension Health Questionnaire

The EQ-5D was included to further assess predictive validity of the HSQ. It is a widely-used measure for describing and valuing health, composed of five dimensions: Mobility, Self-

Care, Usual Activities, Pain/Discomfort, and Anxiety/Depression (Brooks & EuroQol Group, 1996). Each of these dimensions can be measured using a three-level (EQ-5D-3L) or five-level (EQ-5D-5L) Likert scale (Herdman et al., 2011), both of which have excellent psychometric properties but the five-level version is more sensitive to change (Feng et al., 2021). Using the EuroQol registration, the first author (DF) agreed to the EQ-5D Terms of Use, and no license agreement was needed.

A participant's responses to the EQ-5D reveal their *health state* (e.g. 11111 is indicative of full health); a formula can be applied to this 5-digit code to derive an *index value*, which reflects how good or bad a health state is according to the preferences of the general population of a country/region. These preferences are determined using a *value set*; a representative sample from that country/region – the value set for England was used in the current study. A higher index value indicates better health-related quality of life.

5.2.3.3 UCLA Loneliness Scale

The UCLA-LS is a measure of subjective feelings of loneliness and social isolation, which may be a moderator in the relationship between hospital stress and patient outcomes. Originally a 20-item questionnaire (Russell et al., 1978), a short version of three items has since been validated, exhibiting comparable psychometric properties to the original (Hughes et al., 2004). The three-item version was chosen to avoid unnecessarily burdening the participants. Items ask how often the respondent feels lonely or isolated (the current study focussed on the weeks leading up to hospitalisation), and are measured on a three-point Likert scale, from 'Hardly Ever' to 'Often'. Higher scores indicate more feelings of loneliness.

5.2.3.4 Lubben Social Network Scale

The LSNS is a measure of social engagement including family and friends, and may also be a moderator in the relationship between hospital stress and patient outcomes. A 12-item

and six-item version are available, both with acceptable psychometric properties (Lubben, 1988; Lubben et al., 2006). The six-item version was chosen to avoid unnecessarily burdening the participants. Items focus on the number of friends or relatives the respondent has had contact with in the past month (the current study focussed on the month prior to hospitalisation), with six response options: 0, 1, 2, 3–4, 5–8, 9+. Higher scores indicate more social support.

5.2.4 Analysis

Data was analysed using R Statistical Software (v4.3.2; R Core Team 2023) (data and code can be accessed at: https://github.com/DMFord97/HSQ-associations). Independent Samples t-tests were employed to compare mean differences in HSQ scores between demographic variables, and Pearson's product moment correlations were used to test for unadjusted associations between the HSQ and other variables. Four hierarchical linear regressions were utilised to test the ability of the HSQ to predict four post-hospital outcomes: feelings of vulnerability, time to return to usual activities, health-related quality of life (measured with EQ-5D), and outcomes seen in the PACT-M (sores/wounds not healing, infections, falls, and unplanned contact with GP/A&E). For each outcome variable, age and sex were controlled for in step 1, the HSQ-55 total score was entered at step 2, the UCLA-LS and LSNS were entered as moderators at step 3, and finally, at step 4, multiplicative interaction terms were entered. This process was repeated using the HSQ-55 subscales to further explore the relationships between variables; however, interaction terms were not entered for each subscale to reduce the number of comparisons. All continuous predictor variables were mean centred before entering into the regression analyses, and standardised beta values were used to allow for comparisons. To account for the large number of regression analyses, a more

conservative threshold for significance of $p = 0.01$ was employed for these tests (e.g., see O'Connor et al., 2023).

5.3 Results

5.3.1 Descriptive Statistics

Of the 660 participants, 366 were female (55.5%), 292 were male (44.5%), and 2 selected either "other" or "prefer not to say" (0.1%). Ages within the recruited sample ranged from 18–97 years ($M = 54.0$, $SD = 17.3$), and were diverse in ethnicity, education, and marital status. HSQ total scores ranged from 55–513 out of a maximum 550, with a mean score of 208.4 ($SD = 92.9$), UCLA Loneliness Scale scores ranged from 3–9 ($M = 4.3$, $SD = 1.8$), and LSNS scores ranged from 6–36 ($M = 20.3$, $SD = 6.1$).

5.3.2 Associations with In-Hospital Stress

Comparison of mean stress levels revealed significant differences in HSQ-55 total scores for sex, ethnicity, planned/unplanned hospital stays, and surgical/medical patients, but not for education or marital status (see Table 5.1). Participants that were male, White, had planned to stay in hospital, or were receiving surgery, reported less in-hospital stress than their counterparts. However, the majority of surgical patients had planned on staying in hospital (66%), likely for an elective surgery; while the majority of medical patients had not planned on staying (89%), and were likely admitted for emergency treatment. After controlling for planned/unplanned hospital stays, via an ANCOVA, the difference in HSQ-55 total scores between medical and surgical patients was no longer significant ($t = –0.30$, $p = 0.768$).

Table 5.1. Differences in HSQ total scores between variables

Demographic	HSQ-55 Total Score		Independent Samples t-test
Sex	Male (n = 292) M = 193.9	Female (n = 366) M = 220.1	t (631.5) = –3.64, p < 0.001
Ethnicity	White (n = 549) M = 204.0	Other ethnic groups (n = 111) M = 230.6	t (164.6) = –2.89, p = 0.004
Education	No degree (n = 305) M = 204.9	Degree (n = 355) M = 211.3	t (614.9) = –0.872, p = 0.384
Marital status	Married (n = 383) M = 208.4	Unmarried (n = 273) M = 207.9	t (571.6) = 0.07, p = 0.945
Planned stay	Yes (n = 223) M = 179.1	No (n = 437) M = 223.3	t (438.3) = –5.89, p < 0.001
Surgery*	Yes (n = 276) M = 191.6	No (n = 380) M = 219.7	t (578.1) = –3.84, p < 0.001

*when controlling for whether the hospital stay was planned or unplanned, there is no longer a significant difference in HSQ total scores between surgical and medical patients.

Pearson's product moment correlations were performed, revealing that age, loneliness (UCLA-LS), social support (LSNS), and length of stay, were each associated with HSQ-55 total scores (see Table 5.2). Higher levels of in-hospital stress were associated with younger age, higher loneliness, less social engagement and longer hospital stays. However, we noted that the correlation with length of stay was on the threshold of statistical significance. The number of previous hospital stays had no association with in-hospital stress.

Table 5.2. Association between HSQ total score and other variables (N=660)

Variable	Pearson's Correlation
Age	$r = –0.23$, $p < 0.001$
UCLA-LS	$r = 0.36$, $p < 0.001$
LSNS	$r = –0.17$, $p < 0.001$
Number of stays in lifetime	$r = –0.02$, $p = 0.526$
Number of stays in past year	$r = –0.01$, $p = 0.819$
Length of stay	$r = 0.08$, $p = 0.049$

UCLA-LS – UCLA Loneliness Scale
LSNS – Lubben Social Network Scale

To further explore demographic differences, t-tests and correlations were employed to observe how sex, age, and ethnicity differed amongst the seven HSQ factors (see Appendix B). Females were significantly more stressed than males in all factors except for the Inconvenienced factor (#3), where there was no significant difference between sexes. For all seven factors, there was a significant, small-to-medium sized negative association with age, implying that in-hospital stress decreases with age. The effect was most notable with factor #3 (Inconvenienced, r = –0.27) and least with factor #4 (Health anxiety, r = –0.11). To explore ethnic differences, white participants were compared against other ethnicities (Asian, Black, Mixed, and other); where other ethnic groups were significantly more stressed in three of the seven factors (#2 Away from home, #3 Inconvenienced, and #7 Disrupted patient experience). There were no statistically significant differences by ethnicity for the other four factors.

5.3.3 In-Hospital Stress Predicting Post-Hospital Outcomes

Hierarchical regressions were conducted to test the predictive nature of the HSQ (see Table 5.3). For post-hospital feelings of vulnerability, at step 1 (age and sex), age was a significant predictor, explaining 1.6% of the variance. At step 2, the HSQ was a significant predictor, explaining an additional 13.8% of the variance; as in-hospital stress increased, so did post-hospital feelings of vulnerability. At step 3 (UCLA-LS and LSNS), feelings of loneliness, captured by the UCLA-LS, was significantly, explaining a further 1.2% of the variance. Finally, at step 4, neither interaction term reached statistical significance when entered into the model.

For time to return to usual activities, at step 1 (age and sex), age was once again a significant predictor, explaining 6.6% of variance. At step 2, the HSQ was significant, and explained a further 1.8% of the variance; time to return to usual activities increased with in-hospital stress. At step 3 (UCLA-LS and LSNS), the UCLA-LS was also significant predictor, explaining 2.1% of the variance. However, at this step, the HSQ was no longer significant at the aforementioned threshold of $p = 0.01$. Lastly, at step 4, neither interaction term reached statistical significance when entered into the model.

For health-related quality of life, measured by the EQ-5D, at step 1 (age and sex), age was a significant predictor, explaining 2.0% of the variance. At step 2, the HSQ was also identified as a significant predictor, and explained an additional 13.8% of the variance; as in-hospital stress increased, health-related quality of life decreased. At step 3, the UCLA-LS was significant, explaining 3.0% of the variance. At step 4, the interaction term between the HSQ and UCLA-LS was significant, explaining 0.9% of the variance. The interaction was decomposed using simple slopes analysis, and as shown in Figure 5.1, the negative relationship between in-hospital stress and health-related quality of life was stronger at higher levels of subjective loneliness (steeper slope in Figure 5.1) compared to lower levels (more gentle slope in Figure 5.1).

For the outcomes seen in the PACT-M, at step 1 (age and sex), neither variable was significant. At step 2, the HSQ was a significant predictor, explaining 3.9% of the variance; the likelihood of adverse events increased with in-hospital stress. At step 3, both the UCLA-LS and LSNS were significant, and explained 2.8% of variance. Finally, at step 4, neither interaction term reached statistical significance when entered into the model.

Table 5.3. Hierarchical regression analyses testing the effects of in-hospital stress on post-hospital outcomes (N=660)

		β step 1	β step 2	β step 3	β step 4	ΔR^2 for step	Total R^2	F-Change
	Post-hospital feelings of vulnerability							
Step 1	Age	0.116**	0.203***	0.214***	0.215***	0.016	0.016	5.23**
	Sex	0.059	0.012	0.008	0.007			
Step 2	HSQ-55		0.386***	0.349***	0.349***	0.138	0.154	104.66***
Step 3	UCLA-LS			0.123**	0.126**	0.012	0.166	4.52*
	LSNS			0.025	0.025			
Step 4	HSQ-55 × UCLA-LS				–0.018	0.001	0.167	0.15
	HSQ-55 × LSNS				–0.021			
	Time to return to usual activities							
Step 1	Age	0.257***	0.289***	0.306***	0.300***	0.066	0.066	22.61***
	Sex	0.008	–0.009	–0.016	–0.014			
Step 2	HSQ-55		0.140***	0.100*	0.096*	0.018	0.084	12.73***
Step 3	UCLA-LS			0.163***	0.136**	0.021	0.106	7.63***
	LSNS			0.079*	0.080*			
Step 4	HSQ-55 × UCLA-LS				0.066	0.005	0.111	1.89

	HSQ-55 × LSNS				–0.021			
	EQ-5D							
Step 1	Age	–0.115**	–0.202***	–0.222***	–0.215***	0.020	0.020	6.43**
	Sex	–0.088*	–0.041	–0.033	–0.038			
Step 2	HSQ-55		–0.386***	–0.336***	–0.331***	0.138	0.158	105.12***
Step 3	UCLA-LS			–0.195***	–0.157***			11.83***
	LSNS			–0.085*	–0.084*	0.030	0.188	
Step 4	HSQ-55 × UCLA-LS				–0.117**	0.009	0.198	3.74*
	HSQ-55 × LSNS				–0.039			
	Outcomes seen in PACT-M (sore/wound healing, infections, falls, contact GP/A&E)							
Step 1	Age	0.102*	0.148***	0.168***	0.166***	0.011	0.011	3.59*
	Sex	0.036	0.010	0.002	0.003			
Step 2	HSQ-55		0.206***	0.172***	0.171***	0.039	0.050	26.53***
Step 3	UCLA-LS			0.171***	0.160***	0.028	0.079	9.80***
	LSNS			0.129**	0.129**			
Step 4	HSQ-55 × UCLA-LS				0.034	0.001	0.080	0.28
	HSQ-55 × LSNS				0.011			

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

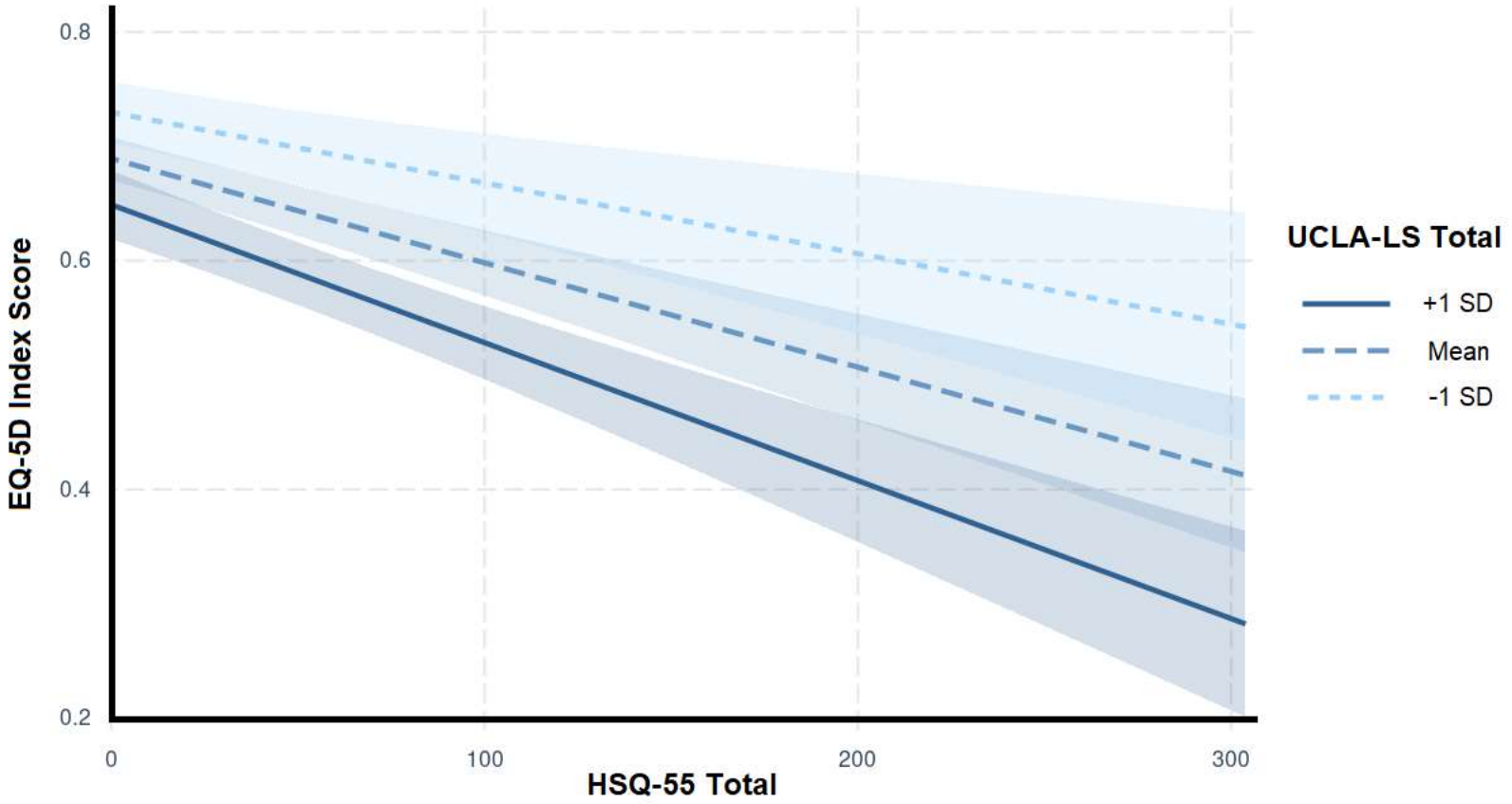


Figure 5.1. Simple slopes plot depicting the interaction between subjective loneliness and perceived in-hospital stress on health-related quality of life.

The hierarchical regressions were repeated, but using the seven subscales of the HSQ, rather than its total score (see Table 5.4 for a summary of the main findings, Appendix C for the full regression findings, and the HSQ in Appendix A for the items that comprise each subscale). For post-hospital feelings of vulnerability, at step 2, 24.8% of the variance was accounted for, but only factors #4 (Health anxiety) and #5 (Negative effects of treatment) were identified as significant predictors. As health anxiety and negative effects of treatment increased, so did post-hospital feelings of vulnerability. Unlike in the total score model, at step 3 (UCLA-LS and LSNS), the UCLA-LS was no longer significant.

For time to return to usual activities, at step 2, only factor #4 (Health anxiety) was identified as a significant predictor, and 5.7% of the variance was explained, such that higher levels of health anxiety were associated with more time taken to return to usual activities. At step 3 (UCLA-LS and LSNS), the UCLA-LS significantly explained 1.9% of the variance, and unlike in the total score model, the HSQ remained significant at this step.

For the EQ-5D, at step 2, four factors reached statistical significance when entered into the model (1. Quality of care, 4. Health anxiety, 5. Negative effects of treatment, and 7. Disrupted patient experience), and 31.2% of the variance was explained. Higher scores on factors #1, #4, and #5 were associated with lower health-related quality of life. Unexpectedly, higher levels of stress reported in factor #7 was associated with an increased quality of life; however, when observing the simple correlation, this was shown to be a suppressor effect ($r = –0.17$, $p < 0.001$). At step 3 (UCLA-LS and LSNS), the UCLA-LS was significant and explained a further 2.4% of the variance.

For the PACT-M outcomes, factors #3 (Inconvenienced) and #4 (Health anxiety) were significant, and 10.0% of the variance was explained. Higher health anxiety was associated with an increased likelihood of experiencing adverse events. Unexpectedly, more reports of

being inconvenienced while in hospital was associated with fewer post-hospital adverse events; however, when observing the simple correlation, this was shown to be a suppressor effect (r = 0.04, p = 0.324). At step 3, both the UCLA-LS and LSNS were significant, accounting for an additional 2.4% of the variance.

Table 5.4. Main findings of the hierarchical regression analyses testing the effects of the HSQ subscales on post-hospital outcomes (N=660)

	Standardised β Values (from Step 2)			
	Vulnerability [a]	**Activities [b]**	**EQ-5D [c]**	**PACT-M [d]**
Factor 1. Quality of care	0.101	0.124	–0.200**	0.160*
Factor 2. Away from home	–0.013	–0.068	0.072	–0.053
Factor 3. Inconvenienced	–0.101	–0.099	0.063	–0.166**
Factor 4. Health anxiety	0.388***	0.193**	–0.279***	0.263***
Factor 5. Negative effects of treatment	0.243***	0.119*	–0.446***	0.111*
Factor 6. Ward environment	–0.107	–0.063	0.127*	–0.033
Factor 7. Disrupted patient experience	–0.046	–0.045	0.196***	–0.048
Variance explained by HSQ factors (R^2)	0.248	0.057	0.312	0.100

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

[a] Post-hospital feelings of vulnerability

[b] Time to return to usual activities

[c] Health-related quality of life (EQ-5D index score)

[d] Outcomes seen in PACT-M (sore/wound healing, infections, falls, contact GP/A&E)

The hierarchical regressions were once again repeated, comparing the amount of variance explained using the long (HSQ-55), medium (HSQ-28), and short (HSQ-10) versions of the measure (see Appendix D). The differences between the long and medium versions of the measure were negligible, but the amount of variance explained was notably less when using the short version.

5.4 Discussion

The current study examined demographic differences of in-hospital stress, and its ability to predict post-hospital outcomes. This was accomplished via a retrospective survey, completed by a diverse and representative sample of 660 recent inpatients. It was found that perceptions of in-hospital stress differed by age, sex, ethnicity, length of stay, planned/emergency admissions, and levels of social support and loneliness. Additionally, results showed that the HSQ significantly predicted poorer post-hospital outcomes; namely, feelings of vulnerability, time to return to usual activities, health-related quality of life, as well as outcomes seen in other hospital surveys, such as the PACT-M (falls, sore/wound healing, infections, and unplanned contact with GP/A&E). The predictive relationship between in-hospital stress and health-related quality of life was stronger when patients reported feelings of loneliness.

5.4.1 Demographic differences of in-hospital stress

Certain groups of patients exhibited higher levels of perceived in-hospital stress. Younger patients were more stressed than their older peers; interestingly, this was not due to a lack of familiarity with the hospital environment, as it was found that the number of previous

stays had no association with in-hospital stress. The relationship with age was consistent across all seven domains of the HSQ, implying that the stressors reported did not differ by age, but that younger patients found being in hospital generally more stressful. This finding is consistent with those of Volicer and colleagues (1977) who also observed a negative association between age and in-hospital stress. Also in accordance with the current study, Volicer found that females reported more in-hospital stress than males (Volicer & Burns, 1977). Results from the HSQ show that this finding was observed across six of the seven domains, which implies females experience the in-hospital environment to be more stressful. This may be due to a number of factors; for example, males may be less willing to admit feelings of stress (see Matud, 2004), or males and females may be affected by stress differently (Brivio et al., 2020; Volicer & Burns, 1977).

In addition to age and sex, ethnicity was also found to be associated with in-hospital stress. Overall, White patients were significantly less stressed than patients of Asian, Black, Mixed, and other ethnic backgrounds. This is particularly concerning as the negative impacts linked with the stress of hospitalisation are likely to be exacerbated by other health inequalities that these groups experience, such as the increased risk of adverse events and safety events (Chauhan et al., 2020). Patients from ethnic minority backgrounds are disproportionately burdened by social determinants of health, which can often be met with unsuitable healthcare (Matthew, 2018), and concerted efforts are needed at both the individual and system levels to address these (Wade et al., 2022). In particular, the current study highlighted three areas for improvement, relating to the three HSQ factors that differed between ethnic groups: being away from home, being inconvenienced, and having a disrupted patient experience. Tackling these differences is likely to require a multi-faceted intervention that addresses racism, the different cultural needs of patients, and where relevant, language barriers.

5.4.2 In-hospital stress predicting post-hospital outcomes

The HSQ was significant associated with all four post-hospital outcomes administered in the current study. The effect was stronger for subjective outcomes (medium-sized effect for health-related quality of life and feelings of vulnerability), and weaker for objective outcomes (small effect size for time to return to usual activities and the PACT-M outcomes). This finding is similar to a recent meta-analysis, which found a small association between in-hospital stress and objective patient outcomes, and a medium effect with subjective patient outcomes (Ford et al., 2023). The predictive properties of the HSQ-55 are matched by the HSQ-28, meaning the medium-length version may be more appropriate for some study designs – for example, if the researcher sought to measure the effects of in-hospital stress but was less interested in identifying all of the individual stressors at play. The HSQ-10 was not as strong at predicting post-hospital outcomes but still appears to be an effective tool, especially for patients groups that would find the longer versions too burdensome.

The time periods considered by three of the four post-hospital outcomes were between two and six weeks after discharge (the fourth outcome, time to return to usual activities, allowed participants to select from a range of time periods). The time frame of up to six weeks was chosen as the effects of post-hospital syndrome have been shown to last up to 45 days (approximately 6.5 weeks) for those patients who neither die nor are readmitted (Dharmarajan et al., 2015), such as those recruited in the current study. The findings that in-hospital stress can predict a range of outcomes in this time period is consistent with the theory of hospitalisation-induced allostatic overload being the aetiology behind post-hospital syndrome (Goldwater et al., 2018; Krumholz, 2013) – whereby the stress of hospitalisation is thought to have a physiological wear and tear effect, leading the body into a state of vulnerability and increasing the likelihood of adverse events. This is further supported by the current study in

that the large majority of participants reported times to return to usual activities of "4–6 weeks" or less.

The HSQ domain with the largest association across the post-hospital outcomes was health anxiety, which was significantly related to all four outcomes, followed by negative effects of treatment, which was significantly related to two of the four outcomes. These two health-related factors were the only ones associated with post-hospital feelings of vulnerability and time to return to usual activities. It might be the case that these factors are indirectly measuring the severity of the respondent's condition (the more serious the treatment, the more likely the patient is to fear for their health), and that these individuals feel more vulnerable and take longer to recover than patients in better health receiving more minor treatments (e.g. Zhang et al., 2016). For health-related quality of life, a more diverse range of stressors were identified as important, including quality of care and disrupted patient experience, as well as the two factors mentioned above. Health anxiety was the only factor associated with the occurrence of falls, sores/wounds not healing, infections, and unplanned contact with the GP or A&E. It is unsurprising that the two health-related factors predicted the largely health-related outcomes included in the current study; improvement efforts would likely be best targeted in aiming to reduce inpatient anxiety regarding their health (e.g., via education; Weisfeld et al., 2021).

Chiefly, our results suggest that the inpatient experience, regardless of stressors relating to having worse physical health, may have a lasting effect on quality of life and risk of adverse events, for several weeks after discharge. Findings from the current study are in agreement with Krumholz's work, proposing that hospitalisation is a traumatic event (Detsky & Krumholz, 2014) which leads to a generalised vulnerability to adverse events (Krumholz, 2013). We also found that this relationship can be compounded by loneliness and, to a lesser extent, a lack of social support. Psychosocial factors, such as stress and loneliness, are critical

to health (O'Connor et al., 2021), not least in a hospital context. Future interventions might focus on those stressors identified as the most stressful elements of hospitalisation, for example disrupted sleep (Ford et al., 2024b, Preprint), in order to improve patient wellbeing and save resources.

5.4.3 Limitations

Several limitations were apparent within the current study. The majority of the cohort were recruited via Prolific; a research participant platform which may limit the generalisability of the findings. Moreover, the current sample was more educated than the general public, and was lacking in participants aged over 80 years, a population which made up approximately 20% of NHS inpatients in 2022–23 (NHS Digital, 2023). Secondly, the retrospective nature of the current study may have influenced the accuracy of the results, as it relies on the participant's ability to recall events from up to one year ago. Additionally, we recognise that the cross-sectional nature of the design limits any causal relationships from being confirmed. Therefore, the authors suggest that future research addresses some of these limitations by employing the HSQ in hospitals to current inpatients, and adopting a longitudinal design to better assess the predictive ability of the measure with a battery of health outcomes.

5.4.4 Conclusion

In-hospital psychological stress, measured by the HSQ, is associated with a range of post-hospital outcomes. The relationships were stronger for subjective outcomes than objective, and health-related stressors (health anxiety and negative effects of treatment) exhibited the strongest associations. Patients that were female, younger, from an ethnic

minority background, did not plan on staying in hospital, or had a longer length of stay, scored higher on the HSQ. Loneliness and social support also affected in-hospital stress and its complex relationship with post-hospital outcomes.

Chapter 6

Does in-hospital stress predict post-hospital outcomes? A pilot feasibility study

6.1 Introduction

6.1.1 Background

Psychological stress is known to adversely influence health and wellbeing by causing negative changes in mental health outcomes and multiple physiological processes (O'Connor et al., 2021). More specifically, there is an association between psychological stress and immune system dysfunction (Glaser & Kiecolt-Glaser, 2005; Segerstrom & Miller, 2004), cardiovascular disease, coronary heart disease, and stroke (Kivimäki & Steptoe, 2018). In response to stressful events ('stressors'), endocrinological mediators such as cortisol (the so-called 'stress hormone') are released and physiological parameters are adjusted, causing the body to veer from its homeostatic state, This process of adapting is necessary for survival and is known as *allostasis* ('remaining stable by being variable'; see Sterling & Eyer, 1988). However, with prolonged exposure to stress, the body experiences excessive physiological fatigue from an inefficient management of stress mediators; a concept known as *allostatic load* (McEwen, 1998; O'Connor et al., 2021). When this load becomes too great, the body experiences deleterious effects; a concept known as *allostatic overload* (McEwen, 2018; see Guidi et al., 2021).

Allostatic overload is theorised to be the cause of *post-hospital syndrome* (PHS); an acquired generalised risk, where the patient experiences a transient period of vulnerability to

adverse events (e.g., post-operative wound infection) following hospitalisation (Krumholz, 2013). Indeed, in some prominent conditions, only a third of all post-discharge readmissions were the same as that of the index admission (Jencks et al., 2009). This is even lower still for some conditions: the 30-day readmission for patients hospitalised due to acute myocardial infarction is approximately one in six (Khera et al., 2018), where only 10% of those readmissions were for a subsequent myocardial infarction, while the other 90% were for a myriad of conditions (Dharmarajan et al., 2013). Consequently, Krumholz (2013) suggests that we should view the post-discharge period as a generalised syndrome of physiological impairment, rather than a routine recovery specific to the initial ailment.

More recently, the relationship between allostatic overload and PHS has been elaborated on by Goldwater and colleagues (2018). These authors have outlined several "hospital-related stressors" that are likely catalysts of allostatic overload: sleep disruption, malnourishment and dehydration, mobility restriction, and pain. However, this list is by-no-means comprehensive, there exists an unknown (and likely vast) number of these stressors, for example: loss of control (Taylor, 1979), mental distress (Aass et al., 1997), equipment visibility (Tanja-Dijkstra, 2011), lack of light and nature (Jamshidi et al., 2020), and, perhaps the most salient of all, relationships with staff (Koenig et al., 1995; Volicer & Bohannon, 1975). The combination of these stressors may make for an unpleasant experience for inpatients in their already vulnerable states (e.g., Caraballo et al., 2019).

Indeed, it follows that, if stress causes deleterious effects, and if hospital stays expose patients to an assortment of stressors, then hospitalisation may be contributing to these adverse patient outcomes (this is the essence of PHS). Previous research has characterised hospitalisation as a traumatic event (e.g., Detsky & Krumholz, 2014; Rawal et al., 2019), even resembling interrogation (Mishark et al., 2020), and has recorded that patient-reported hospital experiences are potentially associated with patient outcomes (Dong et al., 2019; McAlister et

al., 2019; Raghuveer et al., 2021; Rawal et al., 2019; Wang et al., 2016). This was supported by our recent systematic review (Ford et al., 2023). In fact, regardless of stress, hospitalisation may be damaging for patients (particularly older adults), being a likely risk factor for cognitive decline (Chinnappa-Quinn, 2020; Wilson et al., 2012), functional decline (Boyd et al., 2009; Covinsky et al., 2003; Sager et al., 1996), decompensated frailty (Wray et al., 2021), and new iatrogenic disability (Covinsky et al., 2011; Volpato et al., 2007).

Therefore, taken together, there is an immediate need for us to improve our understanding of in-hospital stress, and its effects on in-hospital and post-hospital patient outcomes – so as to understand what are the most common stressors, how we might intervene to reduce them, and then to evaluate the impact of these interventions. To accomplish this, we have developed (Ford et al., 2024a) and validated (Ford et al., 2024b, Preprint) a self-report questionnaire measuring in-hospital psychological stress, the Hospital Stress Questionnaire (HSQ). The measure contains 55 items, each pertaining to a hospital-related stressor (see *Measures* section for more details).

6.1.2 Aims and Rationale

In a future study, we will aim to determine whether in-hospital stress can be used as a predictor of post-hospital outcomes, using a survey on hospital experiences (including the HSQ and a battery of other measures). However, before a full-scale study can be conducted, we must first conduct a pilot feasibility study, with the following aims:

1. To test the feasibility of administering the above survey (most importantly the HSQ) to current inpatients.
2. To do so with an inclusive approach, accounting for barriers such as delirium, language, and sight/hearing impairments.

3. To estimate the attrition rate of completing a three-month follow-up survey.
4. To help inform an appropriate sample size for the full study.

Should this research be feasible, and a full study supports the predictive validity of the HSQ, it has potential to be used as a diagnostic tool, in combination with other risk factors (e.g. age, family history, social support, etc.), to estimate a patient's risk of adverse events.

6.2 Method

6.2.1 Design

The current pilot feasibility study will employ a longitudinal, observational design. Data collection will take place at two time points: a first survey completed in hospital, and a second survey completed three months later. Both phases of the study can be completed without access to the internet, as to avoid digital exclusion. Figure 6.1 displays the proposed timeline of the study.

6.2.2 Setting

Participants will be recruited from three wards at Bradford Teaching Hospitals NHS Foundation Trust: a ward providing care for older people, one general medical ward, and one general surgical ward.

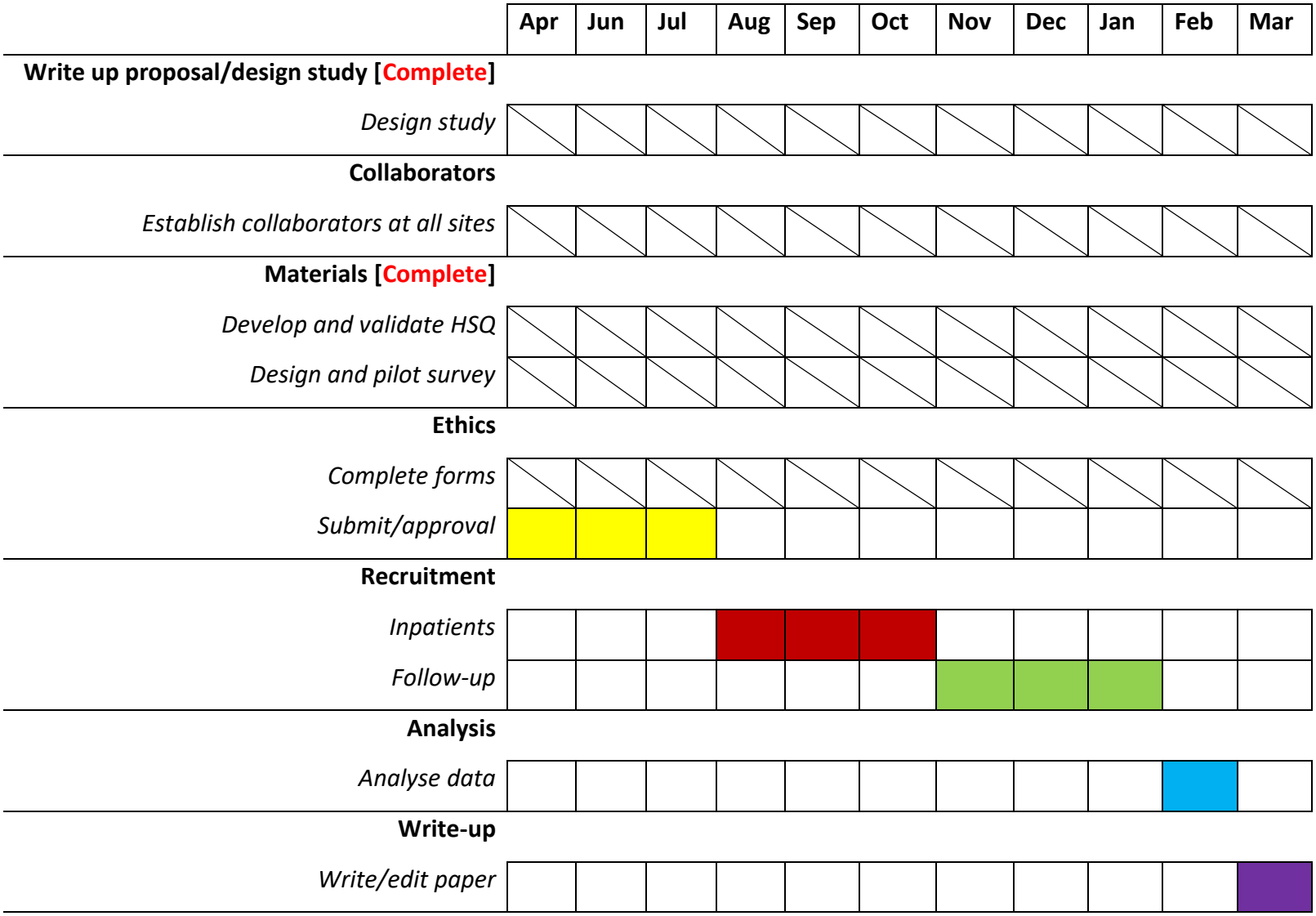


Figure 6.1. Gantt chart project timeline April 2024 onwards (including completed stages).

6.2.3 Participants

For pilot feasibility studies, there is no agreed upon justification for the number of participants needed, sample sizes between 24 and 50 have been recommended (Julious, 2005; Sim & Lewis, 2012). The most commonly cited sample size justification is 30 (Lancaster et al., 2004), and so the current study will aim to recruit 30 patients. Participants must be (i) over 18 years old, (ii) current inpatients for a medical or surgical condition that is not classed as paediatric, maternity, or psychiatric care, and (iii) have been admitted 3–6 days prior to completing the survey. The three above medical conditions were excluded from the current study as the stressors associated are vastly different to other conditions (see e.g., Pichler-Stachl et al., 2016), and therefore are not captured by the HSQ. Administration of the survey between days 3 and 6 of admission has been adopted from previous hospital stress measures (Koenig et al., 1995; Volicer et al., 1977), as this time frame allows patients to experience a wide range of stressors, while also avoiding losing too many eligible patients to early discharges.

Some patients may not have capacity to provide informed consent or the study may be too burdensome for them, and so researchers will ask ward staff if they believe the patient in question has capacity to provide informed consent and is well enough to participate in the study. If, while interacting with the patient, the researcher suspects that the patient may lack capacity, or is too burdened by the study, the researcher will not proceed with the study at this time. However, to avoid excluding vulnerable patients (e.g. those presenting with dementia, cognitive impairment, or delirium) from this research, the researcher will seek to find an informal carer, such as a friend or relative, who can act as a consultee throughout the study. In cases where the patient regains the capacity to consent within the 3–6 day inclusion criteria (e.g. once an infection has been treated, delirium is likely to resolve), the patient will be asked to re-consent, even if they originally gave consent. As fluctuating capacity is not uncommon in the hospital environment, particularly in older adults, the researcher will ask the patient

questions throughout the study to informally assess capacity, such as, ‘Just to make sure I’ve explained the study well to you, can you tell me how many times I said we would do a follow up?’, or ‘So when did you come into hospital?’, despite already knowing the answer. If the patient presents with confusion as a result of these questions, the researcher will seek out a friend or relative that can act as a consultee.

Some patients may lack the ability to read and respond to the survey, for example, the patient’s first language may not be English, or there may be physical, cognitive, or communication impairments due to their condition (e.g. stroke). In such cases, the researcher will be mindful throughout of the need to communicate in language comprehensible by the patient. To accommodate this, we will employ a two-stage recruitment process: (i) an informal approach and brief verbal summary of the key points of the study, if the patient expresses interest in participating, this will be followed by (ii) the researcher reading aloud the Participant Information Sheet and Consent Form, both of which are written in plain English. Additionally, the researcher will offer to read aloud each question within the survey, and the patient will be invited to dictate their answers for each question, which the researcher can then write down on their behalf.

6.2.3.1 Recruitment/procedure

Inpatients that meet the inclusion criteria, and are judged to be well enough to participate by both the researcher and the clinical ward staff, will be identified by ward staff. A member of the research team will then approach the patient and, after making acquaintance, will ask if they would be interested in taking part in a research study, consisting of two surveys – one to be completed now and one to be completed in three months – each taking approximately 10–15 minutes.

Patients interested in taking part will be provided with a Participant Information Sheet, along with a Consent Form. Should the patient present with confusion, a consultee (friend or family member) will be allowed to complete the surveys on behalf of the patient – a Consultee Information Sheet and Declaration Form will be provided. Responses submitted by consultees will be flagged as proxy responses for the sake of analysis. Should the patient be visually impaired or physically unable to sign the Consent Form, a Witness Consent Form will be provided – an NHS Trust colleague will witness the participant consenting and sign the witness form. If the patient is unable to read or respond to the survey independently, the researcher will offer to read aloud all study documents and the survey. All of the above documents are provided in Appendix A.

After gaining informed consent to take part in this study, participants will be presented with the first survey (see Appendix B), either electronically via a secure platform (e.g. Qualtrics) or in paper form, according to the individual patient's preference. Ward staff will not have access to the participants' survey responses, as some of the questions pertain to the staff, and this knowledge may cause complications in the staff-patient relationship (note: if the patient requires the questions reading aloud, researchers will ensure staff are not within earshot – members of the research team have taken this approach in previous studies and have not encountered any issues). Completed paper responses and signed consent forms will be stored in separate locked drawers in the Wolfson Centre for Applied Health Research for 5 years. This survey is comprised of the HSQ-55, UCLA (three items), LSNS (six items), PHQ-4, EQ-5D-5L and EQ VAS, demographic questions taken from the Office for National Statistics UK Census, and several background questions relating to the patient's health. Upon completion, participants will be asked for contact details, where the research team can send the follow-up survey – contact details will be either an email address, phone number, or postal address, according to the individual patient's preference. The research team will adhere to the principles

of GDPR/Data Protection Act regarding the holding of this identifiable patient data. Three months later, participants will be contacted via their preferred method and asked to complete a follow-up survey, comprised of questions relating to post-hospital outcomes (see Appendix C). Should the patient choose to complete the survey in paper form, via post, an envelope with a postal address and prepaid stamp will be provided. Attrition rate will be calculated from recording how many of the 30 participants do not respond. Three months (approximately 90 days) was chosen as an appropriate follow-up period based on previous studies relating to post-hospital syndrome (e.g., Brownlee et al., 2017; Hart et al., 2020; Kirshenbaum et al., 2019; Sharoky et al., 2017; van Seben et al., 2020). As a token of appreciation for their time, participants will receive a £10 gift voucher after completing each of the two stages of the study, for a total of £20, either electronically or by post, according to their preference.

6.2.4 Measures

6.2.4.1 Hospital Stress Questionnaire

The HSQ is a self-report measure of inpatient psychological stress, consisting of 55 items measured between 1 (no stress) and 10 (extreme stress). The tool was developed and validated by the same research team as the current proposal (Ford et al., 2024a; 2024b – Preprint). Development consisted of 21 semi-structured interviews, using a diverse sample, and comparison with previous in-hospital stress measures (e.g., the Hospital Stress Rating Scale (HSRS); Volicer & Bohannon, 1975). Interviews were analysed using quantitative content analysis, identifying 67 hospital-related stressors, and the resulting stressors were posed as questions. Stressors identified via the interviews covered all of the stressors presented in the previous measures, and proposed 12 new stressors. The HSQ was then piloted on 10 laypersons to provide face validity, and presented to the Yorkshire Quality and Safety Research Group to

provide content validity. Finally, the measure was completed by 200 persons who had been in hospital in the past 12 months for at least 24 hours, in order to provide initial validation: both internal consistency (α = 0.97) and convergent validity (*r* = 0.77 with PSS-10) were excellent.

A full validation was also conducted. A diverse sample of 660 recent patients retrospectively completed a survey on their hospital experiences, which included the HSQ. Reliability, validity, and latent factor structure were explored. An exploratory factor analysis identified seven factors: quality of care, away from home, inconvenienced, health anxiety, negative effects of treatment, ward environment, and disrupted patient experience. Long (55 items), medium (28 items), and short (10 items) versions of the HSQ were produced, all exhibiting acceptable psychometric properties. The HSQ-55 has shown internal consistency reliability (overall α = 0.97; factors α = 0.71–0.91), convergent validity (with the PSS-10; r = 0.71), known-groups validity (planned visit (*M* = 179.1) less stressed than emergency visit (*M* = 223.3), *t* (438.3) = -5.89, *p* < 0.001), predictive validity (predicting EQ-5D-5L index scores, *r* = -0.35; and EQ VAS self-rated health, *r* = -0.32), and test-retest reliability (*r* = 0.90).

6.2.4.2 EuroQol 5-Dimension Health Questionnaire

The EQ-5D is a widely-used measure for describing and valuing health using five dimensions: Mobility, Self-Care, Usual Activities, Pain/Discomfort, and Anxiety/Depression (Brooks & EuroQol Group, 1996). Each of these dimensions can be measured using a three-level (EQ-5D-3L) or five-level (EQ-5D-5L) Likert scale (Herdman et al., 2011), both of which has excellent psychometric properties but the five-level version is more sensitive to change (Feng et al., 2021). A participant's responses to the EQ-5D reveal their *health state* (e.g. 11111 is indicative of full health); a formula can be applied to this 5-digit code to derive an *index value*, which reflects how good or bad a health state is according to the preferences of the

general population of a country/region. These preferences are determined using a *value set*; a representative sample from that country/region – the value set for England will be used in the current study. The EQ-5D also includes a visual analogue scale (the EQ VAS): a thermometer where the respondent can indicate self-rated health between 0 (worst possible health) and 100 (best possible health). The EQ-5D-5L and EQ VAS will be included in both the in-hospital and post-hospital survey, and have potential to be used as moderators (in-hospital) and outcomes (post-hospital).

6.2.4.3 UCLA Loneliness Scale

The UCLA is a measure of subjective feelings of loneliness and social isolation. Originally a 20-item questionnaire (Russell et al., 1978), a short version of three items has since been validated, exhibiting comparable psychometric properties to the original (Hughes et al., 2004). The three-item version was chosen to avoid unnecessarily burdening the participants. Items ask how often the respondent feels lonely or isolated, and are measured on a three-point Likert scale, from 'Hardly Ever' to 'Often'. The UCLA was included in the survey to account for the moderating effect of loneliness on the relationship between stress and health (see O'Connor et al., 2021).

6.2.4.4 Lubben Social Network Scale

The LSNS is a measure of social engagement including family and friends. A 12-item and six-item version are available, both with acceptable psychometric properties (Lubben, 1988; Lubben et al., 2006). The six-item version was chosen to avoid unnecessarily burdening the participants. Items focus on the number of friends or relatives the respondent has had contact with in the past month, with six response options: 0, 1, 2, 3–4, 5–8, 9+. The LSNS was included in the survey to account for the moderating effect of social support on the relationship between stress and health (see O'Connor et al., 2021).

6.2.4.5 Patient Health Questionnaire

The PHQ is a self-administered screening tool for anxiety and depression (i.e., distress), and has been shown to be valid and reliable as both a nine-item (PHQ-9: Kroenke et al., 2001) and four-item (PHQ-4: Kroenke et al., 2009) version. The latter was chosen to avoid unnecessarily burdening the participants. Questions ask respondents to answer how often they felt a particular way in the past two weeks, where two questions pertain to anxiety, and two to depression. Each item is measured on a four-point scale, from 'Not at all' (0) to 'Nearly every day' (3). The PHQ was included in the survey to account for the moderating effect of distress on the relationship between stress and health (see O'Connor et al., 2021).

6.2.5 Planned Analysis

Data will be analysed using regression analyses, similar to those seen in Chapter 5. Hierarchical linear regressions will be employed to test the ability of the HSQ to predict (i) the occurrence of unplanned readmissions, (ii) health-related quality of life (measured by the EQ-5D), (iii) time to return to usual activities, (iv) post-hospital feelings of vulnerability, and (v) other health outcomes seen in the PACT-M (sore/wound healing, infections, falls, and contact with a GP or Emergency Department). Age and sex will be entered at Step 1 as control variables, the HSQ will be entered at Step 2, and the UCLA-LS, LSNS, and PHQ-4 will be entered at Step 3 as potential moderators. Interaction effects will be examined at Step 4, and any significant interactions will be examined using simple slopes analysis.

Chapter 7

General Discussion

7.1 Chapter Summary

The final chapter of this doctoral thesis will summarise the findings of the original pieces of work presented in Chapters 2–5, presented in the context of the thesis aims. These findings will then be considered in view of the previous academic literature, regarding hospital stress, allostatic overload, and post-hospital syndrome. Strengths and limitations of the works within this thesis will be discussed, and potentially fruitful future lines of enquiry will be offered (such as the study proposed in Chapter 6). This chapter will also discuss implications for research, healthcare policy, and practice, each informed by the findings of this body of work. Finally, the key messages from this thesis will be presented.

7.2 Summary of Thesis Findings

7.2.1 Aim 1: In-hospital stress and patient outcomes

In light of the seminal article by Goldwater and colleagues (2018) – linking the stress of hospitalisation with allostatic overload, and theorising it to be the aetiology behind post-hospital syndrome – the first goal of this thesis was to examine this relationship via the amalgamation of previous empirical works. Therefore, the first aim of this thesis was to "*synthesise the existing evidence-based in order to quantify the strength of the association between hospitalisation-induced allostatic overload and patient outcomes (i.e., the theory of*

post-hospital syndrome)". Chapter 2 contains the systematic review and meta-analysis seeking to answer this question (Ford et al., 2023).

The current review was the first of its kind, and synthesised results from 10 diverse studies, each of which had administered a measure of in-hospital stress and included at least one patient outcome. A statistically significant association was found between these two variables: there was a small to medium negative effect, indicating that as in-hospital stress increased, patient outcomes deteriorated, though no inference about causality can be made. The size of the effect was significantly stronger for subjective outcomes (e.g., quality of life) than for objective outcomes (e.g., unplanned readmissions). The size of the effect was also significantly stronger for outcomes measured while the patient was still in hospital (e.g., length of stay), than for those measured after the patient had been discharged (e.g., time to return to usual activities).

However, these findings must be interpreted within the context of the limited academic literature. This review included relatively few articles and reported on a variety of patient conditions, in-hospital stress measures, and patient outcome measures, which complicated attempts to aggregate the effect sizes within each study. Despite this, heterogeneity values were only moderate, leave-one-out analysis identified no statistical outliers, and every association within the included studies presented in their predicted directions – as in-hospital stress increased: beneficial patient outcomes (e.g., physical status, quality of life, etc.) deteriorated; and adverse patient outcomes (e.g., pain, readmission, etc.) increased. Therefore, the results of this systematic review and meta-analysis indicated that patient outcomes may be, in part, a function of the stress experienced by patients during their hospital stay.

7.2.2 Aim 2: Development of a tool to measure in-hospital stress

Given that the hospital stress measures covered in Chapter 1 each had their own shortcomings – making them unsuitable for use in robust research studies – and also noting that a validated tool to measure hospital stress is required to examine its relationship with patient outcomes, the next aim of this thesis was to "*develop a comprehensive tool to measure the hospital stress experienced by inpatients, specific to UK hospitals*". Chapter 3 contains the development of the Hospital Stress Questionnaire (Ford et al., 2024a).

A self-report questionnaire was developed, which allows for individual differences in perceived saliency of stressors, and is generalisable across specialties (excluding paediatric, maternity, and psychiatric), hospital-settings, and age groups. The resulting 67-item measure has been deemed appropriate by academics, clinicians, and patients, and has demonstrated excellent initial psychometric properties, including internal consistency and convergent validity. The most common stressors identified were: feeling bored, missing loved ones, and not sleeping well. However, a number of limitations were evident within the development process, largely concerning the sampling; first, there was a lack of participants aged over 70 years – a demographic which makes up a large proportion of NHS inpatients; second, concerning the pilot testing, the sample was recruited entirely via Prolific, an online recruitment platform, which questions the representativeness of the sample; and lastly, neither phase of the development invited current inpatients to participate in the studies (due to the COVID-19 pandemic, we were not able to access these patients). Nevertheless, the HSQ is a promising self-report tool for measuring in-hospital stress.

7.2.3 Aim 3: Validation of the Hospital Stress Questionnaire

In order for the HSQ to be a viable tool for use in future research, it must first be validated in line with the contemporary standards of psychometric theory. Additionally, the current 67-item version of the measure would likely be too burdensome, particularly for

patients who are already in a vulnerable state. Therefore, for the measure to be a feasible option for measuring hospital stress, item reduction must be performed to produce alternate scale lengths (i.e., short, medium, and long versions). Hence, the next aim of this thesis was to "*psychometrically evaluate that the tool is a valid and reliable measure of hospital stress*". Chapter 4 contains the validation of the Hospital Stress Questionnaire (Ford et al., 2024b, Preprint).

An exploratory factor analysis identified seven latent factors, each with an acceptable level of internal consistency, forming the subscales of the HSQ: quality of care, away from home, inconvenienced, health anxiety, negative effects of treatment, ward environment, and disrupted patient experience. Item reduction was also performed, excluding 12 items, which resulted in the final 55-item version of the measure. Medium (28 items) and short (10 items) versions of the measure were also produced. Each of the three versions exhibited excellent psychometric properties, including: internal consistency, convergent validity (correlated with the PSS-10), known-groups validity (those admitted for an emergency experienced more stress than those who knew about and planned for their hospital admission), predictive validity (predicting self-rated health in the two weeks after discharge), and test-retest reliability. The highest rated stressor within the full version of the scale was "Not sleeping well" (M = 5.82), followed by "Feeling helpless or not in control" (M = 5.67), and "Missing loved ones" (M = 5.63).

This large-scale validation study, like the development study, had some limitations regarding the sample recruited. First, the sample was lacking in participants aged over 80 years, a population which made up approximately 20% of NHS inpatients in 2022–23 (NHS Digital, 2023). Secondly, the retrospective nature of the current study raises concerns about the accuracy of the results, as it relies on the participant's ability to recall events from up to one year ago. Nevertheless, it is worth noting that issues relating to recall, if at play, are likely to

have led to evidence of weaker psychometric properties than those observed here. Lastly, the predictive validity reported may be questioned by some, as the survey design was cross-sectional; future studies should administer the measure to current inpatients. Despite these limitations, the HSQ is a valid and reliable tool that is available for widespread use.

7.2.4 Aim 4: Associations with in-hospital stress

Now that the HSQ has been shown to be a valid and reliable measure of in-hospital stress, it can be used to test for associations with post-hospital outcomes (i.e. testing if hospitalisation-induced allostatic overload is associated with post-hospital syndrome). Therefore, the final aim to be addressed in this thesis was to "explore if the hospital stress measured by our tool: (i) differs by patient demographic, and (ii) is associated with post-hospital outcomes". Chapter 5 contains these analyses, which were conducted on the dataset attained from the study presented in Chapter 4.

It was found that perceptions of in-hospital stress differed by age, sex, ethnicity, length of stay, planned/emergency admissions, and levels of social support and loneliness. Additionally, results showed that the HSQ significantly predicted poorer post-hospital outcomes; namely, feelings of vulnerability, time to return to usual activities, health-related quality of life, as well as outcomes seen in other hospital surveys, such as the PACT-M (Oikonomou et al., 2019) (falls, sore/wound healing, infections, and unplanned contact with GP/A&E). The predictive relationship between in-hospital stress and health-related quality of life was stronger when patients reported feelings of loneliness. Limitations with this study are the same as in the previous chapter; most notable of which is the cross-sectional nature of the design, limiting any causal relationships being confirmed. Future studies should address this using longitudinal designs, recruiting current inpatients. Nevertheless, the above findings are important in that they highlight demographic health inequalities and support Goldwater's

theory (2018) of hospitalisation-induced allostatic overload being the aetiology behind post-hospital syndrome (i.e., hospital-related stressors potentially lead to poorer post-hospital health outcomes).

7.2 Identifying and Measuring Hospital-Related Stressors

Inspired by the five hospital-related stressors identified by Goldwater and colleagues (2018), this thesis sought to develop a measure of the vast number of stressors that an inpatient may experience during their hospital stay. From 21 semi-structured interviews with recent inpatients, 67 stressors were identified. These stressors broadly fit into four overarching themes: psychological (e.g., loss of control and uncertainty), interpersonal (e.g., relationships with staff and other patients), environmental (e.g., surroundings and lack of resources), and physical (e.g., events related to the patient's treatment). Table 7.1 displays an example of how the stressors may be categorised into the aforementioned themes. However, these themes are by no means meant to be distinct, and many of the stressors may feasibly fit into one or more of the themes. For example, the stressor "lack of visitors" may be considered to fit best in the interpersonal theme, and yet may also be appropriate in the environmental theme, as it could be argued that this is because the patient is away from home, or that the hospital lacks the resources to accommodate visitations as regularly as the patient wishes.

Table 7.1. An example of how the stressors may be categorised into themes and sub-themes

THEMES / *Sub-themes*	**Stressors**
PSYCHOLOGICAL	
Loss of control	Loss of control Not involved in treatment plan Staff did not ask for consent Relying on others Access to own medication Having to follow hospital schedule

	Confined to bed or ward
Uncertainty	Not knowing Uncertain of diagnosis Unfamiliar with hospital rules Worrying post-hospital Fear health would deteriorate Waiting
Location	Homesick Unfamiliar environment Feeling unsafe Fear of hospital acquired infections Lack of privacy
Depersonalisation	Dehumanisation Wearing a hospital gown
Miscellaneous	Mental distress Boredom Loneliness Financial stress
INTERPERSONAL	
Friends and family	Missing loved ones Worrying about loved ones Lack of visitors Reminded of loved ones who passed away in hospital
Other patients	Disturbed by other patients Concern for other patients wellbeing Sharing a room with other patients
Staff interactions	
○ *Staff-patient*	Staff-patient communication Staff not caring or friendly Staff not listening Staff rude or unprofessional Staff not responsive to buzzer or call Staff not helpful Patient safety violations
○ *Staff-other*	Staff-staff communication Staff disagreed with each other Staff attending to other patients more than you Overhearing staff conversations
ENVIRONMENTAL	

Surroundings	Noise Lights Temperature Food unsuitable Poor/no Wi-Fi or phone signal Lack of cleanliness Hearing or seeing emergencies
Usual activities	Cannot do normal activities Not able to do religious activities Missing small comforts Life on hold
Lack of resources	Staff too busy Equipment lacking Overcrowding Hospital disorganised Poor discharge
PHYSICAL	
Somatic	Disturbed by symptoms Poor sleep Hydration
Treatment	
o *Effects of treatment*	Pain Mobility restriction Iatrogenesis
o *Treatment itself*	Disturbed by observations Bloods taken Drips or tubes in body
o *Logistics of treatment*	Cancellation or delay Change of plans

The most commonly reported stressor was “poor sleep”, mentioned by 19 of the 21 patients interviewed. This same stressor was ranked as the third most stressful item by the 200 participants in the initial validation, and was then ranked as the most stressful item by the 660 participants in the full validation study. Considering that sleep is a vital process for recovery, the quantity of patients reporting that their sleep was disturbed is particularly alarming. Not

only does the psychological stress from losing sleep lead to allostatic overload, negatively impacting the body (Balbo et al., 2010; Goldwater et al., 2018), but these effects are then compounded by the physiological deterioration that takes place as a result of insufficient sleep – sleep disturbances have been associated with: increases in markers of systemic inflammation (Irwin et al., 2016), dysfunctional metabolic and endocrine function (Spiegel et al., 1999), all-cause mortality (Liu et al., 2017), and leading chronic diseases such as obesity, mental health, stroke, and diabetes (Liu et al., 2013).

The relationship between sleep and health is particularly evident in the context of hospitalisation. In a recent study, patients reported significant decline in sleep quality and quantity while in hospital, and these problems persisted for more than three months post-discharge (Willinger et al., 2023). Sleep disruptions in hospital such as early morning phlebotomy (Caraballo et al., 2023) and overnight NEWS observations (Hope et al., 2018) remain high, despite sleep loss in hospital being associated with cardio-metabolic derangements and an increased risk of delirium (Stewart & Arora, 2018). Other hospital-related stressors that were rated highly by participants completing the HSQ, such as pain ("Having pain or discomfort from your treatment") and noise ("Staying in a noisy room"), can exacerbate the problem of sleep disruption, leading to the risk of deleterious effects on immune function, wound healing, and mental health (Kamdar et al., 2012; Stewart & Arora, 2021), and an increased risk for readmission (Kemp et al., 2020).

Recent systematic reviews have been conducted to assess the effectiveness of non-pharmacological sleep interventions for improving inpatient sleep in hospital (Beswick et al., 2023; Miller et al., 2019). Meta-analyses showed medium to large improvements in sleep quality for interventions utilising sleep aids (e.g., ear plugs and eye masks), relaxation (e.g., aromatherapy or guided imagery), music (described as "soothing" or "sleep-inducing"), and manual therapies (e.g., acupressure or reflexology). Using physical sleep aids had the largest

evidence base (22 comparisons), and demonstrated the largest improvements in sleep quality. Eye masks were the most effective sleep aid, either alone or in combination with ear plugs (which were not effective alone). These findings are consistent with those reported in Chapter 4 using the HSQ, where respondents indicated that both light ("Being in a room that was too bright or has no natural light") and noise ("Staying in a noisy room") were particularly stressful. Using physical sleep aids represents a cheap and accessible option that most inpatients will be able to provide and manage themselves, whereby doing so has the potential to both decrease the stress of hospitalisation and improve patient outcomes.

The second highest ranking stressor was "Feeling helpless or not in control". During hospitalisation, the patient is stripped of their independence and is no longer in control of their daily activities, such as when they eat, sleep, or even when they use the bathroom. This helplessness can be compounded by an acute awareness of their mortality, and the lack of control they have over it. Within the literature, there is an absence of recent research on this topic; however, two decades ago, Williams and Irurita (2004, 2005, 2006) proposed the theory of "*optimising personal control to facilitate emotional comfort*". They found that, within hospital, three conditions appeared to influence emotional comfort: the patient's level of security (i.e., how secure they felt), the patient's level of knowing (i.e., how much information they possessed), and the patient's level of personal value (i.e., how valued they felt as a person) (Williams et al., 2008). Each of these three concepts are captured by items in the HSQ, the most notable of which is a lack of knowledge, which is a theme that features heavily in previous stress measures. Patients are often unfamiliar with how they should behave while in hospital, what to expect, and, perhaps most stressful, they can be uncertain of their diagnosis or prognosis (see Koenig et al., 1995; Musavi et al., 2016). A systematic review of 42 studies showed that improving doctor-patient communications was a powerful tool for educating

patients (i.e., addressing the lack of knowledge), and was associated with improvements in both subjective and objective health outcomes (Riedl & Schüßler, 2017).

A third hospital-related stressor which ranked highly was “missing loved ones”; rated as the second highest item in the initial validation, and third highest in the full validation. Within the interviews described in Chapter 3, participants mentioned that their loved ones (typically spouses or parents) provided emotional support, and this was less readily available while in hospital. For example, one patient recalled a time in hospital where they had begun to excessively worry over a relatively minor event, leading to a panic attack, and they believed this would not have happened if their spouse had been there to reassure them. This perspective has been echoed in a recent qualitative study, which found that communication with loved ones while in hospital led to improvements in patient empowerment, experience of hospitalisation, and patient safety (Hriberšek et al., 2023). The authors identified several barriers to communicating with loved ones, most prevalent were visitation restrictions and lack of phone signal. They conclude with the statement that “Loved ones are not ‘visitors’ in a patient’s life” (Hriberšek et al., 2023, p. 10), and instead are an integral part of the patient’s journey.

Following these top three highest rated stressors, several of the other highly rated stressors belonged to the *Quality of Care* factor. The 11 items within this factor are primarily concerned with the hospital staff, for example “16. Feeling like the staff were not listening to you”, “7. The staff not being caring or friendly”, and “52. Feeling like you were not being treated like a person”. The ratings of such items are most likely inflated by the current state of the NHS; in recent years, underfunding and understaffing has led public satisfaction with the NHS to plummet (Morris et al., 2023). Indeed, this is likely to be compounded by the COVID-pandemic, which overlapped with the undertaking of this research. Items such as “6. The staff being too busy” and “8. Having to wait a lot” may have been especially prevalent during the pandemic due to the increased demands on staff, and as such, may have received inflated

scores. In addition to staff-related stressors, items belonging to the *Away from Home* factor may have also been influenced by the pandemic; concepts such as "19. Missing loved ones" and "18. Feeling lonely" were likely influenced by social distancing and restricted visiting hours, and the item "43. Worrying about loved ones" amplified by the knowledge that your significant other is isolated alone during lockdowns, or worse, suffering with COVID.

The *Disrupted Patient Experience* factor captures the insufficiencies of the healthcare system, for example "36. Medical procedure getting cancelled or delayed" may reflect the unprecedented waiting lists during the pandemic, and "38. Equipment or supplies lacking" may reflect the impact of the personal protective equipment (PPE) scandal. Unfortunately, although the factors and individual items discussed were likely influenced by the pandemic, these experiences are not specific to that period. Therefore, the items within the HSQ remain relevant, and future study (such as that proposed in Chapter 6) will enable us to make more informed suggestions of how the item ratings were influenced by the pandemic.

Poor sleep, loss of control (relating to a lack of knowledge), and missing loved ones were the three most salient stressors identified and measured by the studies comprising the development and validation of the HSQ. It is evident that these three stressors alone have significant impacts on the patient's experience of hospitalisation and health outcomes; however, these items represent only the tip of the iceberg. Considering that the HSQ originally identified 67 hospital-related stressors, there exists an acute need to further our understanding of their impact on the patient and their recovery.

7.3 The Impact of In-Hospital Stress on Post-Hospital Outcomes: Consideration of the Evidence

The works conducted within this thesis support Goldwater and colleague's theory (2018) that hospitalisation-induced allostatic overload is a plausible aetiology behind post-hospital syndrome. The systematic review and meta-analysis reported in Chapter 2 provide evidence that psychological stress experienced while in hospital (a proxy for hospitalisation-induced allostatic overload) is negatively associated with post-hospital outcomes (a proxy for post-hospital syndrome). Further, by utilising the HSQ in Chapter 5, we produced primary evidence demonstrating that in-hospital stress is associated with post-hospital outcomes.

In Chapter 5, this effect was observed to be stronger in certain groups of stressors than in others. The HSQ subscale titled "Health anxiety" was the strongest predictor of post-hospital outcomes, and was the only subscale to significantly predict all four outcome measures used in the study. Previously, health anxiety has been shown to be significantly associated with other health-related outcomes, such as increased healthcare use, including hospital admissions (Norbye et al., 2022). This may be due to the nature of health anxiety – these individuals are overly concerned for their health, and so may be more likely to report inflated scores on the largely health-related and subjective measures used in the studies within this thesis (e.g., El-Gabalawy et al., 2013; Thompson et al., 2018). However, it may also be the case that this subscale is indirectly measuring the severity of the respondent's condition (the more serious the treatment, the more likely the patient is to fear for their health), and that these individuals feel more vulnerable and take longer to recover than patients in better health receiving more minor treatments (e.g. Zhang et al., 2016). This explanation is also a plausible explanation for why the subscale "Negative effects of treatment" was the second highest predictor of post-hospital outcomes.

Considering the length of time that this effect is observed, previous studies have shown that the effects of post-hospital syndrome diminish over time, and are reduced by 95% by 45 days post-discharge (Dharmarajan et al., 2015). This thesis supports this finding in two ways:

first, the systematic review and meta-analysis reported in Chapter 2 recorded that in-hospital stress was more strongly associated with in-hospital outcomes than post-hospital outcomes; and second, in the study outlined in Chapter 5, the large majority of participants reported times to return to usual activities of "4–6 weeks" or less (i.e., up to 42 days). It is likely that, by 45 days, the body has recovered from the hospital-induced episode of allostatic overload and returned to its prior homeostatic state.

7.4 Strengths and Limitations

The works presented in this thesis have several strengths. Chiefly, the development and validation processes used to produce a robust measure of in-hospital psychological stress. The strengths of these processes are evidenced in the excellent psychometric properties of the HSQ, suggesting that it is a valid and reliable measure, suitable for use in future studies. This is, in part, accredited to the large samples recruited, which were nationally representative of NHS inpatients in terms of age, sex, and ethnicity. Within the studies presented in the preceding chapters, the HSQ has been completed over 900 times. However, the evidence for psychometric validity that these samples provide is limited, mainly by the fact that the participants recruited were not current hospital inpatients. Despite the measure being intended for use on current inpatients, due to the COVID-19 pandemic it was not possible to recruit from these groups, and so recent hospital inpatients were recruited instead. To address this evidence gap, future work has been planned – outside of the scope of this doctoral thesis – which will test the feasibility of administering the HSQ to current inpatients (see Chapter 6).

A second limitation relating to the study samples is their lack of representativeness. Although the samples were matched in age, sex, and ethnicity to the latest NHS inpatient data, the recruited sample is likely to be more educated than the general population, and featured

fewer individuals aged over 80 years. This is due to a large proportion of the sample being identified via an online recruitment platform (Prolific). However, this limitation will once again be largely rectified by the future study proposed in Chapter 6.

Another limitation of the collection of works in this thesis are the study designs. With the exception of the small sample of participants completing the HSQ twice to provide evidence of test-retest reliability, the rest of the research provides no longitudinal data. This questions the predictive validity of the HSQ, as cross-sectional research cannot provide strong evidence of predictive relationships. In a similar vein, the lack of longitudinal data is particularly relevant for the study outlined in Chapter 5, which utilises regression analyses to test whether in-hospital stress can predict post-hospital outcomes. The findings of this study are restricted by the inability of the results to test for causality in the relationship between the two variables; therefore, it provides limited support for Goldwater's (2018) theory of hospitalisation-induced allostatic overload being the aetiology behind post-hospital syndrome.

7.5 Implications for Research, Healthcare Policy, and Practice

The findings reported from this body of research have potential to be utilised in the influence of future research, healthcare policy, and practice. By consulting a diverse range of patients, a large number of hospital-related stressors were identified and appraised. This work therefore provides a suitable justification for future work to address the stressful experiences of patients in the hospital setting. Examples of such future works are discussed below.

7.5.1 Implications for research

In order to robustly test Goldwater's (2018) theory, and continue to understand the relationship between in-hospital stress and post-hospital outcomes, future research may benefit from building on the works reported in this thesis. Beginning with the pilot feasibility study proposed in Chapter 6, the next logical step would be to conduct a full-scale longitudinal study

which administers the HSQ to current inpatients, and follows up with the patients post-discharge to assess their post-hospital outcomes. Should this be a promising line of enquiry, it may then be viable to design a randomised controlled trial, whereby one group of participants is provided with an effective stress reducing intervention (see Chen et al., 2012) and the other is not. Both groups would be assessed for in-hospital stress (using the HSQ), and the researchers would test if the post-hospital outcomes of the control group are significantly poorer than those of the intervention group.

Such interventions should aim to address the identified stressors by implementing affordable changes, which account for the financial and resource limitations of the NHS and other health authorities. Interventions should also consider that some of the stressors identified are more ameliorable (e.g., sleep, noise, and light) than others (e.g., loss of control, pain/discomfort, and having to wait a lot). Using sleep aids (eye masks and ear plugs) is a pertinent example of an affordable intervention for ameliorable stressors, where hospitals can either provide the sleep aids at a small cost to the patient, or for planned admissions, encourage patients to bring their own.

7.5.2 Implications for healthcare policy

When designing new hospitals, the parties involved would benefit from considering the works of Ulrich and colleagues, who have shown associations within the hospital setting between health outcomes and: window views of natural settings (Ulrich, 1984), exposure to nature-based art (Ulrich et al., 1993), and exposure to gardens and plants (Ulrich, 2002). Incorporating more nature into the hospital will cost more in the short term, but is likely to improve the patient experience, and potentially improve health outcomes, saving money and resources in the long-term. The effectiveness of these interventions may be assessed using the

HSQ in a multi-site study, comparing perceived stress levels between patient staying in hospitals with varying degrees of exposure to nature.

7.5.3 Implications for practice

The implications of this thesis regarding healthcare practice are numerous and widely varied. The themes and sub-themes presented in Table 7.1 might be used to guide the content of future trainings, whether that be in training sessions for qualified staff, or incorporated into university lectures and college courses for future staff. Of particular importance is the *staff-interactions* sub-theme. The stressors listed under this domain were some of the most highly rated by patients completing the HSQ, indicating the significant impact that healthcare staff have on the patient's perceptions of their hospital stay. An example of a feasible implementation would be to include reminders on the ward (such as a staff room poster), stating that it is likely that conversations in this area are within earshot of patients on the ward. While conversations discussing medical matters are routine for staff, if overheard, they may be distressing to the patient that the conversation pertains to.

In staff appraisals, healthcare practice may benefit from placing an increased emphasis on bedside manner, such as the tone and content of the staff-patient interactions. Staff members wishing to improve in this area might be referred to a training course, covering the importance of patient-friendly language, listening, and asking for consent. However, it is necessary to acknowledge that these interactions are potentially more of a resource issue than a staff issue – with chronic underfunding and understaffing, healthcare staff are too busy to perform their jobs to the best of their ability. When staff are rushed to complete all of their work, bedside manner may be the first task to be neglected, prioritising the provision of life-saving treatment. Therefore, in order to improve the patient experience, it is critical that the NHS receives more funding to increase the number of staff members on each shift.

7.6 General Conclusions

This thesis aimed to understand and measure the impact of in-hospital stress on post-hospital outcomes. To measure this, a patient reported outcome measure – the HSQ – was developed (Chapter 3) and validated (Chapter 4), informed by patients and previous literature. The HSQ is suitable for use in future research, and is available in long (55 items), medium (28 items), and short (10 items) forms, all boasting excellent psychometric properties. To understand the overall aim of the thesis, a systematic review and meta-analysis was conducted (Chapter 2), which comprised 10 studies and found a small to medium sized effect between the two variables. This association was significantly stronger for (i) in-hospital versus post-hospital outcomes, and (ii) subjective versus objective outcome measures. These findings were then supplemented by a study which employed the HSQ to test if in-hospital stress can predict post-hospital outcomes (Chapter 5). A significant effect was found, which was once again of a small to medium size, and stronger for subjective than objective outcomes. Stressors relating to health anxiety were the strongest predictors, followed by stressors relating to negative effects of treatment and quality of care. The findings of this doctoral thesis support Goldwater's (2018) theory that hospitalisation-induced allostatic overload is a plausible aetiology behind post-hospital syndrome. In order to bolster this argument, future research ought to test the feasibility of using the HSQ on current inpatients (Chapter 6), conduct a full-scale longitudinal study, and eventually design an effective randomised controlled trial.

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Appendices

Appendix 2.1 – Search Terms

Search terms, last conducted 2nd February 2023:

Table S2.1.

Search terms using MeSH in the MEDLINE database (OvidSP)

Search	PICO	Query	Results
#1	Population	(Inpatients/) OR (Hospitalization/)	156,626
#2	Exposure	(Stress, Psychological/)	132,612
#3	Outcome (MeSH)	(exp Hospitalization/) OR (exp Outcome Assessment, Health Care/) OR (exp Postoperative Complications/) OR (exp Iatrogenic Disease/) OR (exp Vital Statistics/) OR (exp Pain/) OR (exp Infections/) OR (Patient Satisfaction/) OR (Quality of Life/) OR (Quality-Adjusted Life Years/)	5,980,766
#4	Outcome (keyword)	(post-hospital syndrome or posthospital syndrome).mp.	38
#5		#3 OR #4	5,980,773
#6		#1 AND #2 AND #5	1066
#7		Limit #4 to (Abstracts, English Language, Human, "All Adults (19 plus years)")	524

Table S2.2.

Search terms using Emtree in the EMBASE database (OvidSP)

Search	PICO	Query	Results
#1	Population	(Hospital Patient/) OR (Hospitalization/)	696,732
#2	Exposure	(Stress/) OR (Acute Stress/) OR (Behavioural Stress/) OR (exp Chronic Stress/) OR (Emotional Stress/) OR (Interpersonal Stress/) OR (Mental Stress/) OR (Social Stress/)	306,465

#3	Outcome (Emtree)	(Hospital Readmission/) OR (Length of Stay/) OR (exp Treatment Outcome/) OR (exp Postoperative Complication/) OR (exp Iatrogenic Disease/) OR (exp Mortality/) OR (Morbidity/) OR (exp Pain/) OR (exp Infection/) OR (Patient Satisfaction/) OR (exp Quality of Life/)	9,743,282
#4	Outcome (keyword)	(post-hospital syndrome or posthospital syndrome).mp.	55
#5		#3 OR #4	9,743,292
#6		#1 AND #2 AND #5	2649
#7		Limit #4 to (Abstracts, English Language, Human, (Adults or Aged), (Article or Article in press))	832

Table S2.3.

Search terms using the PsycINFO Thesaurus in PsycINFO (OvidSP)

Search	**PICO**	**Query**	**Results**
#1	Population	(exp Patients/) OR (Hospitalization/)	111,960
#2	Exposure	(Stress/) OR (Chronic Stress/) OR (Environmental Stress/) OR (Psychological Stress/) OR (Social Stress/)	88,618
#3	Outcome (Thesaurus)	(Hospital Admission/) OR (exp Treatment Outcomes/) OR (Health Outcomes/) OR (Postsurgical Complications/) OR (exp Physical Health Assessment/) OR (Death and Dying/) OR (Morbidity/) OR (exp Pain/) OR (exp Infectious Disorders/) OR (exp Health Status/) OR (Treatment Effectiveness Evaluation/)	402,478
#4	Outcome (keyword)	(post-hospital syndrome or posthospital syndrome).mp.	5
#5		#3 OR #4	402,481
#4		#1 AND #2 AND #5	219
#5		Limit #4 to (Abstracts, English Language, Human, Adulthood, Journal)	130

Table S2.4.

Search terms using CINAHL Subject Terms in CINAHL (EBSCO)

Search	PICO	Query	Results
#1	Population	Used the *inpatient* search filter	N/A
#2	Exposure	(MH "Stress") OR (MH "Stress, Psychological")	69,251
#3	Outcome (Subject Terms)	(MH "Institutionalization+") OR (MH "Outcomes (Health Care)+") OR (MH "Postoperative Complications+") OR (MH "Iatrogenic Disease") OR (MH "Vital Statistics+") OR (MH "Pain+") OR (MH "Infection+") OR (MH "Patient Satisfaction") OR (MH "Quality of Life") OR (MH "Quality-Adjusted Life Years")	1,488,253
#4	Outcome (keyword)	Post hospital syndrome	32
#5		#3 OR #4	1,488,269
#6		#1 AND #2 AND #5	471
#7		Limit #4 to (Abstract Available, English Language, Human, All Adult, Peer Reviewed, Research Article)	155

Table S2.5.

Search terms used for navigating Web of Science

Search	PICO	Query	Results
#1	Population	TS = (*hospital* AND inpatient*)	75,965
#2	Exposure	TS = (*stressor* OR "stress" NOT ("stress incontinence" OR "stress urinary" OR "oxidative stress" OR "*traumatic stress"))	1,731,293
#3	Outcome	TS = (readmission* OR readmit* OR "length of stay" OR "patient outcome*" OR "treatment outcome*" OR "surgery outcome*" OR complication* OR "iatrogen*" OR mortality OR morbid* OR pain* OR infect* OR "patient satisf*" OR "quality of life" OR "quality-adjusted life years" OR "post-hospital syndrome" OR "posthospital syndrome")	5,531,768
#4		#1 AND #2 AND #3	677
#5		Limit #4 to (Languages: English; Document Types: Articles)	586

TOTAL (before removing duplicates): 2227

TOTAL (after removing duplicates): 2035

Appendix 2.2 – EPHPP Assessments

Table S2.6.

EPHPP Assessments for each of the included studies

Author, year	**A**	**B**	**C**	**D**	**E**	**F**	**Overall**
Ahmadi, 1985	3	3	2	1	1	2	3
Baharlooei et al., 2017	3	3	1	2	1	2	3
Chalageri et al., 2021	3	2	2	3	1	1	3
Edmondson et al., 2014	3	2	2	3	3	1	3
Karademas et al., 2009	2	3	2	1	3	2	3
Karaer et al., 2021	3	3	2	3	2	3	3
Pati et al., 2016	2	1	2	2	1	1	1
Tully et al., 2008	2	3	2	2	1	1	2
Tully et al., 2011	2	3	2	2	1	1	2
Volicer, 1978	2	3	1	2	2	2	2

1 = strong
2 = moderate
3 = weak

Appendix 2.3 – R code

```
#### Start-up# ###
# Load packages
library(dplyr)
library(metafor)
library(robumeta)
library(weightr)

# Set WD (change this to wherever your data is stored)
setwd("~/OneDrive - University of Leeds/YQSR work/Dan Ford review/Code and data")

# Import data
newmeta <- read.csv('newmeta.csv')

#### Meta ####
# Convert rs to zs for meta
dat <- escalc(measure = "ZCOR", ri=r, ni=n, data = newmeta, slab = paste(authors, year, sep = ", "))

# Random effects meta-analysis results
res <- rma(yi, vi, data = dat)

# 95% CI for heterogeneity stats
confint(res)

# Back-transform meta-z to r, then produce overall pooled effect
predict(res, digits = 3, transf = transf.ztor)

# Forest plot of results
forest(res, xlim = c(-.7,1), ilab = dat$outcome, ilab.xpos = -.35, atransf = transf.ztor, at=transf.rtoz(c(-
.2,0,.2,.4,.6), digits=c(2,1)))
text(-.63, 17, cex=1.5, "Author, year")
text(-.35, 17, cex=1.5, "Outcome")
text(.9, 17, cex=1.5, "Correlation [95% CI]")
text(-.49, -.9, bquote(paste(":  (Q = ", .(formatC(res$QE, digits=2, format="f")), ", df = ", .(res$k -
res$p), ", p = ", .(formatC(res$QEp, digits=2, format="f")), "; ", I^2, " = ", .(formatC(res$I2, digits=1,
format="f")), "%)")))

#### Robustness ####
# Assess influence of individual studies
influence(res)

# Assess pooled effects in leave one out analyses
leave1out(res)

# Assess small study bias visually (asymmetry)
funnel(res)

# Assess asymmetry statistically in three ways (3rd method good for outliers)
regtest(res)
ranktest(res)
weightfunct(dat$yi, dat$vi, table = TRUE)

# Assess robustness of results to omitted small studies, then visualise potential asymmetry
trimfill(res)
funnel(taf)

# Reproduce results but with robust variance estimation (RVE) meta-analysis
```

```
robu(formula = yi ~ 1, data = dat, studynum = sample, var.eff.size = vi, modelweights = "HIER", small
= TRUE)


### Sub-group analyses ###

# Study quality (0 = poor; 1 = strong/moderate)
rma(yi, vi, subset = quality == 0, data = dat)
rma(yi, vi, subset = quality == 1, data = dat)

# Patient outcome measure (0 = objective; 1 = subjective (self-reported))
rma(yi, vi, subset = self == 0, data = dat)
rma(yi, vi, subset = self == 1, data = dat)

# Patient outcome measure (0 = post-hospital; 1 = in-hospital)
rma(yi, vi, subset = hospital == 0, data = dat)
rma(yi, vi, subset = hospital == 1, data = dat)



#### Meta-regression analyses ####

# Individual predictor effects
rma(yi, vi, mods = ~ age, data = dat) # Age - continuous
rma(yi, vi, mods = ~ male, data = dat) # Gender - male versus female (assuming 1 = male)
rma(yi, vi, mods = ~ quality, data = dat) # Quality - Good versus bad (assuming 1 = good)
rma(yi, vi, mods = ~ self, data = dat) # Measure type - Objective versus subjective (assuming 1 =
objective)
rma(yi, vi, mods = ~ hospital, data = dat) # Outcome type - In-hospital versus out-hospital (assuming 1
= In-hospital)

# Effects of all variables, adjusting for the effects of all the others
rma(yi, vi, mods = ~ age + male + quality + self + hospital, data = dat)
```

Appendix 3.1 – Interview Schedule

Introduction

- Unscripted greeting ("Hello", "My name is…", "How are you?", etc.).
- Read the following script:

"I'll be the person interviewing you. I'd like to start by thanking you for taking part and telling you a bit about the reason for this interview.

Without going into too much detail, being in hospital can sometimes slow down a patient's recovery because of the stress they feel. I'd like to find out exactly what it is about being in hospital that can make a person feel stressed. That means there are no right or wrong answers. I just want to hear how you felt when you were in hospital, and if anything made you feel stressed.

I'm now just going to repeat a few things that you should have seen on the forms you read earlier. The interview will be voice recorded – is that okay? Taking part is your choice, so you are free to leave at any point, and nothing bad will happen. You can also skip any questions that you don't want to answer – just let me know and we can move onto the next question. You will also be anonymous, and so whatever you say in this interview, no one will know it was you. Do you have any questions?

If you're happy with what I just said, we can start now. It won't take any longer than an hour. Can I turn on the voice recorder now?"

Background Information

Q1. What is your age?

A. 18 – 24
B. 25 – 34
C. 35 – 44
D. 45 – 64
E. 65 +
F. Prefer not to say

Q2. What is your sex?

A. Male
B. Female
C. Prefer not to say

Q3. What is your highest level of education?

A. No qualifications
B. GCSE/O Level (or vocational level 2 and equivalents)
C. A Level (or vocational level 3 and equivalents)
D. Undergraduate degree
E. Postgraduate degree
F. Prefer not to say

Q4. What is your ethnicity?

A. White
B. Mixed or Multiple ethnic groups
C. Asian or Asian British
D. Black, African, Caribbean, or Black British
E. Other ethnic groups
F. Prefer not to say

Personal stress

Question:

5. "What would normally make you feel stressed? I'm not talking about the hospital yet, just your day-to-day life."

Prompts:

"What kind of things do you worry about?"

"Can you tell me about a time in the past where you've felt stressed?"

Hospital context (quick questions)

Questions:

6. "What was the reason for your most recent hospital stay?" AND WHEN?
7. "Did you have surgery?"
8. "How long were you in hospital?"
9. "Was it your first time in hospital?" [if "yes", skip to Q12]
10. "How many times in your life have you been a patient in hospital?"
11. "When was the last time you were a patient in hospital *before* the time we mentioned earlier?"

Hospital experience

Questions:

12. "Could you quickly walk me through a typical day for you while you were in hospital?"
13. "Did you ever have any visitors?"

Prompts:

"Let's start with the morning, when you would wake up."

"What was your ward like? Were there lots of other patients?"

"Who were your visitors? How often would they visit?"

Note for interviewer:

Note down any stressors mentioned; elaborate on each of them once P has finished walking through their typical day.

Potential hospital improvements

Questions:

14. "What do you think could have been done better by the hospital ward you were in?"
15. "What do you think is already being done to improve the hospital ward?"

Prompt:

"You mentioned you didn't like [stressor]. How do you think that could be improved?"

"Did you notice anything that you thought was being done well?"

Known stressors

Main question:

16. "I have a short list of things that other people have found stressful while they were in hospital: I'm going to read them one at a time and we can talk about each one. The first one is… [Question]"

List of known stressors (from previous research):

Note: only list stressors that have not already been adequately discussed.

Stressor	Question	Prompt(s)
Sleep disruption (Stewart & Arora, 2018)	"Did you sleep well?"	"Did you get woken up a lot?" "Was the bed comfortable?" "Did you have any nightmares?"
Hydration (Oates & Price, 2017)	"Did you drink enough?"	"Did you ever feel dehydrated?"

Malnutrition (Franklin et al., 2011)	"Did you have a healthy diet?"	"Were you tube-fed?" "What kind of food did you eat?"
Mobility restrictions (Smart et al., 2018)	"Did you feel like you could move around enough?"	"Did you get to walk around much?"
Physical pain (Gregory & McGowan, 2016)	"Were you in any pain from anything other than [reason for hospitalisation]?"	"Did you need to have many injections?"
Mental distress (Aass et al., 1997)	"How was your mood?"	"Did you feel down a lot?" "Did you often feel on-edge?
Loss of control (Taylor, 1979)	"Did you feel like you were no longer in control?"	"Did you feel helpless?"

Stressor saliency

Question:

17. "Of all the things that made you feel stressed in hospital, what would you say are the worst three? Listing the worst one first."

Prompt:

List all stressors the participant admitted to experiencing and ask them to pick the worst three.

Final

"That is all of the questions done – is there anything else important that you would like to say before we end the interview? Anything that you think we may have missed?"

Thank participant again for their time and terminate the interview.

Appendix 3.2 – Example quotes of stressors

Table S3.1.
Hospital-related stressors identified: frequencies and examples

Hospital-related stressor	*n*	Example quote
Poor sleep	19	'No, because it was just very busy still. And like I could hear stuff going on. It was very bright and they just had to keep coming to like switch drips or like change stuff so like no it was very disturbed sleep.' [P#19]
Loss of control	15	'I thought yeah, you go in, you want to feel comfortable, you're out of your own surroundings, everything is out of your control.' [P#06]
Pain	15	'Muscle tension, aches and pains. I have that anyway, but it was worse than ever.' [P#01]
Noise	15	'Well, people yelling, uh, people shouting, bed squeaking, wheels on the beds moving around, other instruments getting moved around, doctors talking… The lighting had a flickering sound where I was.' [P#15]
Staff-patient communication	14	'Yeah, yeah, it was uh, they were male nurses. They were OK. They were doing their duty but not very verbal. Uh, they were just handing over the medicine, and were checking the body temperature and the blood and that's it.' [P#18]
Staff too busy	14	'If you're coming out of the shower it is like they won't have time to talk to you, just like... put your clothes on, let's sort you out or something. I need more time and you just want them to talk to you, but they just don't have time for anything.' [P#01]
Staff not caring or friendly	13	'It was like they're not listening and being sharp, and that kind of thing was going on.' [P#21]
Waiting	13	'So I was trying to deal with that, and then there's this eternal wait as a patient, you don't know when the doctors are going to come.' [P#08]
Food unsuitable	12	'So come lunchtime, very often the choice of food that I'd make wasn't there. There was no choice of a light or a convalescent diet. Or food that was easy to eat, especially being nauseated, there was generally things with chips or potatoes, which I don't eat too much of, and I certainly don't eat sliced white bread. So it was very difficult to get a healthy diet. And of course I wasn't having a visitor that could bring me anything in, and there wasn't a shop trolley or anything.' [P#08]
Mobility restriction	12	'No, no because uh, I was totally under, my pulse was under glucose and other syringes were attached to me, so I was totally, for 24 hours, I was bedridden.' [P#18]

Not knowing	9	‘But the waiting time, just the level of like just being left around waiting, not knowing what's going to happen and feeling like, you know, this is just getting worse and worse. Can we do something?’ [P#10]
Boredom	9	‘And there's no form of entertainment for patients that would help them get relief of their stress, maybe something such as a television that could bring a bit of excitement to the patients.’ [P#14]
Mental distress	9	‘I felt scared, anxious. I thought am I actually ever gonna leave this place?’ [P#15]
Adverse effects	8	‘You know, the medication is kind of, you know, it cures certain things, but it creates other problems and actually managing that is probably part of the challenge for me.’ [P#10]
Fear health would deteriorate	8	‘But I mean, yeah, that was the most stressful thing really, was just being worried for myself and my health, you know? Like, I suppose I didn't think I was gonna die, I felt reasonably confident I was gonna pull through this. But it's sort of the nagging thought in the back of my head, you know, given the death rate of what was going on. The obvious worry is, you know, how badly am I ill, you know?’ [P#16]
Staff not listening	7	‘I just feel like they should listen to the patient, and then they should try to understand what the patient is telling them instead of suggesting.’ [P#11]
Disturbed by other patients	7	‘Everything that she wanted. Demands, and she was screaming and, you know, making a lot of noise.’ [P#20]
Loneliness	7	‘And then if I’m in the hospital all alone, without any support from maybe friends and family, that could also make it stress for me. Because at some point, maybe here I will have to take care of myself all alone.’ [P#11]
Missing loved ones	7	‘I would say definitely the kind of, yeah, the experience of being by myself and not being able to speak to people, it was a relief when, you know, my mum phoned, or I was able to see [wife] when she came in for that minute.’ [P#10]
Staff made a mistake	6	‘When the consultant came to see me, and I'd been trying to tell everybody that my arm was blue and painful. And several times he tried to tell me that it was just a muscle ache. And I said, “Why would my arm be purple for a muscle ache?” and finally he sent me for a scan, and then I was waiting in the ultrasound department and a doctor called me and he said, “Oh, you're the person that's here for the reassurance scan. Which arm is it?” I said “It's the one that's purple”, and he said, “Oh God”. He did a scan and I had a clot from below my elbow up to my neck, in the vein.’ [P#08]
Staff rude or unprofessional	6	‘I said, “Excuse me…” and I said politely, I don't want to be upsetting anyone, “Excuse me, this isn’t hot, can I have a hot cup of tea, please?” She said, “It is hot. I just warmed the kettle up now.” I said, “It's cold”, she said, “Oh, you want to touch it?”’ [P#21]
Staff not responsive to buzzer or call	6	‘And I called out to the staff to you know, “Can you come and, you know, aspirate me and get rid of this bile”, nobody came. And so, what I did was use my mobile phone to phone the hospital switchboard, get put through to the ward, to tell whoever answered the phone, the person in bed, blah, blah, requires your assistance as soon as possible, because he

		is basically drowning in his own bile, and that was the only time that anybody came to help me. Because they ignored the buzzer. They ignored me calling out.' [P#17]
Disturbed by observations	6	'I think being woken up in the middle of the night – now, I understand they have to do their observations, but – when you're sleeping and being woken up every couple of hours, that can be quite stressful too.' [P#05]
Relying on others	6	'I think that's something I worry about, because I have been admitted when I haven't been able to get out of bed, when I've had to rely on somebody getting me out of bed, and you suddenly realise, gosh, if I can't get out and walk, and get myself a drink off my side, and things like that. Then how do I do that without pressing a buzzer and getting an irate nurse?' [P#06]
Confined to bed or ward	6	'The rest of the time I was basically, uhm, you know, just hold up in my bed or I had an arm chair next to my bed I could sit in. So I was just sat around.' [P#16]
Feeling unsafe	5	'You are laid in bed, vulnerable surrounded by these people around you. Yeah, and it's really, actually not acceptable for a woman. You shouldn't be in here in your strange clothing in front of strange man.' [P#21]
Concern for other patients wellbeing	5	'So, the doctor and the nurse came in the middle of the night and they're talking to her. The lady is not even on the planet, she's not connecting – she's having a schizophrenic episode. I said "Please ring her family", "Oh no, we haven't got her signed consent", I said "She doesn't know what planet she's on! Ring her family. Get someone to speak to her, or ask them whatever…" you know, "We can't do that". I said, "What about our protection? [Other patient's name] here, who's had nearly having a heart attack, I've had an episode, what about our welfare? And hers?"' [P#21]
Hospital disorganised	5	'At discharge, they lost my narcotics and said that I hadn't brought them in. And so I don't know where they went. It was always very difficult to get them regularly. My drugs and vitamins for my heart and my immuno-suppressed condition, it was very hard to get those on time and I did have some problems because I wasn't getting the drugs regularly.' [P#08]
Sharing a room with other patients	5	'The washroom and bathrooms, there are really only one or two so it was really a big, uh, you can say obstacle, because I have other Gastro disease also so it takes me a lot of time for, uh, urinary and motion purpose. But due to other patients that also need to use the same washrooms, so I was really in discomfort in that way.' [P#18]
Staff-staff communication	5	'And then when consultants come to talk to you, if it's not your consultant, they tend to keep asking you to go over everything, and that's stressful 'cause you think "Well, I've told somebody all of this, you know, the day before" or they'll sort of say "Oh well, can you just talk me through it? Can you just say to me about it? So how far have we come?" and you're like, can you not read notes?' [P#06]
Access to own medication	5	'I have some medication like my order narcotic pain relief which is given 12-hourly and it's helpful. But if I'm a patient, I just do what I need to do here in hospital, because all of my tablets were taken away, and I said "Because I'm alert, I

		believe I can have my pills, to manage my pills myself and inform you what I've taken", and they said, no, that wasn't possible, so they took everything away.' [P#08]
Hearing or seeing emergencies	5	'I remember when I was in the high dependency unit, I actually was begging them to get me out of there because it was so stressful to hear everything going on, like it was horrible and I was absolutely crying my eyes out' [P#09]
Homesick	5	'At some point I was already getting tired of staying in the hospital. I was getting there because I just needed to go home, and maybe I was just tired of being indoors, staying in one room for days. And I was feeling like my life was at a standstill because I didn't go to work. I didn't go out to do things I would have done if I were at home.' [P#13]
Hydration	5	'I spent a lot of time dehydrated at first when I was very ill. It was very difficult to get anybody to bring in a fresh jug of water.' [P#08]
Overcrowding	5	'I was dropped off by my husband and I was given directions to I don't know what you would call it, but it was like a ward, but it wasn't. It was just like tiny little cubicles, where I was just given blood pressure, pulse, just talked through what the operation was about. But I felt it was almost like a cattle market. There was so many people there for operation. And it just felt so uncomfortable.' [P#05]
Overhearing staff conversations	5	'And then I remember later on in the night I heard, it was her and one of the other night nurses, two of them seated, then one of them was like "when I had COVID I was lying at home out in the garden in the sun and talking to all… Oh, and I had a brilliant time off blah-blah." And I was just thinking, you know, just literally you're in a hospital currently in a respiratory ward looking at people, every single person in that ward was COVID positive.' [P#02]
Cancellation or delay	5	'They only mentioned to me about surgery when it was going to happen, but obviously it was delayed.' [P#15]
Not involved in treatment plan	4	'Just because I guess like they decided the treatment obviously, because they're the experts, but I feel like it was decided without like even telling me what was going on. So like it was all their decision and it just like they just came and it just happened. So I feel like treatment was just given to me and I didn't have really any say.' [P#19]
Equipment lacking	4	'And there wasn't a proper shower chair in there, there was just a kind of like a plastic chair that visitors sit on. So it wasn't really stable, and that was in a wet room so it would get incredibly wet all the way up to the toilet pedestal. So walking across the floor was dangerous.' [P#08]
Bloods taken	4	'And then she tried to get the arterial blood out of me, and she went in to one wrist, didn't get it, went into the other wrist, didn't get it. Went back to the other one, got it, well got a bit and then she says "Well, I'll have to try again because it was a mixed sample" and then she went into my other wrist and have been for the fourth time, at this stage I was crying with pain. I was very distressed, and she gave up.' [P#02]
Disturbed by symptoms	4	'Like a typical day, well, I felt so sick, I felt so ill that I don't really know it's a little bit of a blur.' [P#19]
No visitor policy	4	'I'm happy in my own company, so I couldn't have cared less if there wasn't any visitors allowed, but actually that's not true because I think I would have been a lot less stressed if I had been allowed visitors. Because, for example, see that

		breakdown I had because I thought I had an infection, that was because I was on my own, allowing those thoughts to fester and fester. Whereas if I'd had my family visiting, I'd have been able to talk about that with them and they'd have said, "Oh don't be silly, you're fine", you know, or reassured me.' [P#09]
Temperature	4	'I think the temperature for me was really warm. They're thinking about everybody as a whole. But yeah, it's something I mentioned, but just they said that there's nothing they can do about it because it's there for everybody.' [P#01]
Unfamiliar environment	4	'I wasn't even told where I could go and have a shower. I had to find my own way. And these are things that I think are very important. You need to be able to find your way about the place, and as I said to you, I always find it difficult when I'm in a strange place. And obviously it was a new hospital. It was first time I'd been there.' [P#05]
Lack of cleanliness	3	'And one of them left a bloodied dressing on my bedside table. Well, that dressing stayed there for I think it was about seven or eight hours. OK, and it was an obvious bloody dressing and I'd been visited by various people trying to take blood out of me. Nobody cleared it up. Eventually, a nurse came along to do something, I can't remember what, and her hand touched the bloody dressing, which she flicked onto the floor.' [P#17]
Worrying about loved ones	3	'I'd have a video call or phone call with my husband, trying not to upsetting him. He's 76, he's older than me and has his own health care problems, and so I was trying to keep him as informed as I could… So my mood, I tried to keep myself cheerful. But I was anxious about my husband.' [P#08]
Having to follow hospital schedule	3	'And like many people have routine, I don't want a cup of tea straight after my lunch, but that's when they give you a cup of tea, and you don't feel you can press your buzzer to ask them "Can I have a cup of tea now?"' [P#06]
Lights	3	'They've always got electric lights on. Now, I don't have a problem with electric lights, I really don't, but when it's nice weather and what have you and they keep switching, you know, the lights are on full, you can't go anywhere where it's just natural light.' [P#06]
Drips or tubes in body	3	'The main thing was the drip that was being put in my body. I could take about two to three drips a day, and that was really disturbing for me.' [P#14]
Reminded of loved ones who passed away in hospital	3	'So then they transferred me over to [hospital name], which wasn't very fun because that's where my dad passed away.' [P#15]
Staff did not ask for consent	3	'I suppose, one big thing I say is not being told by the staff why you're getting something done or explain to you what's actually happening. I find that the nursing staff tend to do that. Even in the emergency department, I remember having a swab shoved up my nose, like I already had my positive test. But I remember them coming at me with it, this girl, she was so rough. So, so rough, and she never told me she was going to do that or, you know, not even saying "Can I?" she didn't ask permission to even do that, just came at me with this thing and shoved it up my nose.' [P#02]

Poor discharge	2	‘And the other factor is your discharge. That's really stressful for a lot of people. I know it is for me because usually they're giving you new meds, and you get like taken from your bed space, because they need the bed space ASAP, to go and sit in a room and then you get told “Can you just go and sit outside the ward?” and you can be… the last time I was in it took them four hours’ [P#06]
Cannot do normal activities	2	‘Like my daily job. I'm actually a fashion designer so I love to do my work, but I wasn't able to do that while in the hospital.’ [P#11]
Fear of hospital acquired infections	2	‘It was a sort of medical geriatric ward, there were people with infections and all sorts of things outside of the room for me. Uhm, which used to freak me out a little bit because they'd come in without gowns on or gloves, and so that worried me that I would get cross-contaminated, and I did get cross-contamination.’ [P#08]
Lack of privacy	2	‘And this nurse came and I said “I need to go to the loo”, she said “We’ll bring you a bed pan”. I said “No. I need to go to the loo because of…” – this is where part of the nightmare starts – it’s a mixed ward, men on both sides.’ [P#21]
Dehumanisation	2	‘I think, a lot of the time when you're sent to hospital, you're just, you're just a figure. That's what you are, or you’re a number. You know, I hate this aspect, I was bed number one, and … it's offensive to just label someone as, you know, bed number one. Number one, you know, that’s not what you are. You’re a person. I think in health care as well, a lot of the times, you know, people are just looking at paperwork and looking at, you know, the numbers, and not actually treating the person.’ [P#02]
Financial stress	2	‘We had a lot of problems in the family as well, financially. So if he [husband] took time off work, he’d lose his job.’ [P#01]
Life on hold	2	‘On the day that I had my surgery, I became a great grandmother, so there was some, you know, it was a really interesting kind of time for my family as well, because obviously, um, that was quite hard that I was missing out on that’ [P#03]
Poor/no Wi-Fi or phone signal	2	‘I think for a lot of people the most important thing is connection with the outside world, and I found that wherever I stayed, I had my operation in a hospital near Nottingham, uhm, I could not communicate with my family because there's no signal, in every hospital I've been in I haven't been able to use my phone.’ [P#03]
Uncertain of diagnosis	2	‘And having to do describe what's going on with you to a doctor, it's not always easy 'cause you're not sure how to describe it sometimes.’ [P#07]
Worrying post-hospital	2	‘It was, then, I was thinking about: how would I get home? What’s going to happen? Would I get any help and support there?’ [P#01]
Missing small comforts	1	‘There’s just basics, just tea and stuff like that. That's all you need.’ [P#21]

Not able to do religious activities	1	‘So yeah, I follow Islam, strong Muslim. I like to get my five prayers done but I obviously couldn’t really do that due to the pain in my leg at the time.’ [P#15]
Staff attending to other patients more than you	1	‘I think the doctor should like really work more on attending to the black people. They should attend more like equally to the white people, 'cause they mostly attend to the white people than the black people. So, I didn't really like it.’ [P#12]
Unfamiliar with hospital rules	1	‘I think, uh, any personal assistant, or, uh, I think was missing. Who can guides where we have to go from? Who you have to consult and what would the procedure if you are under NHS or you are doing private?’ [P#18]
Wearing a hospital gown	1	‘You are laid in bed, vulnerable surrounded by these people around you. Yeah, and it's really, actually not acceptable for a woman. You shouldn't be in here in your strange clothing in front of strange men.’ [P#21]

Appendix 3.3 – Sources informing HSQ items

Table S3.2
Sources informing each of the 67 questionnaire items of the HSQ

Questionnaire item	Source(s)
1. Not sleeping well	• QCA: 'Poor sleep' • HSRS: '6. Being awakened in the night by the nurse' • HSI: '1.3. Sleep disturbed by frequent tests, blood draws, medications' • HRSQ-EP: '17. Disruption of routine and normal habits and behaviors such as sleep and resting, activity, and diet'
2. Feeling helpless or not in control	• QCA: 'Loss of control' • HSI: '4.3 Sense of loss of control over life' • HRSQ-EP: '14. Hospital rules about issues such as bed time, time to eat, visiting hours, and time to take medication'
3. Having pain or discomfort from your treatment	• QCA: 'Pain' • HSRS: '19. Thinking you might have pain because of surgery or test procedures'; '19. Thinking you might have pain because of surgery or test procedures'; '28. Having medications cause you discomfort'; '40. Not getting relief from pain medications'; '42. Not getting pain medication when you need it' • HRSQ-EP: '25. Being in pain due to the illness'
4. Staying in a noisy room	• QCA: 'Noise' • HSI: '7.2. Noise level on unit' • HRSQ-EP: '16. Noise and traffic'
5. The staff not communicating well with you	• QCA: 'Staff-patient communication' • HSRS: '29. Having nurses or doctors talk too fast or use words you can't understand'; '37. Not having your questions answered by the staff' • HSI: '3.1.5. Doctors not speaking loudly or slowly enough'; '3.2.4. Nurses not speaking loudly or slowly enough' • HRSQ-EP: '9. Use of unfamiliar words by doctor or the nurse'; '11. Communication of the staff with me'
6. The staff being too busy	• QCA: 'Staff too busy' • HSRS: '26. Having the staff be in too much of a hurry' • HSI: '7.1. Insufficient nurses on unit to make patient feel safe'

	• HRSQ-EP: ‘10. Doctor or the nurse not having enough time to respond to my needs’
7. The staff not being caring or friendly	• QCA: ‘Staff not caring or friendly’
8. Having to wait a lot	• QCA: ‘Waiting’ • HSI: ‘7.3. Problems during admission with waiting/other procedures’
9. The food being bad or not meeting your dietary requirements	• QCA: ‘Food unsuitable’ • HSRS: ‘21. Having to eat cold or tasteless food’ • HSI: ‘7.5. Inadequate facilities (food, recreation, room fixtures)’ • HRSQ-EP: ‘15. Hospital facilities such as room, bed, lighting, food, temperature and conditioning’
10. Feeling like you could not leave your bed or ward	• QCA: ‘Mobility restriction’; ‘Confined to bed or ward’ • HSRS: ‘10. Having to stay in bed or the same room all day’ • HRSQ-EP: ‘3. Mobility limitation due to the connected equipment’
11. Not knowing what was going to happen to you	• QCA: ‘Not knowing’ • HSRS: ‘26. Not knowing when to expect things will be done to you’; ‘41. Not knowing the results or reasons for your treatments’ • HSI: ‘4.1. Hospitalization and illness unexpected’; ‘5.2. Uncertainty of prognosis’
12. Feeling bored	• QCA: ‘Boredom’ • HSRS: ‘8. Not being able to get newspapers, radio, or TV when you want them’ • HSI: ‘7.5. Inadequate facilities (food, recreation, room fixtures)’ • HRSQ-EP: ‘1. Fatigue and impatience due to the long length of treatment’
13. The staff making a mistake that caused you harm	• QCA: ‘Staff made a mistake’
14. Worrying that your treatment/medication will have side effects	• QCA: ‘Adverse effects’ • HSRS: ‘32. Knowing you have to have an operation’ • HSI: ‘1.1. Adverse effects from a medical procedure’; ‘1.2. Adverse side-effects from medications’ • HRSQ-EP: ‘8. Not being confident in the care and treatment’; ‘22. Fear of death due to the risks of disease and treatment’
15. Fearing your health will get worse	• QCA: ‘Fear health would deteriorate’ • HSRS: ‘45. Thinking you might lose your hearing’; ‘46. Knowing you have a serious illness’; ‘47. Thinking you might lose a kidney or some other organ’; ‘48. Thinking you might have cancer’; ‘49. Thinking you might lose your sight’

	• HSI: ‘8.1. Recurrent hospitalizations’; ‘8.3. Realization of how near the end is’ • HRSQ-EP: ‘8. Not being confident in the care and treatment’; ‘22. Fear of death due to the risks of disease and treatment’; ‘23. Worry about long lasting or persistent disability’; ‘24. Having another physical illness or disability besides current disease’
16. Feeling like the staff were not listening to you	• QCA: ‘Staff not listening’ • HSI: ‘3.1.2. Doctors don’t take complaints seriously’
17. The other patients being difficult	• QCA: ‘Disturbed by other patients’ • HSRS: ‘14. Having a roommate who is unfriendly’
18. Feeling lonely	• QCA: ‘Loneliness’ • HSRS: ‘15. Not having friends visit you’; ‘31. Not having family visit you’ • HSI: ‘4.4. Loneliness’
19. Missing loved ones	• QCA: ‘Missing loved ones’ • HSRS: ‘20. Worrying about your spouse being away from you’; ‘38. Missing your spouse’ • HRSQ-EP: ‘18. Limited contact with family and friends’
20. The staff being rude or unprofessional	• QCA: ‘Staff rude or unprofessional’ • HSI: ‘3.1.3. Lack of courtesy and respect from doctors while on rounds’; ‘3.2.3. Lack of courtesy and respect from nurses’
21. The staff not being responsive to the buzzer	• QCA: ‘Staff not responsive to buzzer or call’ • HSRS: ‘35. Not having your call light answered’ • HSI: ‘3.2.1. Nurses’ lack of responsiveness to patients needs’ • HRSQ-EP: ‘13. Staff not responding in a timely manner to my needs’
22. Having blood taken	• QCA: ‘Bloods taken’ • HSI: ‘1.3. Sleep disturbed by frequent tests, blood draws, medications’ • HRSQ-EP: ‘4. Diagnostic or therapeutic measures such as blood sampling or venipuncture or intravenous catheterizing’
23. Being disturbed by observations (e.g. blood pressure)	• QCA: ‘Disturbed by observations’ • HSRS: ‘6. Being awakened in the night by the nurse’ • HSI: ‘1.3. Sleep disturbed by frequent tests, blood draws, medications’ • HRSQ-EP: ‘4. Diagnostic or therapeutic measures such as blood sampling or venipuncture or intravenous catheterizing’
24. Having to rely on others	• QCA: ‘Relying on others’

	• HSRS: '30. Feeling you are getting dependent on medications' • HSI: '2.1. Difficulty with role transition to patient'; '4.2. Fear of dependency'
25. Not feeling safe	• QCA: 'Feeling unsafe' • HSI: '3.1.1. Lack of trust (doctor-patient)'; '3.2.2. Lack of trust (nurse-patient)'; '7.1. Insufficient nurses on unit to make patient feel safe'
26. Worrying about the wellbeing of other patients	• QCA: 'Concern for other patients wellbeing' • HSRS: '12. Having a roommate who is seriously ill or cannot talk with you'
27. The hospital not being organised	• QCA: 'Hospital disorganised' • HSI: '8.2. Poor transfer of information from PMD to hospital doctors'
28. Sharing a room with strangers	• QCA: 'Sharing a room with other patients' • HSRS: '1. Having strangers sleep in the same room with you'
29. The staff not communicating well with each other	• QCA: 'Staff-staff communication' • HSI: '8.2. Poor transfer of information from PMD to hospital doctors'
30. Not being allowed access to your usual medication	• QCA: 'Access to own medication'
31. Hearing or seeing emergencies	• QCA: 'Hearing or seeing emergencies'
32. Feeling homesick	• QCA: 'Homesick' • HSRS: '33. Being hospitalized far away from home' • HSI: '6.1. Being away from home'
33. Not getting enough to drink	• QCA: 'Hydration'
34. Being in an overcrowded ward	• QCA: 'Overcrowding' • HSRS: '9. Having a roommate who has too many visitors' • HRSQ-EP: '16. Noise and traffic'
35. Overhearing the staff having conversations	• QCA: 'Overhearing staff conversations' • HSI: '3.1.6. Perceived disagreement among doctors on diagnosis or testing'
36. Medical procedure getting cancelled or delayed	• QCA: 'Cancellation or delay' • HSI: '1.4. Unexpected changes in scheduling or tests or procedures'

37. Not being involved in the treatment plan	• QCA: ‘Not involved in treatment plan’
38. Equipment or supplies lacking	• QCA: ‘Equipment lacking’ • HSI: ‘7.5. Inadequate facilities (food, recreation, room fixtures)’ • HRSQ-EP: ‘15. Hospital facilities such as room, bed, lighting, food, temperature and conditioning’
39. Having to deal with the symptoms of your illness (e.g. sickness)	• QCA: ‘Disturbed by symptoms’ • HSI: ‘8.4. Symptoms of illness’
40. Being in a room that was too hot or too cold	• QCA: ‘Temperature’ • HSRS: ‘16. Being in a room that is too cold or too hot’ • HSI: ‘7.5. Inadequate facilities (food, recreation, room fixtures)’ • HRSQ-EP: ‘15. Hospital facilities such as room, bed, lighting, food, temperature and conditioning’
41. Being in an unfamiliar place	• QCA: ‘Unfamiliar environment’ • HSRS: ‘3. Having to sleep in a strange bed’; ‘5. Having strange machines around’; ‘23. Being cared for by an unfamiliar doctor’ • HRSQ-EP: ‘6. Unfamiliarity with hospital’s environment’
42. Being in an unclean room	• QCA: ‘Lack of cleanliness’ • HSRS: ‘11. Being aware of unusual smells around you’ • HSI: ‘7.5. Inadequate facilities (food, recreation, room fixtures)’ • HRSQ-EP: ‘15. Hospital facilities such as room, bed, lighting, food, temperature and conditioning’
43. Worrying about loved ones	• QCA: ‘Worrying about loved ones’ • HSRS: ‘20. Worrying about your spouse being away from you’ • HSI: ‘6.2. Worry about the care of sick family members at home’; ‘6.3. Worry about who will care for family in future’ • HRSQ-EP: ‘20. Family disturbances’
44. Having to follow the hospital’s schedule	• QCA: ‘Having to follow hospital schedule’ • HSRS: ‘2. Having to eat at different times than you usually do’ • HSI: ‘Inflexibility of hospital routines’ • HRSQ-EP: ‘14. Hospital rules about issues such as bed time, time to eat, visiting hours, and time to take medication’; ‘17. Disruption of routine and normal habits and behaviors such as sleep and resting, activity, and diet’
45. Being in a room that was too bright or has no natural light	• QCA: ‘Lights’ • HSI: ‘7.5. Inadequate facilities (food, recreation, room fixtures)’

	• HRSQ-EP: ‘15. Hospital facilities such as room, bed, lighting, food, temperature and conditioning’
46. Having tubes in your nose, mouth, or other body parts	• QCA: ‘Drips or tubes in body’ • HSRS: ‘39. Being fed through tubes’ • HRSQ-EP: ‘4. Diagnostic or therapeutic measures such as blood sampling or venipuncture or intravenous catheterizing’
47. Being reminded of loved ones who passed away while in hospital	• QCA: ‘Reminded of loved ones who passed away in hospital’
48. The staff not asking for consent before treating you	• QCA: ‘Staff did not ask for consent’
49. Not being able to do your usual activities	• QCA: ‘Cannot do normal activities’ • HSI: ‘2.2. Health problem limits activity’; ‘2.3. Physician imposed limits on diet, habits, or activity’
50. Fearing that you may pick up an illness from being in hospital	• QCA: ‘Fear of hospital acquired infections’
51. Feeling like you had no privacy	• QCA: ‘Lack of privacy’ • HRSQ-EP: ‘12. Staff not respecting my privacy’
52. Feeling like you were not being treated like a person	• QCA: ‘Dehumanisation’
53. Worrying about money	• QCA: ‘Financial stress’ • HSRS: ‘27. Thinking about losing income because of your illness’; ‘36. Not having enough insurance to pay for your hospitalization’
54. Feeling like your life was on hold or you were missing out	• QCA: ‘Life on hold’ • HSRS: ‘18. Being in the hospital during holidays or special family occasions’
55. Having poor Wi-Fi or phone signal	• QCA: ‘Poor/no Wi-Fi or phone signal’ • HSRS: ‘22. Not being able to call family or friends on the phone’ • HSI: ‘7.5. Inadequate facilities (food, recreation, room fixtures)’ • HRSQ-EP: ‘15. Hospital facilities such as room, bed, lighting, food, temperature and conditioning’
56. Not being sure of your diagnosis	• QCA: ‘Uncertain of diagnosis’ • HSRS: ‘43. Not knowing for sure what illness you have’; ‘44. Not being told what your diagnosis is’

	• HSI: ‘5.1. Uncertainty of diagnosis’ • HRSQ-EP: ‘26. Low awareness about disease and treatment’
57. Worrying how you will cope once leaving hospital	• QCA: ‘Worrying post-hospital’ • HSI: ‘6.3. Worry about who will care for family in future’
58. Missing your usual small comforts (e.g. hot tea)	• QCA: ‘Missing small comforts’
59. Not being able to pray or do other religious activities	• QCA: ‘Not able to do religious activities’ • HRSQ-EP: ‘19. Difficulty doing religious obligations’
60. Feeling like the staff focused on other patients more than you	• QCA: ‘Staff attending to other patients more than you’ • HSI: ‘3.1.4. Doctors not spending enough time with patients’
61. Not knowing the hospital rules	• QCA: ‘Unfamiliar with hospital rules’ • HRSQ-EP: ‘5. Unfamiliarity with hospital’s rules’; ‘7. Being unaware of their own rights in the hospital’
62. Having to wear a hospital gown	• QCA: ‘Wearing a hospital gown’ • HSRS: ‘4. Having to wear a hospital gown’
63. Needing help going to the bathroom	• HSRS: ‘7. Having to be assisted with bathing’; ‘13. Having to be assisted with a bedpan’ • HSI: ‘8.5. Taking a bath’ • HSRQ-EP: ‘2. Requiring help for personal matters such as using catheter or else in bed’
64. Worrying that your appearance might change (e.g. scars)	• HSRS: ‘17. Thinking your appearance might be changed after your hospitalization’ • HRSQ-EP: ‘21. Worry about changes in body appearance due to illness and treatment’
65. Being transferred between wards or hospitals	• YQSR Group
66. The hospital not meeting your individual needs (e.g. disability)	• YQSR Group
67. Not being able to smoke, drink alcohol, or use other substances	• Research team

HRSQ-EP Hospitalisation-Related Stressors Questionnaire for Elderly Patients; *HSI* Hospital Stress Index; *HSRS* Hospital Stress Rating Scale; *QCA* Quantitative Content Analysis

Appendix 3.4 – HSQ

Hospital Stress Questionnaire (HSQ)

What is the questionnaire about?
This questionnaire aims to measure how much stress you experienced **during your hospital stay**. While answering the questions, consider 'stress' as feeling tense, worried, or wound up by a situation.

Completing the questionnaire
Please read each question carefully, keeping in mind your **most recent** stay in hospital and select one option for each question. **If you did not experience any of the events described in the questions**, please select N/A. This should take you around 5-10 minutes to complete. The best approach is to answer quickly.

During your hospital stay, please rate how much stress you felt as a result of:

	Not at all stressful (1)									Extremely stressful (10)	
1. Not sleeping well	1	2	3	4	5	6	7	8	9	10	N/A
2. Feeling helpless or not in control	1	2	3	4	5	6	7	8	9	10	N/A
3. Having pain or discomfort from your treatment	1	2	3	4	5	6	7	8	9	10	N/A
4. Staying in a noisy room	1	2	3	4	5	6	7	8	9	10	N/A
5. The staff not communicating well with you	1	2	3	4	5	6	7	8	9	10	N/A
6. The staff being too busy	1	2	3	4	5	6	7	8	9	10	N/A
7. The staff not being caring or friendly	1	2	3	4	5	6	7	8	9	10	N/A
8. Having to wait a lot	1	2	3	4	5	6	7	8	9	10	N/A
9. The food being bad or not meeting your dietary requirements	1	2	3	4	5	6	7	8	9	10	N/A
10. Feeling like you could not leave your bed or ward	1	2	3	4	5	6	7	8	9	10	N/A
11. Not knowing what was going to happen to you	1	2	3	4	5	6	7	8	9	10	N/A
12. Feeling bored	1	2	3	4	5	6	7	8	9	10	N/A
13. The staff making a mistake that caused you harm	1	2	3	4	5	6	7	8	9	10	N/A
14. Worrying that your treatment/medication will have side effects	1	2	3	4	5	6	7	8	9	10	N/A
15. Fearing your health will get worse	1	2	3	4	5	6	7	8	9	10	N/A
16. Feeling like the staff were not listening to you	1	2	3	4	5	6	7	8	9	10	N/A

17. The other patients being difficult	1	2	3	4	5	6	7	8	9	10	N/A
18. Feeling lonely	1	2	3	4	5	6	7	8	9	10	N/A
19. Missing loved ones	1	2	3	4	5	6	7	8	9	10	N/A
20. The staff being rude or unprofessional	1	2	3	4	5	6	7	8	9	10	N/A
21. The staff not being responsive to the buzzer	1	2	3	4	5	6	7	8	9	10	N/A
22. Having blood taken	1	2	3	4	5	6	7	8	9	10	N/A
23. Being disturbed by observations (e.g. blood pressure)	1	2	3	4	5	6	7	8	9	10	N/A
24. Having to rely on others	1	2	3	4	5	6	7	8	9	10	N/A
25. Not feeling safe	1	2	3	4	5	6	7	8	9	10	N/A
26. Worrying about the wellbeing of other patients	1	2	3	4	5	6	7	8	9	10	N/A
27. The hospital not being organised	1	2	3	4	5	6	7	8	9	10	N/A
28. Sharing a room with strangers	1	2	3	4	5	6	7	8	9	10	N/A
29. The staff not communicating well with each other	1	2	3	4	5	6	7	8	9	10	N/A
30. Not being allowed access to your usual medication	1	2	3	4	5	6	7	8	9	10	N/A
31. Hearing or seeing emergencies	1	2	3	4	5	6	7	8	9	10	N/A
32. Feeling homesick	1	2	3	4	5	6	7	8	9	10	N/A
33. Not getting enough to drink	1	2	3	4	5	6	7	8	9	10	N/A
34. Being in an overcrowded ward	1	2	3	4	5	6	7	8	9	10	N/A
35. Overhearing the staff having conversations	1	2	3	4	5	6	7	8	9	10	N/A
36. Medical procedure getting cancelled or delayed	1	2	3	4	5	6	7	8	9	10	N/A

37. Not being involved in the treatment plan	1	2	3	4	5	6	7	8	9	10	N/A
38. Equipment or supplies lacking	1	2	3	4	5	6	7	8	9	10	N/A
39. Having to deal with the symptoms of your illness (e.g. sickness)	1	2	3	4	5	6	7	8	9	10	N/A
40. Being in a room that was too hot or too cold	1	2	3	4	5	6	7	8	9	10	N/A
41. Being in an unfamiliar place	1	2	3	4	5	6	7	8	9	10	N/A
42. Being in an unclean room	1	2	3	4	5	6	7	8	9	10	N/A
43. Worrying about loved ones	1	2	3	4	5	6	7	8	9	10	N/A
44. Having to follow the hospital's schedule	1	2	3	4	5	6	7	8	9	10	N/A
45. Being in a room that was too bright or has no natural light	1	2	3	4	5	6	7	8	9	10	N/A
46. Having tubes in your nose, mouth, or other body parts	1	2	3	4	5	6	7	8	9	10	N/A
47. Being reminded of loved ones who passed away while in hospital	1	2	3	4	5	6	7	8	9	10	N/A
48. The staff not asking for consent before treating you	1	2	3	4	5	6	7	8	9	10	N/A
49. Not being able to do your usual activities	1	2	3	4	5	6	7	8	9	10	N/A
50. Fearing that you may pick up an illness from being in hospital	1	2	3	4	5	6	7	8	9	10	N/A
51. Feeling like you had no privacy	1	2	3	4	5	6	7	8	9	10	N/A
52. Feeling like you were not being treated like a person	1	2	3	4	5	6	7	8	9	10	N/A
53. Worrying about money	1	2	3	4	5	6	7	8	9	10	N/A

54. Feeling like your life was on hold or you were missing out	1	2	3	4	5	6	7	8	9	10	N/A
55. Having poor Wi-Fi or phone signal	1	2	3	4	5	6	7	8	9	10	N/A
56. Not being sure of your diagnosis	1	2	3	4	5	6	7	8	9	10	N/A
57. Worrying how you will cope once leaving hospital	1	2	3	4	5	6	7	8	9	10	N/A
58. Missing your usual small comforts (e.g. hot tea)	1	2	3	4	5	6	7	8	9	10	N/A
59. Not being able to pray or do other religious activities	1	2	3	4	5	6	7	8	9	10	N/A
60. Feeling like the staff focused on other patients more than you	1	2	3	4	5	6	7	8	9	10	N/A
61. Not knowing the hospital rules	1	2	3	4	5	6	7	8	9	10	N/A
62. Having to wear a hospital gown	1	2	3	4	5	6	7	8	9	10	N/A
63. Needing help going to the bathroom	1	2	3	4	5	6	7	8	9	10	N/A
64. Worrying that your appearance might change (e.g. scars)	1	2	3	4	5	6	7	8	9	10	N/A
65. Being transferred between wards or hospitals	1	2	3	4	5	6	7	8	9	10	N/A
66. The hospital not meeting your individual needs (e.g. disability)	1	2	3	4	5	6	7	8	9	10	N/A
67. Not being able to smoke, drink alcohol, or use other substances	1	2	3	4	5	6	7	8	9	10	N/A
Other (write in)	1	2	3	4	5	6	7	8	9	10	N/A

Overall, how stressed did you feel during your hospital stay?

No stress (1)									Worst possible stress (10)
1	2	3	4	5	6	7	8	9	10

If you have any additional comments, please write them here:

_____
_____
_____

Appendix 4.1 – Hospital experiences survey

[Information sheet and Consent form presented]

Are you over 18 years old? [can only proceed if answered “yes”]

Have you stayed in a hospital in the UK? [can only proceed if answered “yes”]

Was that stay in hospital longer than 24 hours? [can only proceed if answered “yes”]

Was that stay in hospital in the past 12 months? [can only proceed if answered “yes”]

Was that stay in hospital for psychiatric or maternity care? [can only proceed if answered “no”]

Thank you for taking the time to complete this survey. You have been invited to take part because you are (i) over 18 years old and (ii) have stayed in a UK hospital (iii) for at least 24 hours (iv) in the last 12 months, (v) for any reason that was NOT for psychiatric or maternity care. We are interested in hearing about your hospital experience.

In this survey, you will be asked to complete some background information about yourself and your hospital stay. This will be followed by three questionnaires on your hospital experience, stress levels, and overall health. Altogether, the survey should take around 15 minutes to complete. For all questions, the best approach is to answer quickly.

What is your current age?

What age were you when you went into hospital?

What is your sex?

Is the gender you identify with the same as your sex registered at birth?

What is your ethnic group?

What is your highest level of education completed?

What is your legal marital/civil partnership status?

In your life, approximately how many times have you stayed in hospital for more than 24 hours?

In the past 12 months, how many times have you stayed in hospital for more than 24 hours?

When was the most recent time you stayed in hospital for over 24 hours? (Please give the exact date, if possible)

IMPORTANT
For the rest of the questions, please answer with your **most recent hospital stay** in mind (i.e. your answer from the previous question).

How long were you in hospital?

What was the reason for your hospital stay? (e.g. 'I had a heart attack'). If unsure, please write 'I don't know'.

Which UK hospital did you stay in? (e.g. 'Leeds General Infirmary').

What type of ward did you stay on? (e.g. 'cardiology' or 'intensive care unit'). If unsure, please write 'I don't know'.

Did you have surgery?

Was your hospital stay planned beforehand?

What type of hospital did you stay in?

How prepared did you feel to go home when you left hospital? [1–10]

How long after leaving hospital did it take you to get back to the usual activities you did before going into hospital? (e.g., driving, work, cooking, housework, leisure, etc.)

Was this hospital stay a readmission from a previous hospital stay?

If yes, when was the original hospital stay? (Please give the exact date, if possible)

Did you experience any of the following within approximately 6 weeks of leaving hospital:

- Did you have any sores or wounds that would not heal?
- Did you have any infections?
- Did you have a fall?
- Did you have any additional problems that lead to contacting the GP, A&E, or anyone else?

In the six weeks after leaving hospital, how vulnerable did you feel? E.g., feeling weak, unsafe, or that your health might get worse. [1–10]

In the weeks leading up to your hospital stay…

- How often did you feel that you lacked companionship?
- How often did you feel left out?
- How often did you feel isolated from others?

In the month leading up to your hospital stay…

- [Concerning the people you are related to:]
- How many relatives did you see or hear from at least once in the month?
- How many relatives did you feel close to such that you could call on them for help?
- How many relatives did you feel at ease with such that you could talk about private matters?
- [Considering all of your friends and neighbours:]
- How many of your friends did you see or hear from at least once in the month?
- How many friends did you feel close to such that you could call on them for help?
- How many friends did you feel at ease with such that you could talk about private matters?

Questionnaire (1 of 3)
HSQ (See Appendix 3.4)

Questionnaire (2 of 3)
The questions in this scale ask you about your feelings and thoughts **during your hospital stay**. In each case, you will be asked to indicate by circling how often you felt or thought a certain way.

[PSS-10 questions, each asking "While in hospital…"]

Questionnaire (3 of 3)
Under each heading, please select the **ONE** box that best describes your health **IN THE TWO WEEKS AFTER BEING DISCHARGED FROM HOSPITAL.**

[EQ-5D-5L questions]

We would like to know how good or bad your health was **in the two weeks after being discharged from hospital.**
This scale is numbered from 0 to 100.
• 100 means the best health you can imagine.
• 0 means the worst health you can imagine.

[EQ VAS]

Appendix 4.2 – Sample demographics

Table S4.1.

More detailed breakdown of ethnicities within current sample.

Ethnicity	N	%
Asian or Asian British	**55**	**8.3**
Indian	19	2.9
Pakistani	15	2.3
Bangladeshi	3	0.5
Chinese	8	1.2
Other	10	1.5
Black, Black British, Caribbean or African	**30**	**4.5**
Caribbean	8	1.2
African	22	3.3
Other	0	0
Mixed or Multiple ethnic groups	**20**	**3.0**
White and Black Caribbean	13	2.0
White and Black African	1	0.2
White and Asian	3	0.5
Other	3	0.5
White	**548**	**83.0**
English, Welsh, Scottish, Northern Irish, or British	518	78.5
Irish	5	0.8
Gypsy or Irish Traveller	0	0
Roma	0	0
Other	25	3.8
Other ethnic group	**6**	**0.9**
Arab	2	0.3
Other	4	0.6
Prefer not to say	**1**	**0.2**
Total	**660**	**100**

Demographic Frequencies and Percentages

Gender same as sex at birth:

Yes – 657 (99.5%)

No – 0 (0%)

Prefer not to say – 3 (0.5%)

Education:

None – 23 (3.5%)

GCSE (or equivalent) – 128 (19.4%)

A-Level (or equivalent) – 154 (23.3%)

Undergraduate – 237 (35.9%)

Postgraduate – 118 (17.9%)

Marital:

Single – 172 (26.1%)

Married – 368 (55.8%)

In a registered civil partnership – 15 (2.3%)

Separated, but still legally married / in a civil partnership – 12 (1.8%)

Divorced/Dissolved – 49 (7.4%)

Widowed – 40 (6.1%)

Prefer not to say – 4 (0.6%)

Surgery:

Yes – 276 (41.8%)

No – 380 (57.6%)

I’m not sure – 4 (0.6%)

Planned/unplanned:

Planned – 223 (33.8%)

Emergency – 437 (66.2%)

Appendix 4.3 – Mean and standard deviation of each item

Table S4.2.

Mean and standard deviation of each item – ranked from most to least stressful.

Rank	HSQ Item	Mean	SD
1	1. Not sleeping well	5.82	2.80
2	2. Feeling helpless or not in control	5.67	2.85
3	19. Missing loved ones	5.63	3.06
4	12. Feeling bored	5.56	2.90
5	3. Having pain or discomfort from your treatment	5.54	2.73
6	8. Having to wait a lot	5.52	2.92
7	4. Staying in a noisy room	5.24	3.04
8	49. Not being able to do your usual activities	5.24	2.94
9	11. Not knowing what was going to happen to you	5.22	3.08
10	24. Having to rely on others	5.03	2.97
11	15. Fearing your health will get worse	5.00	3.15
12	39. Having to deal with the symptoms of your illness (e.g. sickness)	4.97	3.07
13	51. Feeling like you had no privacy	4.87	3.19
14	6. The staff being too busy	4.80	2.95
15	50. Fearing that you may pick up an illness from being in hospital	4.80	3.13
16	58. Missing your usual small comforts (e.g. hot tea)	4.72	3.04
17	32. Feeling homesick	4.68	3.17
18	10. Feeling like you could not leave your bed or ward	4.46	2.94
19	28. Sharing a room with strangers	4.43	3.15
20	41. Being in an unfamiliar place	4.38	2.98
21	43. Worrying about loved ones	4.32	3.01
22	56. Not being sure of your diagnosis	4.30	3.20
23	57. Worrying how you will cope once leaving hospital	4.30	3.00
24	5. The staff not communicating well with you	4.26	2.90
25	18. Feeling lonely	4.25	2.86
26	9. The food being bad or not meeting your dietary requirements	4.23	2.90
27	54. Feeling like your life was on hold or you were missing out	4.17	2.99

28	14. Worrying that your treatment/medication will have side effects	4.03	2.99
29	55. Having poor Wi-Fi or phone signal	3.75	3.07
30	40. Being in a room that was too hot or too cold	3.73	2.92
31	23. Being disturbed by observations (e.g. blood pressure)	3.68	2.74
32	44. Having to follow the hospital's schedule	3.66	2.77
33	17. The other patients being difficult	3.61	2.73
34	22. Having blood taken	3.55	2.78
35	46. Having tubes in your nose, mouth, or other body parts	3.49	3.00
36	34. Being in an overcrowded ward	3.45	2.85
37	45. Being in a room that was too bright or has no natural light	3.41	2.86
38	63. Needing help going to the bathroom	3.41	2.93
39	16. Feeling like the staff were not listening to you	3.33	2.76
40	27. The hospital not being organised	3.32	2.67
41	62. Having to wear a hospital gown	3.32	2.74
42	7. The staff not being caring or friendly	3.28	2.58
43	29. The staff not communicating well with each other	3.25	2.70
44	35. Overhearing the staff having conversations	3.10	2.57
45	37. Not being involved in the treatment plan	3.10	2.67
46	36. Medical procedure getting cancelled or delayed	3.06	2.87
47	26. Worrying about the wellbeing of other patients	2.95	2.35
48	31. Hearing or seeing emergencies	2.92	2.55
49	52. Feeling like you were not being treated like a person	2.92	2.58
50	21. The staff not being responsive to the buzzer	2.89	2.59
51	53. Worrying about money	2.82	2.68
52	25. Not feeling safe	2.80	2.44
53	47. Being reminded of loved ones who passed away while in hospital	2.80	2.72
54	33. Not getting enough to drink	2.78	2.39
55	64. Worrying that your appearance might change (e.g. scars)	2.74	2.57
56	65. Being transferred between wards or hospitals	2.70	2.58
57	42. Being in an unclean room	2.57	2.39
58	38. Equipment or supplies lacking	2.52	2.36
59	61. Not knowing the hospital rules	2.49	2.19

60	60. Feeling like the staff focused on other patients more than you	2.48	2.23
61	20. The staff being rude or unprofessional	2.40	2.27
62	13. The staff making a mistake that caused you harm	2.32	2.43
63	30. Not being allowed access to your usual medication	2.31	2.27
64	48. The staff not asking for consent before treating you	2.22	2.10
65	66. The hospital not meeting your individual needs (e.g. disability)	2.09	2.15
66	67. Not being able to smoke, drink alcohol, or use other substances	1.95	2.16
67	59. Not being able to pray or do other religious activities	1.75	1.82

Appendix 5.1 – Hospital Experiences Survey

[See Appendix 4.1.]

Appendix 5.2 – Demographic differences by stress type

Table S5.1.

Demographic differences on the HSQ by factor.

Factor	Male	Female	T-test	White	Other Ethnic Groups	T-test	Age
1. Quality of care	36.2	42.8	t (641.9) = –3.82, p < 0.001	39.2	43.1	t (171.8) = –1.83, p = 0.070	r = –0.14, p < 0.001
2. Away from home	35.5	39.5	t (640.8) = –2.93, p = 0.003	36.9	42.2	t (164.3) = –3.01, p = 0.003	r = –0.25, p < 0.001
3. Inconvenienced	27.2	29.5	t (629.1) = –1.72, p = 0.085	27.1	35.7	t (145.0) = –4.43, p < 0.001	r = –0.27, p < 0.001
4. Health anxiety	31.4	35.2	t (621.4) = –2.97, p = 0.003	33.1	35.4	t (167.6) = –1.43, p = 0.154	r = –0.11, p = 0.005
5. Negative effects of treatment	18.9	21.3	t (623.1) = –3.15, p = 0.002	20.0	21.3	t (160.0) = –1.31, p = 0.193	r = –0.15, p < 0.001
6. Ward environment	31.7	36.9	t (643.5) = –3.80, p < 0.001	34.2	36.5	t (176.5) = –1.40, p = 0.164	r = –0.21, p < 0.001
7. Disrupted patient experience	13.0	14.9	t (647.8) = –2.50, p = 0.013	13.6	16.4	t (149.3) = –2.59, p = 0.011	r = –0.18, p < 0.001

Appendix 5.3 – Hierarchical regressions of HSQ subscales on post-hospital outcomes

Table S5.2. *Hierarchical regression analyses testing the effects of the HSQ subscales on post-hospital outcomes (N=660)*

		β step 1	β step 2	β step 3	ΔR^2 for step	Total R^2	F-Change
	Post-hospital feelings of vulnerability						
Step 1	Age	0.116**	0.145***	0.153***	0.016	0.016	5.23**
	Sex	0.059	0.006	0.004			
Step 2	1. Quality of care		0.101	0.096	0.248	0.264	30.58***
	2. Away from home		–0.013	–0.026			
	3. Inconvenienced		–0.101	–0.109			
	4. Health anxiety		0.388***	0.370***			
	5. Negative effects of treatment		0.243***	0.245***			
	6. Ward environment		–0.107	–0.100			
	7. Disrupted patient experience		–0.046	–0.047			
Step 3	UCLA-LS			0.092*	0.007	0.272	3.12*
	LSNS			0.001			
	Time to return to usual activities						
Step 1	Age	0.257***	0.247***	0.263***	0.066	0.066	22.61***
	Sex	0.008	–0.016	–0.023			
Step 2	1. Quality of care		0.124	0.131	0.057	0.123	5.88***
	2. Away from home		–0.068	–0.093			
	3. Inconvenienced		–0.099	–0.103			
	4. Health anxiety		0.193**	0.162**			
	5. Negative effects of treatment		0.119*	0.120*			
	6. Ward environment		–0.063	–0.053			
	7. Disrupted patient experience		–0.045	–0.049			
Step 3	UCLA-LS			0.155***	0.019	0.142	6.93**

	LSNS			0.075			
	EQ-5D						
Step 1	Age	–0.115**	–0.138***	–0.156***	0.020	0.020	6.43**
	Sex	–0.088*	–0.031	–0.023			
Step 2	1. Quality of care		–0.200**	–0.205***	0.312	0.331	42.22***
	2. Away from home		0.072	0.100			
	3. Inconvenienced		0.063	0.070			
	4. Health anxiety		–0.279***	–0.243***			
	5. Negative effects of treatment		–0.446***	–0.448***			
	6. Ward environment		0.127*	0.115*			
	7. Disrupted patient experience		0.196***	0.200***			
Step 3	UCLA-LS			–0.179***	0.024	0.356	11.91***
	LSNS			–0.070*			
	Outcomes seen in PACT-M (sore/wound healing, infections, falls, contact GP/A&E)						
Step 1	Age	0.102*	0.094*	0.113**	0.011	0.011	3.59*
	Sex	0.036	–0.001	–0.010			
Step 2	1. Quality of care		0.160*	0.177*	0.100	0.111	10.13***
	2. Away from home		–0.053	–0.081			
	3. Inconvenienced		–0.166**	–0.165**			
	4. Health anxiety		0.263***	0.230***			
	5. Negative effects of treatment		0.111*	0.110*			
	6. Ward environment		–0.033	–0.023			
	7. Disrupted patient experience		–0.048	–0.053			
Step 3	UCLA-LS			0.160***	0.024	0.135	8.83***
	LSNS			0.122**			

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Appendix 5.4 – Variance explained by HSQ version

Table S5.3.

Amount of variance explained by the HSQ long, medium, and short versions.

HSQ version	ΔR^2 for step 2
Post-hospital feelings of vulnerability	
HSQ-55	0.138
HSQ-28	0.137
HSQ-10	0.118
Time to return to usual activities	
HSQ-55	0.018
HSQ-28	0.017
HSQ-10	0.016
EQ-5D	
HSQ-55	0.138
HSQ-28	0.135
HSQ-10	0.110
Outcomes seen in PACT-M	
HSQ-55	0.039
HSQ-28	0.039
HSQ-10	0.035

Appendix 6.1 – Participant Documents

Please see below for the following study documents:

- Participant Information Sheet
- Consent Form
- Consultee Information Sheet
- Consultee Declaration Form
- Witness Consent Form

In-hospital Experiences Study

Participant Information Sheet

Version 1, 20/03/24

We would like you to take part in this study but before you decide, please read the following information.

What is the purpose of this study?

The purpose of this study is to explore patients' experiences of staying in hospital and their recovery periods. We hope that this information will be used by hospitals and researchers to improve the experience of patients in hospital.

Why have I been asked to participate?

You have been invited to take part because you are (i) over 18 years old, (ii) have been an inpatient in Bradford Royal Infirmary for the past 3–6 days, (iii) for any condition that is NOT psychiatric or maternity care.

What will be involved if I take part in this study?

This study will take place in two parts. First, you will be asked to complete a survey about your hospital stay, along with some background questions about yourself. This will take around 15 minutes to complete. We will then ask for contact details to send you a second survey in three months' time. The second survey will ask about your recovery period and will take about 10 minutes to complete.

What are the advantages and disadvantages of taking part?

Taking part in this study may help to improve hospital experiences for future patients. Additionally, as a token of our appreciation, you will be offered a £10

gift voucher for each of the two surveys completed. Some of the questions may require you to recall stressful experiences from your hospital stay. However, you do not have to answer any questions you do not want to.

Can I withdraw from the study at any time?

You may withdraw from the study, and your data will be deleted. Withdrawal from this study will not affect your hospital care in any way.

Will the information I give be kept confidential?

All of the information you provide will be safely stored on a password protected university computer, or in a locked cabinet in the Yorkshire Quality and Safety Research Group. Your data will be anonymous and only the research team will be able to access it. No personally identifiable data will appear in any publications.

Who has reviewed this study?

This study has been reviewed and approved by [BOARD] Research Ethics Committee (ref number XXX, date approved XX/XX/2024).

If you have any questions or concerns about the study please contact:

Researcher Name: Daniel Ford
Position: Postgraduate Researcher
Contact details: psdmf@leeds.ac.uk

Chief Investigator Name: Rebecca Lawton
Position: Professor, Psychology of Healthcare
Contact details: R.J.Lawton@leeds.ac.uk

Thank you for taking the time to read this information sheet.

In-hospital Experiences Study

PATIENT CONSENT FORM

Anonymous ID: _____

	Please initial in each box
I confirm that I have read and understood the Information Sheet [20/03/2024, version 1] for the above study. I have had the opportunity to ask questions.	
I understand that my participation is voluntary and that I am free to withdraw at any time without giving a reason and without my medical care or legal rights being affected.	
I understand that any data I provide may appear in research publications. I will not be identifiable in any reports or publications from this study.	
I understand that a copy of this Consent Form will be stored securely at this NHS Trust.	
I agree to take part in this study.	

PARTICIPANT:

NAME (capitals)	DATE	SIGNATURE
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RESEARCHER:

NAME (capitals)	DATE	SIGNATURE
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In-hospital Experiences Study

Consultee Information Sheet

Version 1, 20/03/24

Information about being a consultee

Your relative/friend is not able to consent to take part in this research. You have been identified as a person who we can ask about whether or not they would want to be involved. You are known as the consultee and have been provided with the same information about the research project as your relative/friend. If you are unsure you may seek independent advice about this role and what is expected of you. If you do not feel able to take on this role, you may identify someone else to take your place. The following website is a useful source of information about the Mental Capacity Act (2005) and the role of the consultee: https://www.gov.uk/government/publications/mental-capacity-act-code-of-practice

As consultee, you should set aside your own views and advise on whether you think your relative/friend should take part in this research. If you decide that your relative/friend would not wish to take part in this study, the care they receive will not be affected.

This study is organised and run by the Yorkshire Quality and Safety Research Group and the University of Leeds. This study is funded by the National Institute for Health Research. This study has been reviewed and approved by [BOARD] Research Ethics Committee (reference number XXX, date approved XX/XX/2024).

If you agree to act as the consultee for your relative/friend, you will be asked to sign the Consultee Declaration Form after you have read this information booklet.

Information about the research study

What is the purpose of this study?

The purpose of this study is to explore patients' experiences of staying in hospital and their recovery periods. We hope that this information will be used by hospitals and researchers to improve the experience of future patients.

Why have I/they been asked to participate?

Your relative/friend has been invited to take part because they are (i) over 18 years old, (ii) have been an inpatient in Bradford Royal Infirmary for the past 3–6 days, (iii) for any condition that is NOT psychiatric or maternity care. Your relative/friend is not able to consent to take part in this research. You have been identified as a person who we can ask about whether or not they would want to be involved.

What will be involved if I/they take part in this study?

This study will take place in two parts. First, you will be asked to complete a survey about your relative/friend's hospital stay, along with some background questions about them. This will take around 15 minutes to complete. We will then ask for contact details to send you a second survey in three months' time. The second survey will ask about their recovery period and will take about 10 minutes to complete.

What are the advantages and disadvantages of taking part?

Taking part in this study may help to improve hospital experiences for future patients. Additionally, as a token of our appreciation, you will be offered a £10 gift voucher for each of the two surveys completed. Some of the questions

require you to recall experiences your relative/friend may have found stressful. However, you do not have to answer any questions you do not want to.

Can we withdraw from the study at any time?

You may skip any questions, or withdraw from the study entirely, without any consequence. If you choose to withdraw, your relative/friend's data will be deleted. Withdrawal from this study will not affect your relative/friend's care in any way.

Will the information we give be kept confidential?

All of the information you provide will be safely stored on a password protected university computer, or in a locked cabinet in the Yorkshire Quality and Safety Research Group. Your relative/friend's data will be anonymous and only accessible by the research team. No personally identifiable data will appear in any publications.

Who has reviewed this study?

This study has been reviewed and approved by [BOARD] Research Ethics Committee (ref number XXX, date approved XX/XX/2024).

If you have any questions or concerns about the study please contact:

Researcher Name: Daniel Ford

Position: Postgraduate Researcher

Contact details: psdmf@leeds.ac.uk

Chief Investigator Name: Rebecca Lawton

Position: Professor, Psychology of Healthcare

Contact details: R.J.Lawton@leeds.ac.uk

Thank you for taking the time to read this information sheet.

In-hospital Experiences Study

CONSENT FORM

Anonymous ID: _____

	Please initial in each box
I confirm that I have read and understood the Information Sheet for Consultees [20/03/2024, version 1] for the above study. I have had the opportunity to ask questions.	
I have been consulted about _____'s participation in this research project. I have had the opportunity to ask questions about the study and understand what is involved.	
In my opinion he/she would have no objection to taking part in this study.	
I understand that my participation is voluntary and that I can request he/she is withdrawn from the study at any time, without giving any reason and without his/her medical care or legal rights being affected.	
I understand that any data I provide about him/her may appear in research publications. He/she will not be identifiable in any reports or publications resulting from this study.	
I understand that a copy of this form will be stored at this NHS Trust.	
I agree to take part in this study as consultee for _____	

CONSULTEE:

Relationship to participant _____

NAME (capitals)	DATE	SIGNATURE

RESEARCHER:

NAME (capitals)	DATE	SIGNATURE

In-hospital Experiences Study

WITNESS CONSENT FORM

Anonymous ID: _____

	Please initial in each box
I confirm that I have read and understood the Information Sheet [20/03/2024, version 1] for the above study. I have had the opportunity to ask questions.	
I understand that my participation is voluntary and that I am free to withdraw at any time without giving a reason and without my medical care or legal rights being affected.	
I understand that any data I provide may appear in research publications. I will not be identifiable in any reports or publications from this study.	
I understand that a copy of this Consent Form will be stored securely at this NHS Trust.	
I agree to take part in this study.	

NAME OF PARTICIPANT: _____

WITNESS:

NAME (capitals) DATE SIGNATURE

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RESEARCHER:

NAME (capitals) DATE SIGNATURE

--- --- ---

Appendix 6.2 – In-hospital Survey

Are you a patient or consultee? [Researcher can answer]

Participant ID

Demographics to describe sample:

1. What is your current age?
2. What is your sex?
    - Male
    - Female
    - Other
    - Prefer not to say)
3. What is your ethnic group?
    - Asian or Asian British
        - Indian
        - Pakistani
        - Bangladeshi
        - Chinese
        - Other
    - Black, Black British, Caribbean or African
        - Caribbean
        - African
        - Other
    - Mixed or Multiple ethnic groups
        - White and Black Caribbean

- White and Black African
- White and Asian
- Other

- White
  - English, Welsh, Scottish, Northern Irish, or British
  - Irish
  - Gypsy or Irish Traveller
  - Roma
  - Other
- Other ethnic group
  - Arab
  - Other

4. What is your highest level of education completed?
   - None
   - GCSE or equivalent
   - A-Level or equivalent
   - Undergraduate degree
   - Postgraduate degree
5. What is your legal marital/civil partnership status?
   - Single
   - Married/in a registered civil partnership
   - Separated
   - Divorced/Dissolved
   - Widowed

Questions relating to hospital stay:

6. In your life, approximately how many times have you stayed in hospital for more than 24 hours?
7. In the past 12 months, how many times have you stayed in hospital for more than 24 hours?
8. How long have you been in hospital?
9. Which ward are you staying on? [Researcher can answer]
10. What is the reason for your hospital stay? (e.g. 'I had a heart attack')
11. Have you had (or are you scheduled to have) surgery during this hospital stay?
12. Was your hospital stay planned or an emergency?
13. Is this hospital stay a readmission from a hospital stay less than 30 days ago?

    13b. If yes, when was the original hospital stay?

Other questionnaires:

Loneliness (UCLA 3-item)

Social Network (LSNS 6-item)

HSQ-55

EQ-5D-5L & EQ VAS

PHQ-4

Appendix 6.3 – Post-hospital Survey

Participant ID

[Considering the hospital stay when we last saw you:]

1. How long was your hospital stay?
2. Have you been readmitted to hospital since the last survey?

   2b. If yes, when were you readmitted?

   2c. Was this readmission an emergency or planned in advance?
3. How prepared did you feel to go home when you left hospital? [Answer 1-10]
4. How long after leaving hospital did it take you to get back to the usual activities you did before going into hospital? (e.g., driving, work, cooking, housework, leisure, etc.)
5. Did you experience any of the following within approximately 6 weeks of leaving hospital:
   - Did you have any sores or wounds that would not heal?
   - Did you have any infections?
   - Did you have a fall?
   - Did you have any additional problems that lead to contacting the GP, A&E, or anyone else?
6. In the six weeks after leaving hospital, how vulnerable did you feel? E.g., feeling weak, unsafe, or that your health might get worse.

EQ-5D-5L & EQ VAS

PHQ-4