

Plants and wound healing in Uganda: A mixed methods study

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The candidate confirms that the work submitted is their own and that the appropriate credit has been given where reference has been made to the work of others.

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Abstract

In Uganda, many people rely on traditional healers and medicinal plants for their health needs including managing wounds. To date no studies have been published regarding the local Ugandan practice of the use of medicinal plants for wound healing. This study was undertaken to document Ugandan local knowledge of wound healing, the preparation, administration and identification of local medicinal plants.

The mixed methods study comprised three phases:

1. A literature review of the existing literature on plants and wound healing employing systematic techniques.
2. Fieldwork where forty consenting traditional practitioners and local knowledge experts in South Western Uganda were interviewed about their knowledge of wound healing and participated in quantitative surveys regarding medicinal plant use.
3. The interviews and surveys yielded knowledge of wound healing and a list of plants used from which three were selected for relevant phytochemical assays in the laboratory work phase.

The literature review found nine studies that reported on the use of medicinal plants for wound healing in Uganda. The interviews provided data which demonstrated that respondents possessed knowledge of the definition, classification, and diagnosis of wounds. The ethnobotanical survey revealed 38 plants as being important for treatment of wounds. The most represented families were Asteraceae (26.3%) and Solanaceae (15.8%); *Bidens pilosa* L., *Musa paradisiaca* L., *solenostemon latifolius*, *Ageratum conyzoides* L., *Hoslundia opposita* Vahl. and *Microglossa pyrifolia* (Lam.) Kuntze were the most widely used. Preliminary phytochemical screening confirmed the extraction efficiency through presence of polyphenol and flavonoid compounds and demonstrated antioxidant activity of the plant extract.

Ultimately, this thesis uses the mixed methods approach to gain a fuller and more complete understanding of the research questions. It also demonstrates evidence for the use of selected medicinal plants for wound healing in South Western Uganda and gives a description of the category of professionals involved in traditional medicine using medicinal plants.

Contents

Abstract	iv
Contents	v
List of Figures	ix
List of Tables	x
Glossary	xii
Chapter One	1
1 INTRODUCTION	1
1.1 Inception of the thesis.....	1
1.2 Synopsis of the thesis.....	3
Chapter Two	5
2 RESEARCH CONTEXT	5
2.1 Introduction	5
2.2 Health care structures in Uganda	6
2.2.1 Health service delivery.....	6
2.2.2 Health service coverage	7
2.2.3 Demographic information.....	8
2.2.4 Human resources for health.....	9
2.2.5 The current status of Traditional Medicine in Uganda	10
2.3 Area of study	13
2.4 Chapter summary.....	15
Chapter Three	16
3 LITERATURE REVIEW	16
3.1 Introduction	16
3.2 Brief history of Traditional Medicine in Africa	16
3.2.1 Pre-colonial healthcare	16
3.2.2 Post-colonial healthcare.....	17
3.3 Introduction to traditional medicine	19
3.3.1 Definitions.....	19
3.3.2 Traditional medicine in Africa	22
3.3.3 Aetiological theories and diagnosis of illness	23
3.3.4 Strengths of traditional medicine	25
3.3.5 Criticisms of traditional medicine.....	28
3.4 The practice of traditional medicine	35

3.4.1	Traditional herbalism concepts	35
3.4.2	Fundamentals of herbal medicines	36
3.4.3	Custodians of local herbal knowledge.....	36
3.4.4	Herbalists.....	36
3.4.5	Characteristics of TM practitioners.....	38
3.4.6	Types of traditional medical practitioners healers.....	40
3.5	Overview of empirical research on plants and wound healing in Africa	41
3.5.1	History and status of TM research methodologies in Africa.....	42
3.5.2	Research design/methods used.....	43
3.5.3	Use of multidisciplinary teams.....	44
3.5.4	Selection of plant species	44
3.5.5	Local definition and classification of wounds.....	46
3.5.6	Preparation and administration of plant remedies for wound healing	47
3.5.7	Recommended doses of plant therapies for wound healing	48
3.5.8	The wound healing process and relevant biological tests.....	48
3.6	Gaps in the literature	50
Chapter Four		54
4	METHODOLOGY AND METHODS	54
4.1	Introduction	54
4.2	Study purpose	54
4.3	Research Questions.....	55
4.4	Research design	56
4.4.1	A working definition of the mixed methods design.....	58
4.4.2	Application of the mixed methods approach in this study	60
4.5	Phase I: Literature review using systematic methods	61
4.5.1	Eligibility Criteria	62
4.5.2	Search methods for identification of studies.....	62
4.5.3	Sifting, data extraction and analysis.....	63
4.6	Phase II: Fieldwork phase	63
4.6.1	Methods employed	63
4.6.2	Study population	66
4.6.3	Sampling and recruitment	67
4.6.4	Data collection	69
4.6.5	Data analysis	75

4.7	Phase III: Phytochemical studies	79
4.7.2	Selection of Methods	79
4.7.3	Plant material preparation and extraction.....	79
4.7.4	Resuspension procedure	81
4.7.5	Phytochemical assays	81
4.8	Ethical approvals	84
Chapter Five.....		86
5	RESULTS	86
5.1	Introduction	86
5.2	Results from phase I: Literature Review	86
5.2.1	Study Selection.....	86
5.2.2	Summary of included primary studies	88
5.2.3	Study Characteristics	92
5.2.4	Types of injuries treated with medicinal plants	93
5.2.5	Plants used for wound healing from the literature	93
5.3	Results from Phase II: Fieldwork	93
5.3.1	Pilot study of participant recruitment	93
5.4	Demographic characteristics of study participants	95
5.5	The knowledge of wound healing using medicinal plants.....	96
5.5.1	Definition of a wound	97
5.5.2	Classification of wounds	98
5.5.3	Types of wounds.....	100
5.5.4	Plants used for wound healing	100
5.5.5	Comparison of literature review and survey results	105
5.5.6	Part of plants used.....	105
5.5.7	Ethnobotanical rationale of action of plants.....	105
5.5.8	Preparation of remedies.....	107
5.5.9	Method of administration of plant remedies.....	107
5.5.10	Dosage of remedies	108
5.5.11	Infection prevention and control	109
5.5.12	Place from where plants are harvested	109
5.5.13	Extinction and plant diversity	111
5.6	The practice of wound healing using medicinal plants	113
5.6.1	The Healer- Client interaction	114
5.6.2	Diagnosis of wounds.....	116

5.6.3	Traditional healers' treatment charges	118
5.6.4	Peculiar aspects of TM in SW Uganda.....	120
5.6.5	Misconceptions about TM safety.....	122
5.7	Challenges faced in practice outside the formal healthcare system	124
5.7.1	No Reciprocation of referral from western practitioners.....	124
5.7.2	Harassment of their clients by health professionals	124
5.7.3	Difficulty in public differentiation of types of traditional healers...	125
5.7.4	Lack of continuing traditional education (CTE).....	125
5.7.5	Inability to write Death certificates.....	125
5.7.6	Poor or lack of record keeping	126
5.7.7	Fear of blame for death.....	126
5.7.8	'Fake healers'	126
5.7.9	Age related factors.....	126
5.7.10	Poor storage facilities for plant specimens	127
5.8	Summary.....	127
5.9	Results from Phase III: Laboratory work.....	128
5.9.1	Selection of plants for in vitro investigations.....	128
5.9.2	Particle size of plant samples.....	131
5.9.3	Polyphenol content of plant extracts	132
5.9.4	Flavonoid content of plant extracts.....	134
5.9.5	DPPH radical scavenging activity	136
5.9.6	Elastase activity.....	137
	Chapter Six.....	139
6	DISCUSSION.....	139
6.1	Personal reflections on using the mixed methods approach for this study	139
6.2	Introduction	139
6.2.1	The value of the mixed methods approach	139
6.2.2	The utility of the mixed methods approach in this study	141
6.3	Literature review, Phase I.....	144
6.3.1	Integration of literature review and ethnobotanical survey findings	144
6.4	Fieldwork, Phase II.....	146
6.4.1	General demographic characteristics of healers	147
6.4.2	Healers' knowledge of plants and wound healing.....	148

6.4.3	Local definition and classification of wounds.....	149
6.4.4	Objectives of therapy for each plant-based remedy	150
6.4.5	Preparation and administration of medicinal plant therapies	152
6.4.6	Local practice of wound healing using medicinal plants	152
6.5	Laboratory work, Phase III.....	154
6.5.1	Plant preparation	155
6.5.2	Solvent extraction	155
6.5.3	Total phenolic and flavonoid content.....	155
6.5.4	Presence of antioxidant activity.....	155
6.6	Integration of the key findings from the three study phases	156
6.7	Strengths and limitations of the study	157
6.8	Contribution to the body of knowledge.....	158
6.9	Future work	159
6.10	General Conclusions	160
7	References.....	162

Appendix 1:	list of studies excluded from the review and rationale for exclusion	182
Appendix 2:	List of Ugandan medicinal plants identified for wound healing.....	184
Appendix 3:	Pre-pilot testing Topic Guide	187
Appendix 4:	Study Topic Guide.....	188
Appendix 5:	Draft Questionnaire	189
Appendix 6:	Participant consent form.....	191
Appendix 7:	Participant Information Sheet	192
Appendix 8:	Framework for the collection of medicinal plant data	194
Appendix 9:	Ethical approval from SHREC (SHREC/RP/183).....	195
Appendix 10:	Approval of transfer of samples from Uganda to UK.....	196
Appendix 11:	Approval to conduct research in South Western Uganda	196
Appendix 12:	Sample field notes from the fieldwork phase	198

List of Figures

Figure 2-1:	The structure of the Uganda National Health System	7
Figure 2-2:	A mobile herbal drug peddler in Kampala, Uganda 2011	11
Figure 2-3:	Sample advertisements of services rendered by herbal TMPs.....	12
Figure 2-4:	Maps showing area of Fieldwork phase data collection	14
Figure 4-1:	Sequence of mixed data collection methods.....	57
Figure 4-2:	photographs showing the preparation of plants prior to extraction	80

Figure 4-3: Photographs showing aqueous and methanolic extracts before and after drying.....	81
Figure 5-1: PRISMA flow diagram of published studies adapted from (Moher et al., 2009)	87
Figure 5-2: Sex and age distribution of participants	96
Figure 5-3: Types of wound treated by medicinal plants	100
Figure 5-4: Source of herbs for wound healing	110
Figure 5-5: Availability of medicinal plants	111
Figure 5-6: Photograph <i>B. pilosa</i> in situ	129
Figure 5-7: Photograph <i>G. parviflora</i> in situ.....	129
Figure 5-8: Photograph <i>A. conyzoides</i> in situ.....	130
Figure 5-9: Average particle sizes of <i>A. conyzoides</i> , <i>B. pilosa</i> and <i>G. Parviflora</i>	132
Figure 5-10: Representative standard curve for Gallic acid (mg/ml), values represent mean, error bars represent SD $R^2 = 0.992$	132
Figure 5-11: Mean total phenolic content of plants extracts screened in triplicates ...	134
Figure 5-12: Representative standard curve for Quercetin ($\mu\text{g/ml}$), values represent mean $\pm\text{SD}$, $R^2 = 0.999$, $y = 0.0208x - 0.017$; Error bars represent SD	135
Figure 5-13: Representative standard curve for Ascorbic acid ($\mu\text{g/ml}$), values represent mean	136
Figure 5-14: Representative standard curve for Elastase (Units/ml), values represent mean Error bars represent SD, $R^2 = 0.998$ incubated on ice.....	138
Figure 6-1: Diagram showing how each phase of data collection informed the next..	141
Figure 6-2: Integration of healers' responses regarding rationale for plant use and the biology of wound healing adapted from Enoch and Harding (2003).	151
Figure 6-3: Representation of factors influencing the healers' practice of TM	153

List of Tables

Table 2-1: Health service coverage interventions in 2009	8
Table 2-2: Comparison of health indicators by countries level of development	9
Table 2-3: Demographic information for 2010/2011	9
Table 4-1: Overview of how mixed methods answered the study questions.....	60
Table 4-2: Worked example of reputation sampling	68
Table 4-3: Worked example of ranking of study participants	68
Table 4-4: Length of data collection	70
Table 5-1: Characteristics of included studies.....	91
Table 5-2: Types of injuries for which different plant species are used.....	93

Table 5-3: Participants' demographic characteristics	95
Table 5-4: Representation of subthemes regarding the knowledge of wound healing using medicinal plants	97
Table 5-5: Categories and participant quotes for 'definition of a wound' subtheme	97
Table 5-6: Categories and participant quotes for 'classification of a wound'	99
Table 5-7: Medicinal plants used for wound healing from the ethnobotanical surveys	104
Table 5-8: Part of plant used for wound healing.....	105
Table 5-9: Purpose of plant use.....	106
Table 5-10: Reported method of action of medicinal plants.....	106
Table 5-11: Method of preparation of plant remedy for wound healing.....	107
Table 5-12: Administration of plant remedies for wound healing	108
Table 5-13: Dosage of plant remedies for wound healing	108
Table 5-14: Tabular representation of subthemes and categories regarding the practice of wound healing using medicinal plants.....	113
Table 5-15: Representation of subthemes regarding the challenges faced in the practice of wound healing using medicinal plants.....	124
Table 5-16 Healers accounts of the use of selected plant species	131
Table 5-17: Effects of extracting technique on the Total phenolic contents (GAEmg/5g of DW) of leaf extracts	133
Table 5-18: Effects of extracting technique on the Total Flavonoid contents ($\mu\text{g/g}$) of plants extracts	135
Table 5-19: Effects of extracting technique on the DPPH radical scavenging activity (%) of different medicinal plants	137
Table 5-20: Mean optical densities of plant extracts for anti-elastase activity.....	138
Table 6-1: Cross reference literature of plants used for wound healing.....	145

Glossary

AIDS	Acquired Immune Deficiency Syndrome
AHM	African Herbal Medicine
AMT	Alternative Medical Therapy
ARV	Antiretroviral
CAO	Chief Administrative Officer
CAM	Complementary and Alternative Medicine
CDO	Community Development Officer
DDHS	District Director of Health Services
FDA	Food and Drug Administration
GOU	Government of Uganda
HC	Health Centre
HIV	Human Immunodeficiency Virus
HSD	Health Sub District
HSSP	Health Sector Strategic Plan
ICD	International Classification of Diseases
IPT	Intermittent Presumptive Treatment
IRC	Institutional Ethical Review Committee
MoH	Ministry of Health
MRRH	Mbarara Regional Referral Hospital
MUST	Mbarara University of Science and Technology
NGO	Non-Governmental Organisation
NHPRC	National Health Policy Review Commission
PHC	Primary Health Care
PMTCT	Preventing Mother-to-child Transmission of HIV
PLWHA	People Living With HIV/AIDS
QUAL	Qualitative
QUAN	Quantitative
SHREC	School of Healthcare Research Ethics Committee
TBA	Traditional Birth Attendant
TCM	Traditional Chinese Medicine
THETA	Traditional and Modern Health Practitioners Together against AIDS
TM	Traditional Medicine
TMP	Traditional Medical Practitioner
UBOS	Uganda Bureau of Statistics
UNHRO	Uganda National Health Research Organization
NCRL	Natural Chemotherapeutics Research Laboratory

NCRI	Natural Chemotherapeutics Research Institute
UNCST	Uganda National Council of Science and Technology
UNMHCP	Ugandan National Minimum Health Care Package
UPE	Universal Primary Education
WHO	World Health Organisation
WM	Western Medicine

Chapter One

1 INTRODUCTION

A journey of a thousand miles must begin with a single step.

Lao-Tzu

1.1 Inception of the thesis

The motivation for this research was first and foremost borne out of my professional experience as an emergency and critical care nurse. After acquiring a Masters degree, I worked in both community and clinical practice in Uganda. One of my observations from the rural communities was that a large number of injuries were not reported to the health care facilities, especially those sustained by children. I discovered that many parents took their children to the nearest health service providers and these were usually traditional healers, who they claimed were immediately accessible and affordable.

In sub-Saharan Africa, diarrhoea and malaria are the major health challenges, followed by injuries, with an estimated incidence of 40,000 episodes of injury and 100 deaths per 100,000 population per year (Nordberg, 2000). According to WHO (2012) estimates, road traffic injuries kill nearly 1.3 million people annually and 3,500 people die on the world's roads every day. Another discovery happened during a rotation at the casualty unit at Mbarara regional referral hospital (MRRH), which is a large hospital located along one of the major highways in Uganda. During my rotations, patients who had sustained road traffic injuries and injuries from trauma were brought into the unit where they received standard care including x-rays and sometimes even emergency surgery. However, the most irregular thing would happen to patient numbers within the space of 24 hours. For example, I would go home at 5pm and leave close to 40 patients on the unit, but when I returned in the morning the number would have reduced by about 10 patients, with no deaths reported by the night staff. I later learned that during the night, bone setters came to recruit the patients to go for what they termed "proper treatment"

at their establishments; a bone setter is a traditional medical practitioner specialised in the treatment of fractures. The bone setters insisted on only taking patients who had undergone radiological procedures such as scans and x-rays to aid in their diagnosis of fractures. That experience stirred in me a desire to uncover the hidden truths regarding traditional medicine (TM). These findings will have an impact on professional healthcare practice as they can contribute to informing dialogue between biomedical and traditional healers which will eventually improve health care delivery to consumers, which is the ultimate goal.

In the field of medicine, various definitions of Traditional Medicine (TM) are found. WHO (1978a) provides a summarised definition that captures the essence of the various definitions that abound as

The sum total of knowledge or practices whether explicable or inexplicable, used in diagnosing, preventing or eliminating a physical, mental or social disease p8.

Such knowledge may rely on past experience and observations handed down from generation to generation, verbally or in writing (Sofowora, 1993, WHO, 2005a). It also comprises therapeutic practices that have been in existence often for hundreds of years before the development of modern scientific medicine, and are still in use today even without any documented evidence of adverse effects (WHO, 1978a), which is crucial in terms of duty of care to patients. The discussion on the definitions and significance of TM is continued in the Literature review chapter in section 3.3.

In my personal training in western medicine as a nurse, TM was ‘demonised’ or ‘discounted’ by the biomedical professionals, therefore several questions plagued me over the next few months during my personal reflections, for example, “if traditional medicine was as bad and dangerous as it was claimed, why did people keep using it? What secrets had the traditional healers uncovered that we had missed? Was it a cultural practice? Who was trustworthy and who was ripping us off? Was it down to the particular healer? What worked and what didn’t? Which practices were safe and which ones were dangerous? Did today’s doctors know what was best, or did old wives’ tales indeed tap into some ancient wisdom?”

In addition to my personal professional motivation for this research, the study was undertaken because the segment of the population in Uganda that depends upon traditional healers for first-line health care is reported at close to 80% (WHO, 2002) and this disproportionately includes the poor with limited access to western medicine (WM), which means that this thesis seeks to understand an area which will be of great

significance and interest to the Ugandan population, the health sector and policy makers.

Wounds currently represent a major health burden and drain on healthcare resources in Africa (Agyare et al., 2009), but to date no specific studies have been published regarding plants and wound healing in Uganda with respect to injury which is remarkable considering the size of the population that relies on traditional medicine for healthcare. This study therefore aims to build on current empirical evidence of traditional medicine by furthering the understanding of wound healing using medicinal plants in South Western Uganda.

Drawn from this aim, the broad objectives of the study are:

1. To describe the local knowledge of plants and wound healing in South Western Uganda.
2. To use the mixed methods approach to investigate how practitioners use plants in the treatment of wounds in South Western Uganda.
3. To initiate a pilot/ feasibility study into the scientific understanding and potential utility of plants identified for wound healing by respondents.

This thesis was therefore borne out of my personal professional motivation and the current state of the evidence on plants and wound healing in Uganda and Africa.

1.2 Synopsis of the thesis

This study sets out to answer the fundamental question 'what is known about plants and wound healing in South Western Uganda?' Although a short and simple question, when unpacked, it becomes somewhat complicated and has many answers. In order to answer this question properly, the thesis has been divided into six chapters. **Chapter 1** ('Introduction') presents the background of this study and traces the journey of the development of the research question.

Chapter 2 ('Research context') examines an example of a sub-Saharan health system for establishing the context of traditional medicine and healing and critically presents a context in order to provide an understanding of some of the underlying reasons for the wide use of Traditional medicine. It also looks at the status of traditional medicine in Uganda. The particular reasons why Isingiro district was chosen out of the whole of

South Western Uganda are also made apparent towards the end of the chapter as we examine the area of study.

Chapter 3 ('Literature review'), critically examines and evaluates the evidence of the practice of traditional medicine in Africa. The different definitions of Traditional Medicine (TM) are explored within the context of the history of TM in Africa. Evidence is also presented about the theories of disease and the advantages and criticisms of TM. In line with the objectives of the study, the concepts underpinning the ethnobotany of medicinal plants, especially those used for wound healing, are expounded incorporating findings from a narrative review of the empirical evidence. The final part of this chapter provides the justification for the study which is premised on the gaps identified in the literature and on the quality/scope of existing evidence.

Chapter 4 ('Methodology and methods') documents the methodologies employed for understanding plants and wound healing in South Western Uganda from both the field-work and laboratory-work phases. I justify the use of the mixed methods approach and present the innovative way in which 'mixing' of qualitative and quantitative approaches was achieved in this study in order to answer the research question. The research methods, population, sampling, recruitment and data collection techniques are described in detail. Throughout the chapter, I present the work clearly and explicitly to allow the reader to follow the 'decision trail' and to give assurance that the methods are replicable. Later in the chapter, the techniques used for analysis of the data are also discussed and a worked example of the qualitative data analysis is presented.

The research findings from the three phases of data collection: literature review, fieldwork and laboratory work phases are presented in **Chapter 5** ('Presentation of findings').

Chapter 6 (Discussion, implications and recommendations) commences with an interpretation and discussion of findings from the results. The value and utility of the mixed methods approach are examined and the key findings from the thesis are highlighted. Finally the study limitations, possible future areas of research and the general conclusions of the study are presented.

Chapter Two

2 RESEARCH CONTEXT

2.1 Introduction

Recent evidence suggests that globally over half the population and about 80% in Africa/ developing countries, use alternative medicine in one form or the other (WHO, 2000b, Hamill et al., 2000). In addition, ethnobotanical studies have revealed that African plants are being used in the treatment of wounds (Grierson and Afolayan, 1999b, Inngjerdingen et al., 2004, Giday et al., 2007, Teklehaymanot and Giday, 2007, Giday et al., 2009, Agyare et al., 2009, Adetutu et al., 2011). Indeed it is estimated that the annual global spend on all alternative medicines is in the region of £40 billion, making it the fastest growing area of medical spending (WHO, 2002). There has been a cultural renaissance globally, towards more natural methods of healing (Makunga et al., 2008) with an emphasis on holistic care.

The history of wound care is replete with examples of alternative practices. Aside from plants, the literature describes the use of other substances for wound treatment such as honey (Cooper et al., 2000, Bansal et al., 2005, Remmen et al., 2005, Molan and Betts, 2008, Lee et al., 2011), sugar (Shi et al., 2007, Murandu et al., 2011, Mendez et al., 2012), meat tenderizer (Starley et al., 1999, Hewitt et al., 2000, Mikhal'chik et al., 2004, Anuar et al., 2008, Gurung and Skalko-Basnet, 2009, Hafezi et al., 2010, Collard and Roy, 2010) and maggot therapy (Goldstein, 1931, Mumcuoglu et al., 1999, Mumcuoglu, 2001, Sherman et al., 2001, Sherman, 2002, Sherman et al., 2007, Blake et al., 2007, Gupta, 2008, McIntosh et al., 2011). Furthermore, aloe vera (Grindlay and Reynolds, 1986, Watcher and Wheeland, 1989, Schmidt and Greenspoon, 1991, Heggens et al., 1995, Chithra et al., 1998, Reynolds and Dweck, 1999, Vogler and Ernst, 1999, Maenthaisong et al., 2007, Jia et al., 2008, Dat et al., 2012) and other plant products have become standard ingredients impregnated into various wound dressings, which are approved for use by the United States Food and Drug Administration (FDA). This shows how the conventional medicine world continually

draws upon TM to get ideas for treatments, and a few have made the leap from alternative, to conventional.

The focus of this thesis is to investigate how practitioners in South Western Uganda use plants in the treatment of wounds. However in order to gain a better insight into the context of the practice of TM in Uganda, it is the intention of this chapter to help the reader understand the prevailing health situation and status of healthcare in Uganda. To better interpret the findings, the chapter is divided into two sections; Section 2.2 starts with a brief examination of the Ugandan healthcare system, and provides an insight into the health service coverage, health indicators and demographic information about the Ugandan population. The section ends with an overview of the human resources for health available in the country and a few notes on the legal status of TM in Uganda. Section 2.3 presents the health indicators of one part of South Western Ugandan (Isingiro district) and offers the rationale for the choice of the study area.

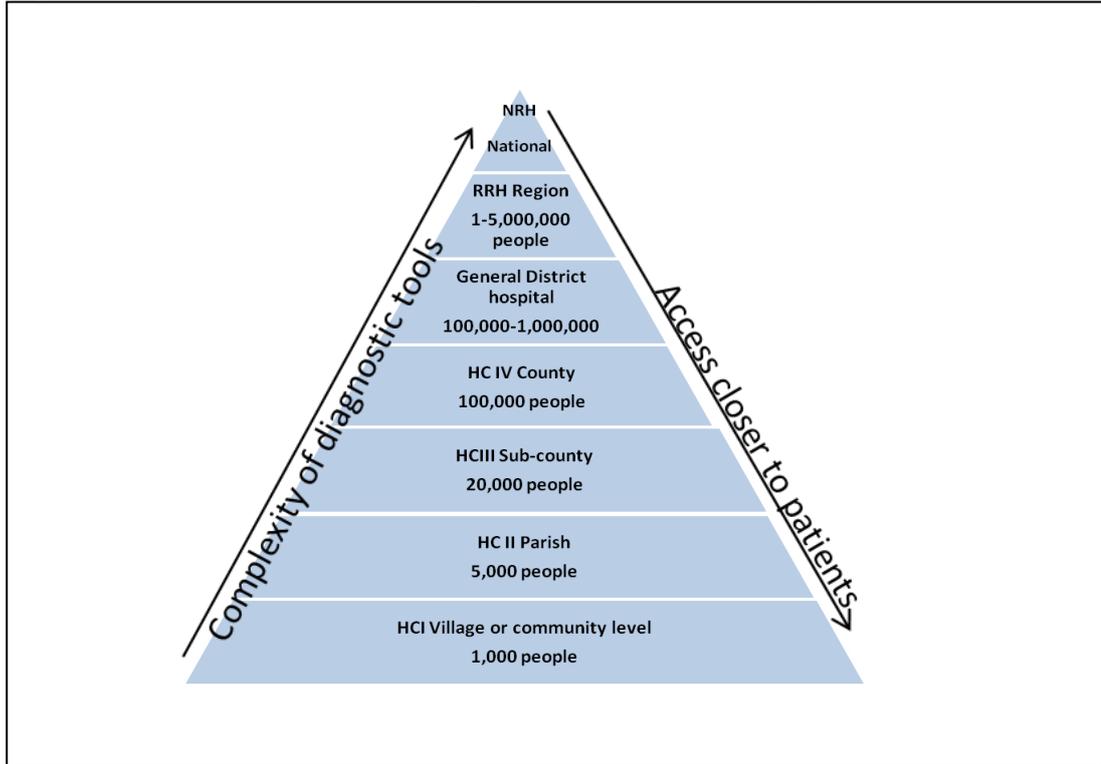
2.2 Health care structures in Uganda

This section starts with an examination of the structures for health service delivery in Uganda then leads into the details of the specific healthcare burdens of the Ugandan population.

2.2.1 Health service delivery

During the post-independence era (1962-1971), Uganda was one of the countries with the best health indices and a vibrant health care system in Africa. Two decades of civil unrest followed and collapse of the health care system (Government of Uganda, 2009). Since the early 1990s, the Government of Uganda has given high priority to the improvement of the health status of people. The healthcare system is currently divided into the Government and private sector; the government health system is arranged in a hierarchical system based on the number of people in a given area starting at the village level with health centre I (HC I) going up to the National referral hospitals (NRH) (Rutebemberwa et al., 2009) (figure 2-1.) The healthcare system works on a referral basis; if for example a level II facility cannot handle a case this is referred to a unit the next level up.

Figure 2-1: The structure of the Uganda National Health System



Adapted from (Ministry of Health, 2000) **HC**-Health centre, **RRH**-Regional Referral Hospital, **NRH**-National Referral Hospital.

The private sector is further divided into three categories; Private Health Care Providers (both for profit and not-for-profit), Non-Governmental Organisations (NGOs) and Traditional Practitioners. The NGO group comprises international and national NGOs, religious bureaux, and community self-help groups (Syngellakis and Arudo, 2006).

Geographical access to conventional health care is limited to about 49% of the population, i.e. population living within five kilometres of a health service unit (MoH, 1992). Rural communities are particularly affected, mainly because health facilities are typically located in towns along main roads.

2.2.2 Health service coverage

Health service coverage indicators reflect the extent to which people in need of treatment actually receive important health interventions (WHO, 2011). Such interventions include: the provision of skilled care to women during pregnancy and childbirth, reproductive-health services, and the treatment of disease in children, adolescents and adults. This means for example (see table 2-1) that only 42% of all births are attended by skilled health personnel. This number represents the proportion

of the population eligible to receive or in need of the intervention. This therefore would be proportion of all women in Uganda of child bearing age (Table 2-1).

Table 2-1: Health service coverage interventions in 2009

Interventions	Percentage of eligible population (%)
Births attended by skilled health personnel	42
ARV coverage among people with advanced HIV infection	39
ARV coverage among HIV infected pregnant women for PMTCT	53
Neonates protected at birth against neonatal tetanus	89
Immunization coverage of measles among 1-year-olds	68
Children <5 sleeping under insecticide treated nets	9
Children <5 with fever who received treatment with any antimalarial	61
Contraceptive prevalence	23.7
Case-detection rate for all forms of tuberculosis	44

Source: World Health Statistics 2011(WHO, 2011)

2.2.3 Demographic information

Uganda has an area of 241,000 km² and a projected population of 32.2 million by 2012 (UBOS, 2002). A Total Fertility Rate of 6.3 births per woman and a contraceptive prevalence rate of 23.7% (WHO, 2011) both contribute significantly to the increase in Uganda's population. The first Human Development Report (HDR) introduced a new way of measuring development by combining indicators of life expectancy, educational attainment and income into a composite human development index, the HDI (UNDP, 2011). The HDI is used to distinguish whether a country is a developed, developing, or underdeveloped. The life expectancy at birth, HIV prevalence and total fertility rates of several countries are compared to those of Uganda based on the HDI classification of countries in table 2-2. Uganda has made progress in improving the health of its population: life expectancy increased from 48 years in 1990 to 52 years in 2009; HIV prevalence reduced from 27% to 6.5% between 2000/01 and 2009 and Total fertility rate reduced from 7.1 in 1990 to 6.3 in 2009 (WHO, 2011).

Table 2-2: Comparison of health indicators by countries level of development

Country	Level of development	Rank (of 196)	Life expectancy at birth	HIV prevalence /100,000	TFR
Norway	Very High	1	77	138	1.9
USA	Very high	4	79	391	2.1
UK	Very high	28	80	137	1.9
Seychelles	High	52	73	--	1.9
Libya	High	64	69	--	2.6
Algeria	Medium	96	72	50	2.3
SA	Medium	123	55	11, 236	2.5
Ghana	Medium	135	60	1,099	4.2
Kenya	Low	143	60	3 664	4.7
Uganda	Low	161	52	3 645	6.1
DR Congo	Low	187	49	--	5.8

Adapted from World health Statistics (WHO, 2012b) and the UNDP human development report 2011 (UNDP, 2011). SA=South Africa, DR= Democratic Republic.

The major causes of death in Uganda are infectious diseases such as bacterial diarrhoea, hepatitis A, typhoid fever, malaria, plague, African trypanosomiasis (sleeping sickness), schistosomiasis and rabies (WHO, 2012b). According to the World Health statistics, an estimated 77 deaths of 100,000 population are caused by unintentional injuries, the total infant mortality rate is 62.47 deaths/1,000 live births and by 2009, an estimated 1,200,000 people were living with HIV/AIDS (WHO, 2012b).

Table 2-3: Demographic information for 2010/2011

Demographic variables	Proportion (%)	Population
Total population	100	31,784,600
Children below 18 years	56	17,799,376
Adolescents (10-24 years)	34.7	11,029,256
Infants below one year	10.9	1,940,132
Children below 5 years	19.5	6,197,997
Women of childbearing age (15-49 years)	23	7,301,458

Source: Annual Health Sector Performance Report 2010/2011 (Ministry of Health, 2011)

The demographic information (Table 2-3) is based on the population census of 2002 (UBOS, 2002) and annual projections by Uganda Bureau of Statistics until the next national census in Uganda which is in 2013.

2.2.4 Human resources for health

There are few hospitals and only 4-10 hospital beds per 10,000 people (WHO, 2011); the density of hospital beds can be used to indicate the availability of inpatient services.

According to WHO, in 2010, there were 3361 physicians and 37,625 nursing and midwifery personnel registered per 10,000 people in Uganda (WHO, 2011). Many trained health workers have migrated abroad or are looking for opportunities to go abroad or are in private practice leaving the government health care units to be run by medical assistants (Ministry of Health, 2000). Migration and loss of skilled workers is a limiting factor in the development of healthcare, putting stress on the system and encouraging reliance on alternative models such as Traditional Medicine, therefore TM fills the gap.

2.2.5 The current status of Traditional Medicine in Uganda

Tabuti *et al.*, (2003), described findings from a study in central Uganda which demonstrated that the traditional health care system is holistic and that the Traditional Medical Practitioners (TMPs) employed plant and animal parts in their treatment of clients' ailments. There were more than 340 TMPs in the county, and they specialised as herbalists, traditional birth attendants (TBAs), bonesetters, diviners and spiritual healers or faith healers (Tabuti *et al.*, 2003a). From this and other studies in Africa (Gessler *et al.*, 1995, Elujoba *et al.*, 2005, Shoko, 2007, Kyomugisha, 2008, Sorsdahl *et al.*, 2010) it is clear that there are many different types of healers who use herbs in one form or the other to effect cures. However since this thesis is focused on plants, we shall focus only on the status of herbal medicine in Uganda and will give more detail about the different types and practitioners of traditional medicine in Africa in Chapter 3 (Section 3.4).

2.2.5.1 Herbal Medicine in Uganda

By the year 2000, there were no manufacturing regulatory or safety assessment requirements for herbal medicines in Uganda (WHO, 2008). These still do not exist and herbal medicines are sold in pharmacies as over the counter medicines, by peddlers (Figure 2-2) and in food markets, without restriction.

Figure 2-2: A mobile herbal drug peddler in Kampala, Uganda 2011



Unlike the biomedical practitioners in Uganda, traditional healers are permitted to advertise their services. Figure 2-3 illustrates sample advertisements for services offered by traditional healers obtained from one of the daily newspapers in Uganda. There is currently still no legal framework in place to regulate traditional medicine in Uganda (Kyomugisha, 2008) which has resulted in several safety issues arising from misuse of these medicines. According to Weisheit and Male (2003), there was at least one traditional healer in Uganda for nearly 290 people compared to one Western trained medical practitioner for every 10,000 people in the urban areas and for every 50,000 in the rural areas. Current World health statistics from WHO indicate that the total number of traditional healers in Uganda is unknown (WHO, 2012b).

Figure 2-3: Sample advertisements of services rendered by herbal TMPs

DR MAYANJA HERBAL JOINT RESEARCH CENTER
 Experts in treating diseases by use of 100% pure Herbal medicine.
 Visit us for counselling and treatment in problems like:

- Prolonged & painful menstruation periods in women
- Weight loss or gain
- Addictions to alcohol, smoking or drugs
- Premature ejaculations and weak erections
- Manhood enlargement (size & length)
- Low sexual appetite
- Red lips
- Fibroids
- Sperm counts
- Women tightening
- Brain boosting in adults and children

For consultations on any other disease or problem contact:
 Dr. Mayanja Isa on 0782-058719/ 0700-973183 Emutungo Kunya Opposite Pine Supermarket on Kinawataka Road and Kireka Kamuli Road Wobulenzi at Bamunanika stage near Mutumba fuel pump Soroti behind attoti petro station on Mbale rd

Email: drmayanja@hotmail.com
"Experience the power of modern Genuine herbal"

SENGA MUWUMUZA
 Time has come for you to smile with senga muwumuza, expert in treating diseases like;

- Stop smoking and alcohol (4 days)
- Man hood enlargement(3 days)
- Scars
- Customer attraction
- Twin flaps (3 days)
- Impotent men
- Barren women
- Fibroids
- Herbal family planning
- Tightening and dry women get fluids (15 mins)
- Lost lovers (4 days)
- Premature ejaculation
- Red lips (2 weeks)
- Men with back pain (1 week)

We deliver

Location Makindye opp. Court, stall NO. 69
 Tel: 0772 832 056 / 0752 832 056

A national research institute on herbal medicines; the Natural Chemotherapeutics Research Laboratory (NCRL) was established in 1963 in response to the many claims made by traditional healers, and following reports of the public outcry regarding the safety of herbal remedies and the rising mortality rates from the use of traditional medicine. Some of the claims made by traditional healers included finding the cure for illnesses like cancer, Human Immunodeficiency Virus infection / Acquired Immune Deficiency Syndrome (HIV/AIDS), hypertension and diabetes mellitus using one 'miracle' pill or solution. It is now known as the Natural Chemotherapeutics Research Institute (NCRI). The NCRI is a research and development centre under the Uganda National Health Research Organization (UNHRO) created by an act of parliament, the 2009 UNHRO Act. The institution is mandated to carry out research on natural products (plants, animal parts and minerals) and the use of traditional methods in the management of human disease with the view of justifying therapeutic claims from traditional medicine practitioners with the intent to safeguard in Uganda (Ministry of Health, 2011).

Upon the recommendation of the National Health Policy Review Commission (NHPRC) to the government in 1987, all traditional herbalists and practitioners formed associations. One hundred and twenty-six different associations have been formed under an umbrella forum known as the Uganda National Integrated Forum for

Traditional Health Practitioners (Kyomugisha, 2008). This forum is responsible for censuring and streamlining all types and forms of traditional health practitioners and their practices in Uganda. Perhaps the most widely known and now gaining wide acceptability is the Traditional and Modern Health Practitioners Together against AIDS (THETA). It is an NGO dedicated to improving the health of Ugandans by promoting collaboration between the traditional and biomedical health systems.

2.3 Area of study

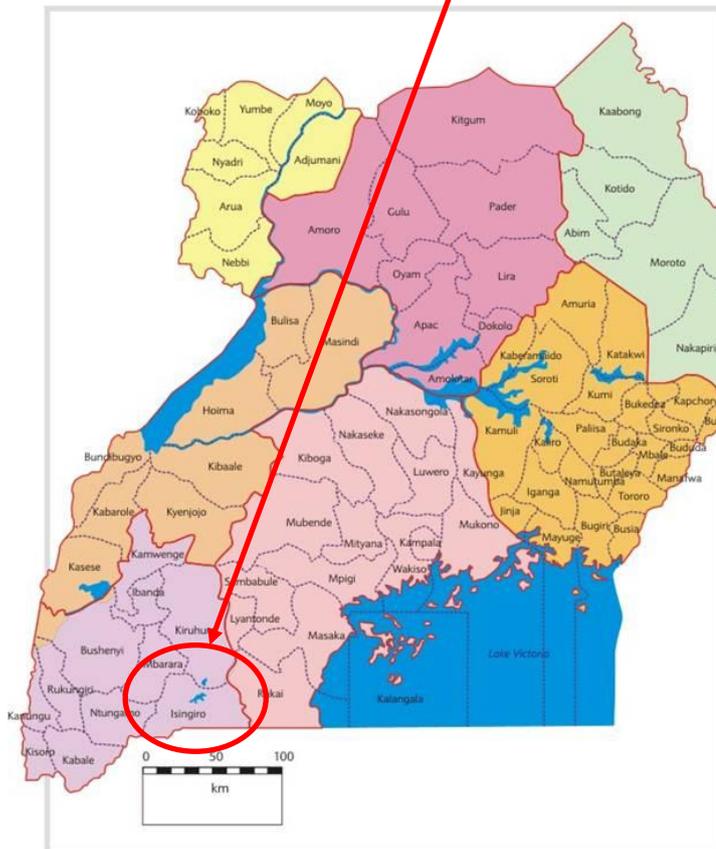
The study was carried out in Isingiro district in South Western Uganda (Figure 2-4) where a significant proportion of the community, estimated between 40-50%, still live in extreme poverty with an estimated annual per capita income of \$250. The area has the highest tuberculosis prevalence in south western Uganda, HIV/AIDS prevalence is estimated at between 8 to 10% (Millenium Villages, 2011) and HIV/AIDS service availability is 77% for HIV/AIDS patients (UBOS, 2002).

According to the latest district statistics, Isingiro district has a population of 380,000 and is served by 52 health centres (UBOS, 2002). Close to 98% of the population (7,600 households) in the district is dependent on agriculture for their livelihoods (Acord Uganda, 2010).

Most pregnant mothers give birth at home, sometimes with the help of traditional birth attendants; only about 5% deliver within health units. The percentage of women who receive the antimalarial (Fansidar) during pregnancy is 51% (UBOS, 2002) (Intermittent Presumptive Treatment (IPT)). The regional referral hospital is located in Mbarara town, 40 km away and accessibility is limited due to hilly terrain and poor roads (Millenium Villages, 2011). Most of the health centres lack medical personnel, adequate supply of basic drugs and medical supplies. The local population therefore does not use the health facilities and this provides an incentive for communities to seek traditional health services for their health needs. Easy access to Traditional Medical Practitioners (TMPs) is therefore one of the main reasons why this district was particularly chosen because of its high rural population and patronage of traditional medicine.

Isingiro district is located about 40km from the research base (Mbarara district) and has similar geographical and social cultural characteristics as Mbarara (Figure 2-4). The researcher could speak the *Runyankore* language and usefully engage with the study participants.

Figure 2-4: Maps showing area of Fieldwork phase data collection



Source: <http://www.weinformers.net/2011/01/10/kyankwanzi-district-locals-cry-over-extortion-by-land-committee/> and <http://www.transitionsabroad.com/listings/work/volunteer/volunteerprogramsafrica.shtml> accessed on September 23, 2012.

2.4 Chapter summary

Given the overall study aim of understanding the relationship between plants and wound healing, chapter 2 has given the background to the study and established the research context. In conclusion, Uganda is a country with limited health resources that needs additional health services, in this respect, TM fills the vacuum and is uniquely embedded within local cultures and systems but also demonstrates some recent evidence of interaction with systems. The next chapter gives a wider overview of the practice of traditional medicine both in Uganda and Africa drawing on different sources of evidence to inform the study of plants and wound healing in Uganda.

Chapter Three

3 LITERATURE REVIEW

3.1 Introduction

This chapter presents a discussion of the different types of evidence concerning the practice of Traditional Medicine (TM) with a specific focus on medicinal plants and wound healing in Africa. Chapter three begins with a brief history of TM in Africa in section 3.2. Section 3.3 then outlines the context and significance of the topic of investigation by answering the question 'What is traditional medicine?' A definition for TM is provided along with some theories about the causes of disease and some advantages and criticisms of TM.

Section 3.4 looks in depth at the practice of traditional medicine with a presentation of traditional herbalism and the different types of TM practitioners and the diagnosis of illness. A narrative overview of the empirical research is then presented in section 3.5. The literature review draws on diverse types of evidence and provides the rationale for the research questions addressed in this thesis in 3.6.

The chapter concludes with a summary of the literature review (section 3.7) and highlights the conclusions, limitations and gaps in the existing literature on the local practice of wound healing using medicinal plants.

3.2 Brief history of Traditional Medicine in Africa

3.2.1 Pre-colonial healthcare

Before European occupation of Africa in the 19th century, each community had a member or members who specialised in some sort of healing (Evans-Pritchard, 1932). Compared to their contemporaries, healers were more community oriented, and focused on preventive as well as curative methods (McMillen, 2004). An individual who could dissociate from what was happening around them and go into a trance in order to

consult gut instinct or 'the spirits' was consequently regarded to be of great value and became the tribal doctor. The remnants of whom can be seen in those we call 'witch doctors' today (Inglis, 1979). It is not clear from the literature whether there were other practitioners utilising other methods or existence of other specialisations among traditional healers, hence this section only reports evidence on the witch doctors.

3.2.2 Post-colonial healthcare

From the earliest European travel documents and missionary reports onward (between roughly 1875 and 1900), the witch doctor/traditional healer frequently appeared as a metonym for Africa, a figure portrayed as incarnating a number of negative attributes that Europeans had ascribed to Africa (Rekdal, 1999). Sometimes the tribal doctors would simply become abstracted, as if unaware of their surroundings; on recovering consciousness, they would relate what they had seen and learned in the trance (Evans-Pritchard, 1932). More often it was reported they had what looked like a fit, foaming at the mouth and going into convulsions, until a voice sounding unlike their own would speak through them, as if they were the dummy of an invisible ventriloquist (Inglis, 1979). Their listener's assumption was that they were possessed by a spirit or spirits were using them as the agency by which they passed their information on to the tribe; warning, say, that a witch, or an evil spirit was at work, and recommending the appropriate remedies (Evans-Pritchard, 1933).

According to Inglis (1979) sickness was attributed to a loss of soul-power compared to the European early models of cause of illness due to imbalances in the different humours for example black bile/earth, yellow bile/fire, phlegm/water, and blood/air. In Africa, it was believed the sick person's soul was being abstracted by the spirits, or by a witch; the tribal doctor's function was to go in pursuit of it and arrange for it to be returned. Or the tribal doctor might put his patients into trances like his own, with the help of rhythm and drugs, inducing convulsions, dissociation and eventually comas; the belief being that they too had been possessed by friendly spirits, helping to cure them (De Smet, 1998).

Diagnosis and treatment were assumed to work by magic in the original sense of the term, by forces of the kind now called psychic or paranormal (Kaplan, 2011). A tribal doctor obtained and held his post by virtue of the belief that with the help of the spirits he could perceive and influence people and objects at a distance (Kubukeli, 1999). Psychological and psychic forces- the two were not kept distinct-continued to be

considered as determining whether people fell ill and whether they could recover. The tribal doctor's influence continued to depend on his ability to convince the tribe of his powers as a diviner, witch-finder and communicator of remedies prescribed by the spirits, rather than on his knowledge of herbs or other aids (Koziell and Laurenson, 1988). Other forms of local healthcare seen even today also existed such as bonesetters and elderly women in the community who helped other women deliver babies; these have now come to be known as Traditional Birth Attendants (TBAs).

Nyaki (2007) suggests that traditional African societies used an experimental approach to develop their own bodies of medical knowledge based on local plants, with the tribal healer acting as the expert database and provider of medicines and patients being used for 'experimentation' without their knowledge or consent. In other instances, a healer would eat a fruit or berry and note a numbing sensation in the mouth and decide instead to consider it for medicinal use. Other discoveries would be by blatant experimentation, for instance, an observation that a leaf rubbed on an insect bite reduced the redness and swelling. Being resourceful, the use of that specific plant was quickly incorporated into their ethnopharmacopoeia (Balick and Lee, 2005). According to Heinrich (2005) an ethnopharmacopoeia is the totality of plants, animals and microorganisms or any other substance used for medical purposes by a culture (p432) (e.g. a particular country or ethnic group in a country).

Internationally, herbal medicine suddenly entered into a new era in the 17th century when it started to be investigated by scientists who sought to improve on nature's medicine cabinet (Singh and Ernst, 2008) but still believed in humors, marking the beginning of dissemination of herbal compendium in the West at least. The latter part of the renaissance period was marked by rapid expansion of ideas with printed materials, reliance on observation and empiricism and development of modern scientific methods. Wider recognition has ensued and WHO has not only declared African traditional healers as an important resource in health promotion, but also has encouraged research on their healing techniques and remedies (WHO, 1978b, Rekdal, 1999).

With the dominance of orthodox, scientific, medicine early in the 19th century, traditional medicine began to be viewed as unconventional because active components had not been identified and proven to be efficacious (Nyika, 2007). It is worth noting that traditional medicine follows different precepts of health and of efficacy. Although this led to the replacement of TM by orthodox medicine in developed countries, in many

developing and low and medium income countries it has remained the “first contact” medicine for most people especially in rural areas (Tabi et al., 2006) probably due to socio-economic reasons. In developed countries however, the alternatives to Western medicine are increasingly used. Some rich northern or developed nations for example UK and USA and other large and recently industrialising countries like China and India have very strong traditions of TM for example Ayurveda, acupuncture and Chinese herbs which nullifies the argument of TM as a feature of developing nations.

3.3 Introduction to traditional medicine

Both plants and animals have been used as sources of medicine since pre-civilization period (Yesilada, 2005). The importance of plants for medicinal purposes is revealed in many verses of the Bible among which Ezekiel 47:12 “the fruit of trees shall be for eating and the leaves for medicine” is notable (Mafimisebi and Oguntade, 2010). Even in modern times, animals and plants continue to play an indispensable role in healthcare (Alves and Rosa, 2007). The evidence that more than a quarter of all the approved orthodox medicines used in the world today contain ingredients derived from plants (Raskin et al., 2002) illustrates this point.

This section addresses the question of “what is traditional medicine?” by providing a definition, enlightening us on the aetiological theories about disease in TM and the reasons for or against its use.

3.3.1 Definitions

3.3.1.1 What is Traditional Medicine?

At a global level, TM eludes precise definition or description because of the different understandings and worldviews people bring to the concept. In 1976, experts at the World Health Organization's (WHO) meeting in Brazzaville in Africa defined TM as follows:

“The sum total of all the knowledge and practices, whether explicable or not, used in diagnosis, prevention and elimination of physical, mental and social imbalance and relying exclusively on practical experience and observation handed down from generation to generation, whether verbally or in writing...Traditional medicine might also be considered to be the sum total of practices, measures, ingredients and procedures of all kinds, whether material or not, which from time immemorial had enabled the African to guard against diseases, to alleviate his sufferings and to cure himself...Traditional medicine might also be considered as a solid

amalgamation of dynamic medical know-how and ancestral medicine (WHO, 2002).

Traditional medicine is a comprehensive yet diffuse term used to refer both to TM systems such as traditional Chinese medicine, Indian Ayurveda and Arabic Unani medicine and to various forms of indigenous medicine. TM therapies can be divided into medication and non-medication therapies (WHO, 2002). Medication therapies involve the use of herbal medicine, animal parts and/or minerals while non-medication therapies are carried out primarily without the use of medications as in the case of acupuncture, manual therapies and spiritual therapies (WHO, 2002). It is very tempting to reduce traditional medicine to a group of therapies which as Hevi (1989) acknowledges is more than that and should be expanded to include folk knowledge, traditions and values, health behaviour rules and patterns, and identified personnel and structures for delivery and restorative therapy.

3.3.1.2 Traditional medicine or Complementary and Alternative Medicine?

The term 'traditional medicine' has been criticised, because it misleadingly implies a homogenous group of medical practitioners (Marsland, 2007). It is also sometimes referred to as natural medicine, folk medicine, indigenous medicine, local medicine, rural medicine, 'bush' medicine, non-conventional, parallel and even unscientific medicine (Sofowora, 1982, WHO, 2002). The term complementary or alternative medicine has come to be used to refer to TM that has been adopted by other populations (outside its indigenous culture) (WHO, 2005b). Social acceptability factor of a particular terminology in health care practice has significant implications for the perceived credibility of the practice thus the use of the umbrella term 'complementary and alternative medicine' (CAM), which correctly implies that these therapies are sometimes used alongside and instead of conventional medicine (McClure, 2002).

Alternative medicine can be defined as any therapy that is not accepted by the majority of mainstream doctors, and typically this also includes those alternative therapies that have mechanisms which lie outside the current understanding of modern medicine (Singh and Ernst, 2008). It encompasses homeopathy, naturopathy, acupuncture, chiropractic and herbalism. On the other hand, complementary medicine refers to the use of treatments drawn from alternative medicine to complement allopathic medicine (Makunga et al., 2008). Tabuti, Dhillon and Lye (2003a) present TM use in Uganda as an alternative rather than as a complementary form of medicine which serves a

different role from that of Western medicine and is recommended for the treatment of psychosocial conditions (e.g. to eliminate the effects of witchcraft) and chronic ailments. The WHO traditional medicine strategy uses the term traditional medicine when referring to Africa, Latin America, South-East Asia and/or the western pacific, whereas the term CAM is used when referring to Europe and/or North America. When referring in a general sense to all these regions, the comprehensive TM/CAM is used (WHO, 2002).

The varying definitions and names for traditional medicine show that this is a field that is not yet fully understood and one that is contentious or in conflict with Evidence Based Medicine (EBM) such in the sense that it is challenging to find a definition or a term that is generally accepted. This therefore calls for further research into TM that strives to uncover what is at the heart of traditional medical practice from within a culture in order to be able to understand it. This thesis seeks to understand the local practice of wound healing through the use of medicinal plants in South Western Uganda by using a mixed methods approach.

3.3.1.3 Local medicinal knowledge

The term local medicinal knowledge is used to refer to the cumulative body of knowledge of medicinal plants and healing practices of a culture that has been handed down through generations (Calvet-Mir et al., 2008), that is socially shared by the members of the same generation and that has been adapted to a particular place, verbally or in writing (Sofowora, 1993, WHO, 2005a, Adewunmi and Ojewole, 2004). Within this is the knowledge of the raw material from which the remedies are produced and the socio-medical aspects implied in their preparation and use (Berkes et al., 2000, Pieroni et al., 2004, Calvet-Mir et al., 2008). The traditional healing knowledge of many people in Africa is usually orally transmitted from one generation to another (WHO, 2000a).

Aside from contributing positively to the primary healthcare delivery of the local populations, this healing knowledge is a potential sustainable source of medicines because of the abundant medicinally-active ingredients present in plants (Adewunmi and Ojewole 2004, Raskin et al., 2002). However, discovery and evaluation of new leads is expensive, which combined with the relatively few recent successes in drug discoveries from plants has resulted in an unwillingness by big Pharmaceutical companies to invest significant resources into this undertaking. African traditional

medicine has generally been associated with a lack of written local knowledge on healing practices. There is a foreseeable danger that if this knowledge is not recorded it will eventually be lost. If this knowledge is written, it can be validated, corroborated and monitored within the public domain which will enhance safety and it is hoped that this transparency and visibility will play a pivotal role in increasing acceptability. This role now falls to researchers to ensure that this information is collected, and described which will lead to it being documented, disseminated in the public domain, validated, and developed by future researchers and practitioners. In light of this, one of the major aims of this thesis is to describe the local knowledge of plants and wound healing in South Western Uganda.

3.3.2 Traditional medicine in Africa

The importance of TM in African societies cannot be overemphasized. It is to the traditional healers that a great majority of people in developing countries turn in times of illness (Tahzib and Daniel, 1986). A study in Kenya showed that patients had a clear sense of when they would go to a western clinic and when they would visit a traditional healer (Van der Geest, 1997). Services from a traditional healer would be particularly sought when an illness has been diagnosed as psychosomatic or when patients perceive the orthodox treatment they receive to be “inadequate” (Hevi, 1989, Gessler et al., 1995). A Traditional Medical Practitioner (TMP)/ traditional healer is a person who has no formal medical training (Agbor and Naidoo, 2011, Ryan et al., 2011), but is recognized by the community in which he/she lives as competent to provide health care by using vegetable, animal and mineral substances (WHO, 2002). More often than not, the decision to consult a TMP is that of the patient or their carers.

In the African context, when all the empirical and scientific knowledge has failed then an appeal is made to the supernatural, magic or witch craft to deal with the difficult and intangible elements involved. When a modern health care unit declares a particular illness beyond any hope of cure, sometimes this may be interpreted as advice to seek traditional treatment (Ryan et al., 2011).

There is evidence that modern doctors use TM to supplement their practice; for instance, a study conducted with traditional healers in Nigeria, reported claims by some herbalists that a few western-trained doctors send cases they cannot cure to them for ‘expert’ care, while others request charms to prevent mishaps in their practice of orthodox medicine (Oyebola, 1980a). These findings are supported by those from a study in central Uganda which reported that some modern health workers occasionally

and informally referred patients with chronic illnesses such as uterine fibroids or migraine or conditions perceived to be of a spiritual nature to the Traditional Medical Practitioners (Tabuti et al., 2003a). It should be noted that the biomedical practitioners would not publicly acknowledge working with the traditional healers except for those employed in projects or centres that are advocating for a closer collaboration between traditional and western practice such as the Traditional and Modern Health Practitioners Together against AIDS (THETA). One reason for this may be that they would appear to condone the practice of using medicinal plants for the management of disease conditions yet Uganda has not quite reached the stage where a western practitioner can declare open support for the practice of TM.

Vuori in 1982 asserted that traditional medicine is typically identified with socio-economic under-development and is considered an indication of backwardness. Bannerman (1981) disagrees with the assertion stating that it is wrong to attribute magical, irrational and superstitious ideas to any group of countries or levels of industrial or educational development since use of CAM and the belief that illness arises from supernatural causes is held by many different countries not only those in the third or developing world. Even in Western countries deeply permeated by the scientific-technological approach to medicine, the population still cherishes many traditional healing practices such as acupuncture and use of herbal medicines and relies on traditional medicine to a greater extent than is usually reported or admitted (Dunlop, 1975, Vuori, 1982). This means that there is greater interaction than is commonly perceived between these systems, the evidence of which does not get into the public domain which in turn impacts on the scientific credibility of the practice hence the rationale for this study.

3.3.3 Aetiological theories and diagnosis of illness

3.3.3.1 Causes of illness and disease

Every medical system whether traditional or modern has four components: theories concerning the causes of diseases (aetiology); theories concerning the disease process (pathology); the treatment of diseases (therapy); and resources available for treatment (material medica, i.e. drugs, devices and persons) (Vuori, 1982). Traditional medicine and western medicine differ significantly in their concept of the cause of illness/disease and their approach to healing as well as the healing method (Hoff and Shapiro, 1986, Gessler et al., 1995).

Western observers sometimes assume, incorrectly, that African concepts of disease aetiology and well-being are dependent upon magical and supernatural phenomena and exclude ideas of natural or physical causation (Good, 1977). In the African context, illness always has a reason; the cause of an illness or discomfort is sometimes ascribed to supernatural forces arising from angered ancestor spirits, evil spirits or the effect of witch craft (Gessler et al., 1995). The reason for an illness is the most important aspect of the disease-more important than an exposition of the disease itself (Kubukeli, 1999). Western medicine does not deal with the existential questions which for the African are most often fundamental and persistent: “why am I ill?” “Why does it affect me and not somebody else?” rather than “what am I suffering from”? For most Africans, good health means not only physical health, but also a healthy situation in everything that concerns them (Conco, 1972, Cocks and Dold, 2000). This definition is aligned with the definition provided by the WHO (1978a) that “health is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity”. This definition has not been updated since 1978 and given that the concepts of wellness and treatments which advocate for holism and the user/patient experience becoming more valued are beginning to dominate the health and wellbeing discourse, an updated definition is essential in order to allow for these emerging trends in health care.

3.3.3.2 Diagnosis of illness and disease

The initial reasons why people find alternative medicine appealing are often related to the three core principles that underlie so many of the therapies. Alternative medicines are said to be based on a more *natural, traditional* and *holistic* approach to healthcare (Singh and Ernst, 2008). However, for many patients, scientific evidence is not the deciding factor in whether or not they adopt a particular alternative therapy (Gessler et al., 1995). Singh and Ernst (2008) suggest that even if patients are aware that the overall conclusion based on all the research is negative, patients are likely to adopt a therapy if it is commonly regarded; which by definition is evidence.

In determining the cause of ‘problems’, some traditional healers consult the spiritual realm and use their dreams as a guide to diagnosing the client’s problem. However in-depth questioning of the client regarding his/her relationships and circumstances, socially and psychologically, precedes this phase (Bruce, 2002). The healer studies the patient as a whole and does not split the body and mind into two entirely separate entities (Kale, 1995, Taylor et al., 2006). He/she does not consider the patient as an isolated individual but as an integral component of a family and a community. These

aspects are sometimes missing from the western medicine model of health care and may serve to give further insights into why people choose TM.

Gessler et al (1995), described the tools of diagnosis used by traditional healers in Tanzania which were restricted to the following main categories: history of the patient, signs and symptoms, physical examination, divination and laboratory tests made in hospital which were similar to the diagnostic systems reported in (Tabuti et al., 2003a). The evidence presented describes the absence of a distinct difference in the methods employed to reach a differential diagnosis by both the traditional and western medical practitioners. For example, a comprehensive consultation includes a detailed case history, individually-prescribed and dispensed herbal medicines, clear dosage instructions and dietary and lifestyle advice (Kyomugisha, 2008).

3.3.4 Strengths of traditional medicine

It is important to develop systems through which effective health care can be made both accessible and acceptable to the people which is the goal of primary health care in low income countries that typically lack access to health care services. The easiest or most economic way of doing this is to boost and make use of existing systems and structures including but not limited to employment of the services of traditional medical practitioners only if they are effective. The first stage in this process is to identify what these systems and structures are, how they function, what they are comprised of and their safety. While it may not be the main purpose of this thesis, studies like this will present findings that may help to inform policies relating to development of systems to improve access to healthcare. Any advantages of TM should be viewed against the background of the socio economic status of developing countries, the magnitude of their health problem, and the few resources available (Sofowora, 1982) in line with this, a range of advantages including social, economic and pharmacologic are cited.

3.3.4.1 Economic advantages

Traditional medical practices are sometimes built from simple home remedies (Ataudo, 1985) and the medicine can be cheaper than modern medicine (Galabuzi et al., 2010, Agbor and Naidoo, 2011). Singh and Ernst (2008) contest this notion and state that not only do alternative therapists offer often ineffective and sometimes dangerous treatments but they also charge very heavily for these products and services although effectiveness and cost are different issues which should not be conflated. Cunningham (1988) proposed that the price increase of traditional medicines could be partly due to a

decline in their availability. This proposition is supported by a study in South Africa which reported a decline in utilisation of traditional healers' services due to the cost (Nxumalo et al., 2011) and one in Uganda where users preferred western medicine because they felt it was cheaper than TM (Tabuti, 2004). This therefore suggests that some people patronise TM because it is good and cheap while others consider it good because it is cheap and so its 'goodness' is judged based on different factors. It is difficult to say whether it is good or cheap because sometimes things that appear cheap are more expensive in the long run, thus one of the ways that 'goodness' can be measured is to conduct studies that investigate the efficacy and safety of these plants to be able to either label them as cheap or expensive.

3.3.4.2 Social advantages

Traditional Medicine is more accessible to most of the population which fulfils one of the major criteria for an effective primary health care service (Asuni, 1979, Tabuti et al., 2003a) as defined in the declaration of Alma Ata (WHO, 1978a). This is reflected in the evidence that almost 60-85% of the population in every developing country has to rely on traditional medicine to meet the health care needs of both the rural and urban populations (WHO, 2000a). This is mainly because of the shortage of hospitals, health centres and health personnel. By way of illustration, the number of physicians per 10,000 people in Uganda is 1.2, 0.4 for Somalia and 3 for Bangladesh which is diminutive when compared to the number of those in countries like the UK (27.4), US (26.7) and Norway (40.8)(WHO, 2011).

In Africa, TM enjoys a much wider acceptability than modern medicine mainly due to availability (Galabuzi et al., 2010). This could be partly due to the inaccessibility of modern medicine as mentioned earlier or the fact that TM blends more readily into the sociocultural life of the people (Maclean and Bannerman, 1982), originates from it and has a way of providing simple and acceptable explanations behind each malady. Apart from sociocultural factors the acceptance of traditional methods of therapy in a given community often depends on economic factors. Many patients seek traditional medical help because of the community belief that certain types of disease only respond to traditional cures (Van der Geest, 1997). For example in 2011 about 2000 people (mainly children) died from malnutrition in a district called Namutumba in Uganda because many parents sought the services of witch doctors who told them that the sickness could not be treated in medical facilities and was caused by eating fish, calling the disease *obwenyanja*, literally meaning small fish (Otago, 2011). This demonstrates

the wider acceptability of TM in Uganda, because although the example above is an evidently harmful practice, communities have such belief and trust in the healers, that they are willing to let them make decisions on their health outcomes sometimes to their detriment.

About 10 years ago, in order to consult a modern doctor, one had to undergo the long complicated and time consuming process of registering and undergoing various diagnostic tests (Gessler et al., 1995); seeing a nurse and then waiting in a long queue before any consultation with the doctor finally takes place. In many cases in the UK for example, there are now fee paying GP practices that will offer short waiting times but at a higher fee. In most rural areas of Uganda for instance one can sit in this queue all day and still not see the doctor either because of closing time or the need to travel back very long distances or the fact that the doctor was not able to come to the health centre or clinic that day (Mwanguzi, 2009).

3.3.4.3 Pharmacologic advantages

Traditional medicine is a potential source of new drugs as well as a source of cheap starting products for the synthesis of known drugs. Until recently, plants were an important source for the discovery of novel pharmacologically active compounds, with drugs being derived directly or indirectly from plants such as reserpine from *Rauwolfia spp* and digoxin from *Digitalis purpurea* (Singh and Ernst, 2008, Al-Qura'n, 2009, Raskin et al., 2002). Raskin et al., (Raskin et al., 2002) reports that the emphasis gradually shifted from extracting medicinal compounds from plants to making these compounds or their analogues synthetically during the 20th century. However, despite this gradual shift, the contribution of plants to disease treatment and prevention is still enormous and there is also the speculative possibility and hope that some revolutionary new drug for treating such incurable diseases as HIV/AIDS and cancer may be discovered in a medicinal plant.

Traditional medicine remedies are mostly compounded from natural products. For this reason, it has been claimed, there is a great likelihood that they are harmless (De Smet, 1991, Galabuzi et al., 2010), however some plants are toxic but still provide drugs. Also the concentration of active principle in the plant is usually small and may be further diluted when a decoction for traditional medicine is prepared. Sofowora (1982) suggests that an aqueous decoction of a plant preparation has a greater bioavailability to the body than the many synthetic drug formulations on the market today. Whilst

there is no documented evidence that such an assertion is true, it can be rationalized on the grounds that the presentation of the active ingredient in the plant in a solubilised form would probably increase absorption by the body even in the crudest forms of extraction such as teas and infusions (Balick and Lee, 2005). This is speculative and misleading when considering secondary plant metabolites such as polyphenols which demonstrate antioxidant activity but are poorly absorbed by the body (Gupta and Dixit, 2011).

Traditional practitioners' potions often come in multi-component preparations claimed to heal several ailments simultaneously. This is more convenient for the patient than taking several different tablets or mixtures (Sofowora, 1982). In addition some clients prefer TM because some forms like herbs are easier to administer than some forms of western medicine like intramuscular and intravenous therapies (Galabuzi et al., 2010, Tabuti et al., 2003a).

Development of resistance to synthetic chemotherapeutic agents is known to occur in modern medicine for example antiretroviral drugs (ARV's) (Vella and Palmisano, 2005, Hong et al., 2011) and resistance to earlier generation antimalarial medicines such as chloroquine and sulfadoxine-pyrimethamine is widespread in most malaria-endemic countries (WHO, 2012a). It is not known however, whether such resistance development has occurred with preparations used in traditional medicine. This could be partly because only a few studies have gone further than listing chemical components or basic biological or pharmacological activity and partly because traditional medical practitioners have not kept records or the limited existing studies. A further analysis of this evidence is found later in this chapter in an overview of empirical research (section 3.5)

3.3.5 Criticisms of traditional medicine

Several criticisms have been raised against traditional medicine and are presented in this section under pharmacological, diagnostic, practice criticisms and the potential threat to plant and animal biodiversity.

3.3.5.1 Pharmacological criticisms

A compelling argument against TM has been lack of scientific proof of its efficacy (Nyika, 2007, Kyomugisha, 2008, Muhammad and Awaisu, 2008). Most of the claims of efficacy are made by TMP's themselves and have not been thoroughly investigated scientifically (Sofowora, 1982, Bye and Dutton, 1991). International opinion with respect to health care standards is often highly suspicious of such health practices and health care systems, which often use 'unscientific methods' (Dunlop, 1975, Good, 1977). A classic example is seen among cancer patients who are often confronted by the intimidating prospects of surgery, radiation and chemotherapy, sometimes referred to as 'slash, burn and poison' by critics of conventional medicine (Singh and Ernst, 2008). Hence, the offer of herbal medicine is tempting because it is often marketed as a natural alternative which is both safer and more effective (De Smet, 1991).

Undoubtedly, the use of herbal remedies has had fatal consequences, but the precise number of herbal induced fatalities is unknown. A review of the potential forensic significance of Traditional Herbal Medicines by Byard (2010) found that an analysis of 251 Asian herbal products from stores in California, USA, identified arsenic in 36, mercury in 35, and lead in 24. An analysis of the Johannesburg forensic database by Stewart et al, (1999) between 1991-1995 revealed 206 cases in which a traditional remedy was implicated as the cause of death and these are only those that underwent a post-mortem which suggests that fatalities related to herbal remedies may be unreported and unrecognised. There are also websites dedicated to dissemination of information regarding the harmful effects of Traditional or herbal medicine <http://whatstheharm.net/herbalremedies.html>, but no official information is given. For example, reports about the deaths of 100,508 people from around the world within the last 50 years whose deaths were related to the patronisation of herbal medicines (2012). Without the information on the fatalities, it is very difficult for governments and regulatory authorities to make policies regarding the use of traditional medicine. On the other hand, even when traditional medicines are devoid of reported pharmacological efficacy, they may have a therapeutic effect thus remedies should not be discarded simply because they have no pharmacological effect but should be considered in their cultural context. This suggests that the effectiveness of remedies needs to be understood within the cultural context, however, any psychosocial effect cannot outweigh any observed or reported toxicity to vital organs or functions (De Smet, 1991).

Another major criticism levied against TMP's is the adulteration of their remedies with conventional pharmaceuticals, deliberately introduced in order to obtain the desired effect (Asuni, 1979, Sofowora, 1982, WHO, 2008, Byard, 2010). This has been reported by Street in South Africa (2008). To illustrate this further, Siegel (1977) reported that Ginseng preparations available in USA are sometimes adulterated with cheaper *Mandragora officinarum* (scopolamine) and *Rauwolfia serpentina* (reserpine) and *Cola* species. The same study recounted a phenytoin poisoning coma which occurred in an epileptic patient who had ingested a Chinese herbal preparation that was promoted as being a pure Chinese medicine for controlling seizures (Lau et al., 2000). In these cases, the product is still viewed as natural and at the same time it is very likely to be effective (Singh and Ernst, 2008). This practice is very dangerous because aside from the ethical and legal consequences, the patient is unknowingly exposing themselves to a potential hazard and unknown quantities of drugs. The drug might interfere with other medicines being taken, causing adverse drug reactions (Street et al., 2008). Alternatively in agreement with Singh and Ernst (2008), a patient might turn to a herbal remedy because he or she is allergic to a particular pharmaceutical, but if the herbal remedy is contaminated with that same pharmaceutical, then the patient is duped into taking the very same compound that he or she is trying to avoid.

A major assumption is made that herbal medicines are safe (or carry no risk for harm) because they are natural or traditional and have been in use for a very long time (Fennell et al., 2004, Calixto, 2000, Fabricant and Farnsworth, 2001). However, traditional medicines and practices can cause harmful, adverse reactions if the product or therapy is of poor quality (Freeman and Motsei, 1992). Sofowora's (1982) suggestion that the exact doses of traditional herbal remedies are less critical than those for modern drugs as the concentration of active principle in a portion is very small and that large volumes need to be taken to obtain any response is very misleading. According to Bye and Dutton (1991) the use of herbal remedies has had fatal consequences, as the precise number of herb induced fatalities is unknown. A study by Stewart (1999) in South Africa found that in some cases, the cause of morbidity or death, ascribed to a traditional remedy, was due to a substance which was neither a herbal nor a traditional remedy in the accepted sense for example arsenic, mercury and lead (Byard, 2010). In agreement with WHO (2008), there is need for increased patient awareness about safe usage of medicinal plants, as well as more training, collaboration and communication among providers of traditional and other medicines. The misconceptions regarding the safety of TM also warrants increased public and

community sensitisation and education regarding the potential risk of harm. This does not only apply to Africa, for example the new European Traditional Herbal Medicinal Products Directive (THMPD) 2004/24/EC came into effect on 30 April 2011 banning hundreds of traditional herbal remedies used in the EU, this directive was issued in order to protect consumers from possible damaging side-effects of over-the-counter herbal medicines (MHRA, 2012). According to a BBC news article by Hughes (2011), this means that only long established and quality medicines will be sold. This reinforces the point regarding the need for more open communication between different health practitioners and tighter regulation and evidence of safety and efficacy to prevent possible deaths due to drug interactions and self-medication.

Evidence suggests that the potions administered in herbal medicine are not standardized for example the dosages given by some of the TMP's are very imprecise (Street et al., 2008, Elujoba et al., 2005). However, a study carried out by Fassil (2005) in Ethiopia revealed that traditional healers are not entirely devoid of measurements and standards. For example, most informants demonstrated awareness of the toxicity of some plants and specific plant parts when administered in large doses. Rudimentary measurement units are routinely used to measure the plant part as well as the amount of water used to prepare the plant treatment. For instance the use of the traditional Ethiopian coffee cup as a measure for the amount of water in preparing an aqueous extract from crushed leaves, as well as for the administration of the treatment/remedy (Teklehaymanot, 2009). Another challenge is that the dosages are not given according to weight and age as would commonly be done in Western medicine. Sofowora (1982) argues that this criticism is not always valid as healers give different doses for adults and children but do not necessarily specify the age although he does provide clarification on how the doses are determined whether by weight or size of the patient or by severity of the condition. The knowledge of the dose is one of the most important aspects of medication administration. As an illustration, when patients are given medication information leaflets in the Western model of care, they will often be told about the dose of the medication they will receive which helps them make an informed decision about their health. Given the characteristics of the population that use TM in Africa and the low literacy levels, one might wonder whether this information is useful or how it could be received or used. If studies are carried out to find out the doses that are used and then further biological tests carried out to determine appropriate doses for weight, sex and age, this might then be translated into doses that are easy to understand for the population, however these studies are currently lacking.

3.3.5.2 Diagnostic Criticisms

Some patients see traditional healers exclusively, but many others see their healer before, during, or after treatment by a modern doctor. Seeing a traditional healer before seeking modern treatment may result in delay in diagnosis and treatment which may be fatal; receiving treatments simultaneously may lead to drug interactions, and seeing a traditional healer after modern treatment could interfere with follow up care (Kale, 1995, Van Der Kooi and Theobald, 2006, Mahonge et al., 2006, Langlois-Klassen et al., 2008). For instance, garlic, which is used by some people living with HIV/AIDS (PLWHA), has been reported to lower blood levels of saquinavir, an antiretroviral medicine (Piscitelli et al., 2001) and St. John's Wort has also been reported to negatively affect indinavir, another antiretroviral drug (Piscitelli et al., 2000). These are only two of the many examples caused in part by lack of awareness among the general public that herbal medicines carry risks (Adewunmi and Ojewole, 2004, Singh and Ernst, 2008) and fear of the repercussions since alternative therapies are still not an acceptable form of treatment in many countries. This may also result because many people are reticent to admit either using or administering traditional remedies. Bye (1991) reports that some doctors, particularly paediatricians, express anger at the patients, who administer herbal remedies to healthy babies, supposedly resulting in the child's death. One could argue that in such cases the cause of death is incorrectly ascribed, since there is usually no evidence of the cause of death from a post mortem, the blame should not be placed wholly on the TMP's or the parents but systems need to be put in place to ensure that any deaths related to use of herbal remedies should not go unnoticed. These systems are developed based on evidence from studies like these and following on from the findings of such studies, mortality registers related to herbal medicine could be established at hospitals and health centres. However, before all this is initiated, a lot more needs to be done to improve communication between western health professionals, TMPs and patients as a first step to identifying, reducing and eventually preventing these fatalities.

Another shortcoming of traditional medicine is the nature of the diagnosis often given by the practitioners. A diagnosis of stomach trouble could mean indigestion, an ulcer, cancer of the stomach or many other possibilities. As a result, therefore, the practitioner tends to treat the symptom rather than the disease, which can sometimes lead to further complications (Sofowora, 1982). Additionally in agreement with Dunlop (1975), even when there may have been appropriate diagnoses or treatment, secondary infections and other complications may arise due to poor sanitary conditions

regarding the preparation of the remedy, which, given the level of technology and knowledge of the traditional healer, may further endanger the health of the individual.

3.3.5.3 Engagement in Occult practices

The intangible aspects or occult practices of traditional medicine cannot be verified scientifically and are therefore regarded with suspicion by modern healthcare practitioners (Good, 1977). In the same way witchcraft and evil aspects of traditional medicine also discredit this form of medicine (Sofowora, 1982). To illustrate this briefly, among the Karanga, herbal treatment is not considered effective before a particular ritual is performed (Shoko, 2007) thus the patients may associate the improvement in their condition with the rituals performed and not the efficacy of the actual remedy administered.

Some complaints have arisen about the equipment available to the healers. The informants reported that the medicines are wrapped in papers, banana leaves or packed in bottles found around the homestead. This means that the medicines cannot be used safely for a long time as there is no way of judging whether the medicine has expired or not (Gessler et al., 1995). Patients also expressed dissatisfaction with the diagnostic methods that are based only on the history of the condition as opposed to western medicine that employs advanced equipment (Mahonge et al., 2006), this suggests that patients want a blended approach to healthcare where they can benefit from the strengths of both models of care.

A placebo is medicine or a procedure prescribed for the psychological benefit to the patient rather than for any physiological effect. A substance that has no therapeutic effect, used as a control in testing new drugs or a measure designed merely to humour or placate someone (Oxford Dictionaries, 2011). The placebo effect has been used to explain why so many people experience some form of recovery soon after taking an alternative treatment; this is the phenomenon where the patient responds positively to a treatment simply because of a sincere belief that the treatment is effective i.e. the power of suggestion can improve health (Pilcher, 2009). Thus a placebo is that symbolic aspect of a healing intervention responsible for changing a person's condition (Straneva, 1991). The placebo effect is a very real phenomenon that is potentially very powerful, providing everything from pain relief to boosting a patient's immune system (Singh and Ernst, 2008).

3.3.5.4 Potential threats to local knowledge and plant sustainability

Another disadvantage of herbal medicine use is the possible damage to nature itself. The harvesting of wild plants for medicines is a genuine threat to the survival of some species. Some TMPs offer remedies that contain animal products such as, tiger bone, rhino horn, and in these cases the trade is pushing species to the brink of extinction. Medicinal plant gatherers collect their materials throughout the year to supply the persistent demand for medicinal plants. If mature plants or trees cannot be found, then the younger ones suffice (Street et al., 2008). It is ironic that those who seek natural herbal cures often do so because they have a love of nature, yet their desire to be at one with nature might be destroying it (Singh and Ernst, 2008). The problem today and for the immediate future, is that enormous commercial pressures remain to exploit herbs by isolating the active ingredients and marketing them sometimes without even giving thought to the effect this might have on the very delicate ecological balance which the plants help to maintain (Inglis, 1979). Herbal materials for products are collected from wild plant populations and cultivated medicinal plants; the expanding herbal product market could drive over-harvesting of plants and threaten biodiversity. Poorly managed collection and cultivation practices could lead to the extinction of endangered plant species and the destruction of natural resources (WHO, 2008). Due to the acute shortage and great demands for these plants, the time factor is often ignored and the plants are harvested and collected before they are mature enough which often leads to over dosing or under dosing (Stangeland et al., 2008) as well as threatening species viability.

3.4 The practice of traditional medicine

This section examines the practice of TM and for the purpose of this study, focuses mainly on traditional herbalism. It also helps the reader gain an appreciation of why a large percentage of the population relies on TM and several reasons why others are reluctant to use TM.

3.4.1 Traditional herbalism concepts

Singh and Ernst (2008) define traditional herbalism as the use of plants and plant extracts in the treatment and prevention of a whole range of diseases. A herbal prescription is formulated to contain certain measured quantities of herbs, observations of the prescription's effects are then noted and if the results are not completely satisfactory then the prescription is re-formulated (VanMarie, 2002).

Traditional herbalism is a very important source of health care and based on local plants and traditions. Today, herbal products are being used worldwide in a variety of healthcare settings, and as home remedies (Fennell et al., 2004). Part of this thesis (Section 4.7) will involve a laboratory analysis of selected medicinal plants for relevant biological activity to validate the use of the herbs mentioned for wound healing in Uganda from a Western scientific viewpoint. Unlike the supernatural component, herbalism is a branch of TM based on the premise that some herbs have botanical components with therapeutic properties (Nyika, 2007).

While other therapies have struggled to be accepted by mainstream medicine, partly because their underlying philosophies conflict with the Western scientific understanding of anatomy, physiology and pathology, the prejudice against herbalism is diminishing in some countries (Singh and Ernst, 2008). Plants contain a complex cocktail of pharmacologically active chemicals, so it is not surprising that some of them can impact on ones well-being. Herbal medicines have been gaining popularity in Western countries in recent years; Chan cites an estimated budget in Europe of £300 million and a steady 10% increase in spending on botanical remedies in the United States alone (Chan, 2003). Consequently, herbal medicine has been embraced by science, to a far greater extent than some of the other CAM therapies (Singh and Ernst, 2008, WHO, 2008). As an illustration, the practice of herbalism has provided the initial active agents for the 'scientific healer' in drugs that have come to form the first line treatment in many disease conditions for example aspirin, digoxin and artemether.

3.4.2 Fundamentals of herbal medicines

Herbal medicines exhibit some peculiar characteristics namely: the active properties are frequently unknown; standardisation, stabilization and quality control are feasible but not easy, the availability and quality of raw materials are frequently problematic and the empirical use in folk medicine is a very important characteristic. In addition, well-controlled, double blind clinical and toxicological studies to prove their efficacy and safety are rare (Adewunmi and Ojewole 2004). They have a wide range of therapeutic uses and are sometimes preferred for the treatment of chronic ailments (Calixto, 2000), thus findings from studies like the current one will build the science base for various aspects of herbal medicine.

3.4.3 Custodians of local herbal knowledge

From a western perspective, the utility of plants stems from the pharmaceutical properties of plants. Geissler et al (2002) suggests that the power of medicinal plants resides partly in relations between place and people, dead and living, past and present, and that people have special ties to plants of their place. As an illustration, townspeople receive medical supplies from rural homes and even people abroad will still consult healers of their culture (Geissler et al., 2002) for example, migrants of a particular ethnic group will consult healers from that ethnic group. In the past, it followed that plants were nobody's individual property. However recently, there has been much discussion about ownership and protection of indigenous knowledge. Medicinal plants can be picked freely and TMPs adapt and draw on the experience of others and they readily share knowledge about phytomedicines among themselves (Tabuti et al., 2003a, Geissler and Prince, 2009)

3.4.4 Herbalists

African herbalists have a wide knowledge of herbal remedies and this term generally refers to those who collect/ prepare/ administer herbs, roots, animal skins and bones and/or sell these to witchdoctors and traditional healers or to the general public (Conco, 1972). Among the Karanga people, the administration and prescription of drugs and herbal medicines is the domain of the herbalist. However, this is also practiced by elder members of the society who may not be as skilled as the herbalists but are viewed as guardians of the knowledge, encouraging the idea of corporate responsibility for the benefit of society (Conco, 1972, Shoko, 2007, Tangwa, 2007). A study by Oyebola (1981), found deep rooted solidarity and communication among Yoruba traditional

healers in Nigeria, this finding agrees with a report by Tabuti (2003a) which reveals that in central Uganda, traditional medicine practitioners adapt and draw on the experience of others which is significant as part of the communal or sharing culture/tradition still valued and exhibited in many parts of Africa. They readily share knowledge about remedies amongst themselves and either exchange this knowledge freely or pay for it. Knowledge of concoctions may be purchased, or a healer if he/she is treating a patient with a condition he/she does not know the cure for, may refer and accompany his/her patient to another healer who knows the cure and learns from there; hence TM also has a referral system in this context. On the contrary, Van der Geest (1997) and Nelms & Gorski (2006) found that many traditional healers consider their medical knowledge as personal property which they protect by keeping it secret and only a few people such as a fully paid up apprentice, or a fellow TMP are allowed to know their secret. Tabuti, Dhillon and Lye (2003a) suggest that the secrecy may result because healing is a source of income to practising TMPs and thus not many are willing to disclose information about their remedies to strangers; however some are more open and are willing to disclose information especially on phytomedicines that are well known.

Herbalists use several types of medicines which range from syrups, creams, powder, to leaves and liquids. Some powder medicines can be applied under the skin after small cuttings are made with the use of a razorblade. Though practices may vary between herbalists in different countries, the overall goal however, is to treat disease by using medicinal plants or other substances (Kyomugisha, 2008). The practitioners take advantage of different indigenous animals, birds and plant species to harvest and prepare their therapies. Dove (2010) distinguishes between two broad categories of healing in the usage of herbal remedies, "*those affiliated with the use of the shrine and those not*".

Herbalists make diagnoses on the basis of physical or mental symptoms and are concerned with medicines *per se* and with the functions of the human body (Green and Makhubu, 1984). Herbalists act more as primary care physicians and are particularly efficient with psychosomatic symptoms (Perrott, 2003). Unlike witchdoctors for example, herbalists are more likely to choose their profession voluntarily, although a parent or relative may make the initial decision or suggestion (Green and Makhubu, 1984, Tabuti et al., 2003a) this is because a call to be a witchdoctor is more spiritual. There is a thin line between practicing herbal medicine and mysticism/divination (sometimes referred to as *juju*, or witchcraft), with many local herbalists or TMPs dabbling in the latter from time to time to complement their herbal business (Onen, 2011). The result of this is that,

on account of certain herbal medicines registering some effectiveness in dealing with certain ailments, people will also go on to believe the more bizarre claims of supernatural power made by these practitioners.

3.4.5 Characteristics of TM practitioners

3.4.5.1 The decision to become a TMP in Africa

The decision to become a TMP varies; for some it is a deliberate choice while others are chosen by spirits. In addition, others become traditional healers following the experience of having an illness cured by traditional medicine (Gessler et al., 1995). According to Kubukeli (1999), who is a practising traditional healer in South Africa, in the black culture of Africa one cannot become a traditional healer until they have experienced a call to “priesthood” or are “called to heal” (Alver, 1982, Bruce, 2002). This is recognised as an illness, the symptoms of which are caused by ancestral spirits who wish to possess the future traditional healer (Nelms and Gorski, 2006, Dove, 2010). Once the call to priesthood is diagnosed, the patient is immediately placed under the care of the traditional healer. This placement therefore captures healing in a religious/spiritual domain which restricts knowledge to a few. This model of care thus incorporates aspects of treating illnesses as well as mentoring.

Traditional healers are an integral part of their people and society (Campbell-Hall et al., 2010). They are on average of the same social class as their patients (Staugard, 1982, Alver, 1982). They know the way of the people (Kale, 1995, Tabuti et al., 2003a). Healers are more accessible geographically and provide a culturally accepted part of the health-care delivery system (Elujoba et al., 2005, Peltzer and Mngqundaniso, 2008, Galabuzi et al., 2010).

3.4.5.2 The transmission of a traditional healing knowledge

The majority of TMPs learn the craft of healing by apprenticing under senior TMPs who are usually relatives. The TMPs in turn train other interested people for a fee. The apprenticeship period lasts about 6-12 months. It is oral and during the whole period of training, the prospective healer lives with the trainer. Some people do not undergo any form of training prior to becoming TMPs but get their powers and healing concoctions from dreams (Tabuti et al., 2003a, Tsey, 1997, Cocks and Dold, 2000, Yahaya et al., 2004). It is important to note that both the ‘non-spiritually based’ and the ‘spiritually based’ practitioners use herbs, roots and other animal products for treatment; the main

difference between the two types of practitioners is the belief systems. The 'non-spiritually based' practitioner tends to look upon their healing plants for what they are, similar to the biomedical approach. The 'spiritually based' practitioner, on the other hand, believes that you cannot treat the illness without adequately dealing with the spiritual factors that are the cause of the disease (Tsey, 1997). There is a certain amount of competition and mistrust among the different categories of healers. For example, spiritual healers often say that herbalists are untrained and unguided by spirits, while herbalists claim that the healers go beyond their divining/diagnostic function in trying to cure with herbal medicines that they inadequately understand (Green and Makhubu, 1984).

3.4.5.3 Payment for services rendered

Traditional healers take payment in kind or are willing to accept instalments if the patient is unable to pay the whole sum immediately (Bannerman et al., 1983, Mahonge et al., 2006). According to (Geissler and Prince, 2009), healers who charge fixed 'prices' for their services, rather than 'just being given something', are subject to suspicion. For example, when one healer bottled a remedy and sold it on the open market other healers complained. A study in Uganda found that some TMPs (50%, $n = 47$) refer patients to hospitals for conditions they feel they cannot cure, or some TMPs specialised in treating spiritual conditions will treat the non-clinical aspect of a disease and refer the clinical conditions to biomedical workers (Tabuti et al., 2003a) once again suggesting a blended approach of care.

3.4.5.4 The length of practice of traditional medicine

Tabuti et al (2003a) demonstrated that TMPs have extensive experience and 88% of them had practised TM for more than 10 years in central Uganda. In Tanzania, a practitioner saw between 1 to 200 cases per week in total (Gessler et al., 1995) while in Ghana they saw between three and five 'new' cases per week (Tsey, 1997). This however, does not imply that for the rest of the week the practitioner was free to do other things. On the contrary, once treatment commenced the client remained under the 'care' of the practitioner even long after active treatment was complete. This meant that at any given time a practitioner had several clients attached to them, clients being classified as under 'treatment' or under 'care' depending on their conditions (Tsey, 1997). Both these classifications fall within the realm of what can be viewed as traditional professional practice.

Findings from a study in Eastern Uganda indicate that the practice of TM is dominated by mature men over 40 years 85% (n=47) (Tabuti et al., 2003a). These findings are supported by findings from a study in South Africa that the average age of practitioners was 40 but the majority (78%) were women (Sorsdahl et al., 2010). This concurs with the general assumption that the elders within a community are the experts in the local ecological knowledge or the local knowledge keepers in medicinal plant use (Elujoba et al., 2005, Fassil, 2005, Shoko, 2007). However a study in Canada on the importance of identifying 'experts' when researching local knowledge (Davis and Wagner, 2003) expected the community to identify the elderly as the custodians of this knowledge among that particular community, but were surprised that this was not the case. They concluded that in carrying out such studies, the factors influencing local knowledge expertise and specification need to be understood so that the actual experts are selected.

3.4.6 Types of traditional medical practitioners healers

It has become tradition in Africa to refer to medical practitioners outside the realm of biomedicine as 'traditional healers'. The term is misleading because it suggests that there is a more or less homogeneous body of medical thought and practice (Van der Geest, 1997). It groups together a constellation of people who do not necessarily have much in common culturally, socially, or even professionally (McMillen, 2004).

A study by Kale (1995) in South Africa makes a distinction between two different types of healers; "The ones who deal with the psychological aspects (witchdoctors and spiritual healers) '*Isangomas*' and those who dispense medicines, (herbalists, bonesetters, traditional birth attendants) '*Inyangas*' (p1182). This division is in agreement with reports from Ghana (Dove, 2010). Conco (1972) also adds a category of individuals not practising as full time traditional doctors (MacCormack, 1982) but known to have some knowledge or skill to treat particular illnesses of natural causation and also a group of persons who have some knowledge of popularly recognised herbs or roots. In this thesis, these individuals shall be referred to as local herbal knowledge experts.

Modernization has resulted in increasingly role specialised traditional healers; broad non-mutually exclusive categories of traditional healers can still be made (Edwards, 1986). Categories include herbalists also called traditional pharmacists by Tabi et al (2006), bone setters, TBAs, divine/spiritual healers, cuppers (Staugard, 1982), witchdoctors/seers/diviners, cultists, psychotherapists, circumcisers, among others;

functional overlap of specialisations is not uncommon (Good, 1977, Hevi, 1989, Bruce, 2002). Tabi et al (2006) also include a unique category of plant drug peddlers who travel to towns and villages, as well as sell herbal medicines at work places, bus stops and at the streets; these peddlers are not necessarily the ones that manufacture the remedies. The main categories of healers in Uganda and the majority of Africa today are herbalists, bone setters (herbalists specialised in the setting of fractures (Oyebola, 1980b)), traditional birth attendants (community attendants at births who provide care at puberty, during pregnancy, labour, postnatal period and give advice about children (Nyanzi et al., 2007)). They also include religious healers (a distinct category in Uganda) who use prayer to heal different ailments or by the performance of sacrifices (Kyomugisha, 2008)) and witchdoctors. Seruwagi (2005) defines witchcraft as the practice of magic especially for evil purposes; the practitioners of witchcraft are known as witchdoctors (Kyomugisha, 2008).

3.5 Overview of empirical research on plants and wound healing in Africa

African herbal medicine (AHM) is as diverse as the cultures in Africa but lacks the strong written tradition and standardisation of traditional oriental practices, which makes research (Homsy and King, 1996) or policy development on TM a challenge. WHO (2000a) suggests that the reasons for the lack of empirical research data are due not only to health care policies, but also to a lack of adequate or accepted research methodology for evaluating traditional medicine. This section presents findings from a systematic search of the literature for empirical evidence related to plants and wound healing in Africa. This scoping literature review sought to answer the following questions:

1. What research methodologies are currently employed and what is the currently recommended practice for conducting research in TM?
2. What is the most appropriate design for conducting studies in TM?
3. Are there any documented approaches for the selection of medicinal plants?
4. What information exists regarding the definition and classification of wounds by traditional healers in Africa?
5. Have any studies clearly presented findings about the preparation and administration of medicinal plants? What do they report about the doses?
6. What are the relevant tests recommended for each phase of the wound healing process and what evidence of this tests exists in Africa?

In order to answer these questions, this overview of the empirical evidence begins with a very brief look at the history and status of TM research methodologies in Africa, and then provides a brief summary of empirical research in the field including: research designs employed, criteria for selection of plants, the local definition and classification of wound healing, preparation and administration of medicinal plants for wound healing and briefly describes the wound healing process and relevant biological tests. The section concludes with a highlight of the gaps identified from the literature and finally an argument that this summary of the current state of empirical evidence contributes to the factors that provide the rationale and justification for this thesis.

3.5.1 History and status of TM research methodologies in Africa

The first serious discussions and analyses of traditional medicine in Africa emerged during the 1960s, before the first ever Organisation of African Unity (OAU) symposium on Traditional Pharmacopoeias and African medicinal plants. In 1968 research in this field was largely uncoordinated and the findings could not be applied in practice. It was led mainly by chemists who were more interested in isolating and characterising organic compounds from plants without bothering to test whether such compounds had biological activity or not (Sofowora, 1980, Raskin et al., 2002). Most studies were driven by a specific interest in the properties of particular medicinal plants and it was not pertinent to the study whether the plant extraction did not have any ethnomedical use or therapeutic activity. As an illustration, according to Fassil (2005) much of the research on Ethiopian TM and medicinal plants prior to 2005 was carried out in a compartmentalized manner with researchers from various disciplines pursuing only their interests in the subject with relative isolation.

More recently, studies on medicinal plant use have moved from the chemically driven model but are still predominantly focused on identification of biologically active constituents with few undertaken from a social science perspective thus the cultural emphasis is frequently neglected (Edwards et al., 2005). Due to the resulting overall 'plant focus', only cursory attention has been paid to the local socio-cultural context in which many medicinal plants are used by ordinary indigenous people and how indigenous peoples conceptualise the relations between indigenous knowledge and knowledge produced by western science, and how they use those forms of knowledge in their daily life (Etkin, 1981, Prance, 1991, Fassil, 2005, Calvet-Mir et al., 2008). These arguments affirm the position adopted by WHO (2000a) that in conducting and evaluating traditional medicine, knowledge and experience obtained through the long history of established practices should be respected. It is against this background that

the literature on the empirical research carried out with medicinal plants used for wound healing in Africa is reviewed.

3.5.2 Research design/methods used

In the early days of anthropology, monographs on 'exotic peoples' always included lists of names of plants used locally either for food or medicinal purposes (Bernardi, 1980). With the development of more intensive types of research, the attention of anthropologists turned to the ethnomedical aspects of the use of plants rather than the mere recording of their botanical names with a few notes on their actual use (Etkin, 1993). As part of the recommendations from the OAU symposium, it was recommended that research centred on finding scientific evidence for the claims of traditional herbal medicine was essential and that a multidisciplinary type of research involving anthropologists, pharmacognosists, chemists, pharmacologists and botanists were necessary (OAU/STRC, 1968). Close to fifty years later, the evidence suggests the need for integration of multi and interdisciplinary approaches. This might demand development and synthesis of methods so that different disciplines can communicate to each other to provide a fuller understanding of traditional medicine, perhaps currently best articulated in terms of mixed method approaches.

From the literature currently available regarding the uses of medicinal plants in Africa, only (Nagata et al., 2011), seeking to identify the medicinal plants used by persons living with HIV/AIDS in Kenya describe the use of a mixed methods study design. It is not clear however what the working definition of the mixed methods design for this study is or whether this is the use of multiple methods rather than the adoption of the approach to guide the study. It is clear however that the mixing of methods takes place only during the data collection phase with proposed quantitative analysis methods only. The study involved the collection of ethnographic qualitative data (participant observation and in-depth open ended interviews) and qualitative data (semi-structured questionnaires) (Nagata et al., 2011). The results on the other hand include both numerical data and narratives from the herbalists' interviews. Tabuti *et al* (2003a) describe their methodology as a *combination of biological and social science approaches that were used to collect the data* (p121). All the other studies simply list different methods that were employed in their studies and although some of them list multiple methods employed, they do not adopt any methodological stance. This therefore reveals a gap in the literature and highlights the first new aspect that this thesis adds to the body of knowledge as it will be the first in Uganda and one of the first

in Africa explicitly using the mixed methods approach for the study of plants and wound healing and traditional medicine in general.

3.5.3 Use of multidisciplinary teams

Not many studies report the use of a multidisciplinary team to make decisions on the identification of the plant species, which plants to investigate and what chemical or biological activity investigations to carry out. In this context, multidisciplinary teams are used for the specialist knowledge of the team members, to connect disciplines and call on different skill sets from the various disciplines involved in the conduct of ethnomedical studies. An ethnopharmacological study in Ghana mentioned using a *team* without being specific and later mentioned a curator/botanist (Agyare et al., 2009), while one in Mali reports the conduct of interviews with a translator knowledgeable in both the local names and the Latin names of the plants in addition to a local medical doctor to correlate the description of the 'wounds' with conventional medical terms (Inngjerdingen et al., 2004). The only study that describes the use of a multidisciplinary team in Uganda is by Stangeland (2011) where semi-structured interviews were conducted by a botanist, a pharmacologist and a physician.

This thesis involves a multidisciplinary team for data collection and selection of appropriate plants for phytochemical tests. The composition of the team and the different disciplines represented are described in section 4.6.4. Reflections on the use of a multidisciplinary team can be used to inform the body of knowledge about the advantages and limitations of this approach since the few studies that used a team neither present nor discuss this information.

3.5.4 Selection of plant species

According to Fabricant and Farnsworth (2001), the number of higher plant species on this planet is estimated at 250,000 (Ayensu and DeFilipps, 1978). By the year 2000, only about 6% had been screened for biologic activity and a reported 15% had been evaluated phytochemically (Verpoorte, 2000). Fabricant and Farnsworth (2001) speculate that these numbers will increase because of the advancement in available screening methods but that the primary discriminating factor in evaluating one plant species over another is the approach researchers will employ to finding leads for discovering new drugs. According to Elisabetsky and Demoraes (1990) and Fabricant and Fansworth (2001), there are several ways to approach the selection of medicinal

plants. There is the random selection followed by chemical screening, chemo-taxonomical where species are selected according to a given chemical category of substances in a genus or family, random selection followed by one or more biological assays, and follow up of ethnomedical uses of plants also called the ethnopharmacological approach in which selection is based on their therapeutical use by an ethnic group.

The information required includes the currently accepted Latin binomial name and synonyms, vernacular names, the parts of the plant used for each preparation, the administration, in what dose and any contraindications and adverse effects, and detailed instructions for agricultural production and collection conditions according to each country's good agricultural practice (Souza Brito, 1996, WHO, 2000a). These kind of data provide valuable information to the pharmacologist in selecting the appropriate model for the investigation of species and the phytochemist who will isolate the active substances (Elisabetsky and Demoraes, 1990); a relevant starting point therefore would be to understand who uses traditional medicine and how researchers in one of the many areas of biomedicine can get useful information about this use, which will guide the selection of medicinal plants for more detailed study (WHO, 2000a, Andrade-Cetto and Heinrich, 2011).

The ethnopharmacology approach of selection of species offers the opportunity to discover prototypes or new structures with new activities (Fabricant and Farnsworth, 2001) but there are some considerations that must be taken into account when using this approach. One immediately obvious issue is that each ethnic group has its own concepts of health and illness as well as different healthcare systems (Kleinman, 1978). It is suggested that in order to allow the rational use of these medicinal plants, they must be 'translated' into the biomedical system and that this 'translation' requires experts with a biomedical background as part of the field team (Zethelius and Balick, 1982, Etkin, 1993).

This suggestion does not explain what is rational about trying to understand one health care system based on parameters created by another system whose practice is based on a different world view. This world view differs in terms of values, characteristics, sharing of knowledge, training, calling and understanding of the theories behind the cause of illness among others which might also make it a limitation. However, the inclusion of the biomedical expert as part of the field team might counter this argument if he/she provides a biomedical 'translation' in the context of the community from which the ethnomedical information is obtained.

3.5.5 Local definition and classification of wounds

If a community has rich local knowledge which has accumulated over a long time, such knowledge should be collected, documented and disseminated (Mahonge et al., 2006). This is a good approach as it ensures that this knowledge will not be lost with the future generations. On the other hand, even though this approach may change one of the major characteristics of TM which is, that knowledge is passed on orally from generation to generation, it will not change the essence of TM. No Ugandan study currently contains a local definition and classification of wounds; however, a few studies have been carried out on plants and wound healing in Africa that have defined wound healing from the healer's perspective. Therefore, one of the intentions of this thesis is to provide a definition and classification of wound healing from practitioners of TM in South western Uganda.

An exploration of the evidence revealed five papers which focus specifically on plants and wound healing effects in Africa, however only two give some insights into the existing local knowledge by inquiring about the practice of traditional medicine rather than focusing on the plants used for wound healing alone. This scoping review was different from the literature review that followed in Chapter 4 (section 4.5) in that it answered questions which served to identify gaps in the literature and thus helped to frame the scope of this study while the literature review provided data that informed the other two phases of data collection as part of the mixed methods approach and employed systematic techniques.

An ethnobotanical survey of plants used for wound healing in Mali (Inngjerdigen et al., 2004) revealed that traditional healers possessed a categorisation system of wounds according to the origin of the wound, the localisation and whether the wound is old or new. An old wound is one that is older than a year and the healers claim that such wounds are provoked by a curse. The healers also defined a wound as an ailment where blood is present and included conditions like stings where the patient might scratch and cause a wound. Blood in the faeces or urine are seen as signs of internal wounds. Agyare et al (2009) obtained similar findings in Ghana with the healers defining a wound as the result of damage to the skin caused by sharp objects, burns, microbial infections, fractures, non-healing wounds, bites and stings. The healers in Ghana also consider peptic ulcers and parasitic infections of the skin as wounds and associated non-healing wounds with spiritual causes. As this will be based on comparison with only two studies, any comparisons made can only be speculative.

Both studies were carried out in West Africa and it will be interesting to compare these findings with those from this thesis (East Africa) in order to determine whether there are disparate systems or local knowledge that precludes a consensus. Only one study reported the objective of therapy of these plants as first aids in the washing of the wounds, extraction of pus, coagulants and to prevent infection of the wounds (Inngjerdingen et al., 2004).

3.5.6 Preparation and administration of plant remedies for wound healing

Some research studies from Uganda do not merely present an inventory of the plants used and their medicinal uses but also include the modes of preparation and administration (Tabuti et al., 2003b, Okello and Ssegawa, 2007, Katuura et al., 2007a, Hamill et al., 2000, Kamatenesi et al., 2011, Lacroix et al., 2011, Namukobe et al., 2011, Ssegawa and Kasenene, 2007, Kamatenesi-Mugisha and Oryem-Origa, 2005, Kamatenesi-Mugisha and Oryem-Origa, 2007). In addition to the mode of preparation and administration, Stangeland et al (2011) include a section on reported relevant ethnomedical uses from the literature of the plants they found in their study in Western Uganda.

A study on plants used for wound healing in Mali (Inngjerdingen et al., 2004), an ethnobotanical study of plants used for wound healing in South Africa (Grierson and Afolayan, 1999b) and an ethnopharmacological survey of plants used for wound healing in Ghana (Agyare et al., 2009) also present a clear description of the preparation and administration of the medicinal plant therapies. Others from Africa include Zimbabwe (Chinemana et al., 1985, Maroyi, 2011, Kambizi and Afolayan, 2001), Madagascar (Novy, 1997), Ethiopia (Wondimu et al., 2007, Teklehaymanot et al., 2007, Abebe, 1986, Teklehaymanot and Giday, 2007), Zambia (Verzár and Petri, 1987), Nigeria (Etkin, 1981, Ajibesin et al., 2008), Tanzania (Maregesi et al., 2007), Guinea (Magassouba et al., 2007), Kenya (Jeruto et al., 2008, Geissler et al., 2002, Nagata et al., 2011, Njoroge and Bussmann, 2007b), Somalia (Samuelsson et al., 1991), Mozambique (Bruschi et al., 2011). From the study years it is evident that it is only relatively recently that researchers started collecting data that incorporates the modes of administration and administration of plant remedies used in Africa.

The studies mentioned above reported the use of the plants in the form of poultice (fresh leaves are ground), decoction, powdered material, washings, and enemas and as gargles for mouth sores.

3.5.7 Recommended doses of plant therapies for wound healing

It is important to note that only Hamill *et al* (2000), Okello and Ssegawa (2007), Kamatenesi *et al* (2011), Lacroix *et al* (2011) and Namukobe *et al* (2011) from Uganda attempt to describe the recommended doses of the plant therapies. It is classified as an attempt because they do not present doses for each remedy and it is assumed that these were not provided or not known. Only study reports from Swaziland (Amusan *et al.*, 2002) and Cameroon (Noumi and Dibakto, 2000) contained very precise doses for each plant remedy although the measurement scales were not validated. One plausible explanation is that the healers don't know these themselves which only serves to reinforce the criticism of traditional medicine as lacking standardised potions and engaging in prescription of imprecise dosages (subsection 3.3.5.1) which means sharing good practice for the 'greater good' of patient outcome will be very difficult.

3.5.8 The wound healing process and relevant biological tests

3.5.8.1 The pathophysiology of wounds

Wounds are defined as physical injuries that result in an opening or break of the skin according to the Oxford Dictionary (2011). In normal skin, the dermis and epidermis exist in a steady balance of many complex and interdependent components, forming an external barrier against the environment (Nguyen *et al.*, 2009). According to the Oxford dictionary (2011), a wound results when this barrier is broken. Once the structural integrity of the skin is compromised, the underlying blood vessels are disrupted and the wound healing process is immediately set in motion. The traditional model of wound healing involves continuous cell-cell and cell-extra cellular matrix (ECM) interactions that allow the process to proceed in four sequential phases; haemostasis, inflammatory, proliferative and remodelling phases and although they sound like isolated and discrete activities, are dynamic and overlapping (Kumar and Leaper, 2008).

1. The blood vessels are damaged as cells are moving to defend the cut surfaces and serum forms to impede bacteria.
2. A clot is formed and fibroblasts start to function because blood is stopped as the epidermis begins to migrate over the wound edges.

3. A scab forms and the myofibroblasts appear, which cause collagen strands to form in the wound and the edges of the blood vessels start to repair the break. The basal layer of the epidermis actively proliferates as the wound is 'roofed over'.
4. The wound is closed and contracting continues deep within the wound, the scab starts to fall off as it contracts and increased fibroblasts and myofibroblasts actively strengthen the deeper layers of the wound.

The wound site is rich in both oxygen and nitrogen-centred reactive species along with their derivatives (Kumar et al., 2007) since wound-related non-phagocytic cells also generate free radicals by involving the non-phagocytic NAD(P)H oxidase mechanism (Griendling et al., 2000). The presence of these radicals will result in oxidative stress leading to lipid peroxidation, DNA breakage, and enzyme inactivation, including free-radical scavenger enzymes. Evidence for the role of oxidants in the pathogenesis of many diseases suggests that antioxidants may be of therapeutic use in these conditions. Topical applications of compounds with free-radical-scavenging properties in patients have shown to improve significantly wound healing and protect tissues from oxidative damage (Thiem and Goślińska, 2004); this in effect provides a rationale for the selection of the 2,2-Diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay as one of the tests for this study. The next section provides an overview of the existing evidence regarding the relevant biological tests for wound healing employed in African studies.

3.5.8.2 Relevant biological tests for wound healing

The literature reveals studies in Africa that have conducted *in vitro* tests on biological activity relevant to wounds. Adetutu et al (2011) carried out ethnomedical surveys in rural Nigeria and performed assays to determine antibacterial, free-radical scavenging activity and cell proliferation and viability of crude extracts of some selected medicinal plants. They also selected *Bridelia ferruginea* for further antibacterial, antioxidant and fibroblast stimulation activity of crude extracts (Adetutu et al., 2011). Two studies in Ethiopia evaluated selected medicinal plants used for wound treatment against wound causing bacteria and their findings justified the use of the plants in wound healing (Tadeg et al., 2005, Taye et al., 2011). An ethnomedical study on wound healing in South Africa led to selection of some plants for antibacterial activity studies (Grierson and Afolayan, 1999a), while another conducted antibacterial assays and *in vitro* tests

for fibroblast growth stimulation (Steenkamp et al., 2004). A study by Chah et al (2006) evaluated selected extracts for antibacterial activity and wound healing properties. According to Houghton et al (2005), animal and *in vitro* tests are now widely employed in ethnopharmacological research because of ethical reasons and their usefulness in determination of active compounds. In that regard, they performed the collagen lattice and proliferation and differentiation tests with keratinocytes as well as assays for antimicrobial and antioxidant properties. One study sought to formulate a herbal product for wound healing from two plants (*Zanthoxylum chalybeum* and *Warbugia ugandensis*) and there after test its preclinical safety and efficacy using rat models (Ogwang et al., 2011). These plants are not uniquely Ugandan but are also found elsewhere and used by other cultures.

Other studies have not conducted tests specific to wound healing but have conducted tests on plants that have been designated for wound healing; antiplasmodial activity of *Diospyros abyssinica* (Hiern) F. White reported to treat tropical ulcers in Uganda (Lacroix et al., 2011), antibacterial activity of 21 South African plants traditionally used to treat infectious or septic ailments (Rabe and van Staden, 1997), anti-inflammatory and anti-microbial activities of some Zulu traditional medicinal plants (Lin et al., 1999), antibacterial activity of *Mangifera indica* (Bbosa et al., 2007), antimicrobial, anti-oxidant, anti-inflammatory and antimalarial activity of South African *vitex* (verbenaceae) species (Nyiligira et al., 2008). These studies have concentrated on antimicrobial/ antibacterial activity because infection is an important cause of morbidity and death and wounds need to be uninfected to heal.

The evidence shows that not many studies have gone beyond presenting an inventory of medicinal plants, while for those that have, many have concentrated on antibacterial/antimicrobial studies with few identifying the phytochemical content of the plants that determine the biological activity viewed in these studies. This thesis will add to the body of evidence by initiating phytochemical assays on selected plants (section 4.7) which will be identified by traditional healers in Uganda as significant for wound healing.

3.6 Gaps in the literature

This scoping literature review sought to identify gaps in the existing evidence by answering the following questions;

1. What research methodologies are currently employed and what is the currently recommended practice for conducting research in TM?

2. What is the most appropriate design for conducting studies in TM?
3. Are there any documented approaches for the selection of medicinal plants?
4. What information exists regarding the definition and classification of wounds by traditional healers in Africa?
5. Have any studies clearly presented findings about the preparation and administration of medicinal plants? What do they report about the doses?
6. What are the relevant tests recommended for each phase of the wound healing process and what evidence of this tests exists in Africa?

According to Andrade-Cetto and Heinrich (2011), a crucial question in ethnopharmacological research is how the information about the use of natural products is obtained; and evidence from the available literature shows that information does not always come directly from the primary users but from other studies or from text books, herbarium information and other sources. By way of illustration, a study by Kyakulaga et al (2011), to identify the wound healing potential of the ethanolic extracts of *Bidens pilosa* and *Ocimum suave* in Wistar albino rats, found that the extracts showed potential for use as an alternative to neomycin for the treatment of wounds but these samples were simply collected from an animal farm with no clear rationale, no mention of involvement of primary users and also no attempt to understand or identify a plausible mechanism. This makes it difficult to disseminate findings to intended users who were not part of the initial plant selection process although to be fair, dissemination was not the main intention of the study.

What is known about traditional medicine in Uganda is largely based upon empirical ethnobotanical studies that have reported a number of plants used to treat various ailments including wounds, there have been no studies specially focusing on the documentation of healers' knowledge of traditional methods of wound healing using medicinal plants. As a result comprehensive data are lacking on species of plants, methods of preparation and administration, and *in vitro* phytochemical findings based on ethnomedical uses of these plants. In addition, no mixed methods studies currently exist in this area and yet this mixed method study design is appropriate for the conduct of ethnomedical studies. This mixed methods study therefore seeks to employ scientifically sound, culturally appropriate and acceptable methods to analyse medicinal plants used for wound healing as part of an overall quest to understand the practice of traditional medicine in south western Uganda. It is therefore the researchers' role to apply the same scientific rigor to complementary and alternative medicine and to ensure that these practices are safe and efficacious (Salcido, 1999). Without further

studies on the plants being used in traditional medical practice, we continue to practice what Dr. Alexander Maclean defined as “*a continued series of experiments upon the lives of our fellow creatures*” (Singh and Ernst, 2008) p35.

In summary, following a review of the existing empirical evidence,

- It has been established that a limited number of studies have been done about the use of medicinal plants for wound healing in Africa, these studies have used many methods for data collection but have not specifically used the mixed methods approach.
- Although evidence exists regarding the plants used for wound healing, what is not available is a rationale of how the healers conceptualise the use of these plants in wound healing.
- Due to the limited African data, many of the ethnobotanical studies on the utilisation of medicinal plant collect data from primary sources but only present an ethnobotany of plants used for the treatment of different medical conditions. Some of these studies have identified plants used for the treatment or healing of wounds (see section on findings from literature review section 5.2) although many of them do not include information on the preparation, administration and doses of these therapies.
- In addition, despite the collection of information from primary sources, most of the questions asked are about the plants themselves without seeking to find the healer’s knowledge behind the administration of these remedies and the healers thoughts regarding the objectives of therapy with the particular plants used.
- The conclusions from most of the studies suggest that further phytochemical and pharmacological tests need to be carried out on these plants especially to assess their safety and efficacy but these have not been conducted yet.

What we do not know is what literature already exists about plants and wound healing in Uganda. The existing evidence also does not tell reveal any information about the therapeutic goal of wound healing with medicinal plants, the preparation and administration of medicinal plants for wound healing, or provide information about relevant phytochemical activity of plant extracts used for wound healing in South Western Uganda.

This thesis will therefore identify what is already known about plants used for wound healing in Uganda and seek to provide a local definition and classification of wounds; explore the objectives of therapy for each plant based remedy, identify the plant species and determine the preparation and administration of each plant remedy used in wound healing in South Western Uganda. In addition, the thesis will establish the most appropriate extraction method for selected plants used for wound healing and initiate phytochemical screening of plant extracts for activity relevant to wound healing through three interlinked study phases: A literature review, a fieldwork phase and a laboratory work phase. The methods of these phases are presented next in chapter 4 (Methodology and methods).

Chapter Four

4 METHODOLOGY AND METHODS

4.1 Introduction

As outlined at the end of the preceding chapter, a review of the literature revealed gaps and limitations in the research evidence that underpinned the rationale for the research question of this thesis. So far, this study has established the context and explored the concepts and evidence surrounding this. This chapter documents the methodologies employed for understanding the local practice of using medicinal plants for wound healing in South Western Uganda.

The beginning of this chapter presents the study purpose and research questions in sections 4.2 and 4.3 respectively. Section 4.4 provides a justification for the use of mixed methods, the rationale for this choice in relation to the research question and explains how 'mixing' of methods was done in the three phases of the study. The methods employed in the literature review phase of the study are outlined in section 4.5, while the methodologies involved in the fieldwork phase including the methods, population, sampling, data collection and analysis and the rationale for the choice of each of these are then addressed in section 4.6. Section 4.7 addresses the same issues explored in 4.6 for the final phase involving laboratory work. Finally, section 4.8 discusses the different ethical and administrative endorsements that were needed prior to the commencement of the study.

4.2 Study purpose

In light of the arguments presented in the section 'gaps in the literature' (section 3.6), the main purpose of this study therefore was to investigate how practitioners in South Western Uganda use plants in the treatment of wounds. As part of this description, the study will also give a detailed account of the preparation and administration of medicinal plant-based remedies for wound healing and present results of preliminary

screening for relevant biological activity of selected plants (see chapter 5). The preliminary screening for biological activity gives depth and richness to the understanding of the local practice.

4.3 Research Questions

According to Tashakkori and Creswell (2007), a strong mixed methods study starts with a strong mixed methods research question. The overarching integrated research question for this study is, 'What is known about plants and wound healing in South Western Uganda?' and in order to answer this question appropriately, it has been broken down into separate qualitative and quantitative sub questions (Teddlie and Tashakkori, 2009). This section presents the sub questions for this study and the objectives in support of each question.

1. What is the existing available literature on plants and wound healing in Uganda?
 - a. To identify what is already known about plants used for wound healing in Uganda.
 - b. To provide a cross reference for use in selection of plants for phytochemical studies.
2. What is the therapeutic goal of wound healing with medicinal plants in South Western (SW) Uganda?
 - a. To determine the local definition and classification of wounds in SW Uganda.
 - b. To explore the objectives of therapy for each plant based remedy. E.g. to prevent infection.
3. How are medicinal plants prepared and administered for wound healing in SW Uganda?
 - a. To identify the plant species used in wound healing in SW Uganda.
 - b. To determine the preparation and administration of each plant remedy used in wound healing in SW Uganda.
4. What is the relevant phytochemical activity of plant extracts used for wound healing in SW Uganda?
 - a. To create a crude aqueous and methanolic extract as a basis for establishing the most appropriate extraction method for selected plants used for wound healing in SW Uganda.
 - b. To initiate a pilot/ feasibility study into the scientific understanding and potential utility of plants identified for wound healing by respondents.

4.4 Research design

The study of traditional health care systems is a multifaceted endeavour which necessitates a multidisciplinary and participatory approach. In recognition of this, the mixed methods research approach was used as an underpinning and guide for this tri-phasic study. The literature review (phase I) revealed that studies on medicinal plants used for injuries in Uganda reported that wounds were the most commonly treated types of injuries for which medicinal plants were used. This finding informed the fieldwork work (phase II) where interviews were conducted with traditional healers and local knowledge experts on plants and wound healing in the community. An ethnobotanical survey of all the plants mentioned during the interviews followed on with the healers to provide a description of these plants including but not limited to their preparation and administration for wound healing. This phase thus provided a list of medicinal plants used for healing and the ethnomedical rationale for the action of the plants. This list of plants was cross referenced with the list from the literature review (phase I) to identify any plants that were used on a wider scale for wound healing in Uganda. After careful consultation of the literature, relevant phytochemical and cell-based studies were selected to investigate the plants for activity to confirm what the healers suggested as possible actions of the plants in wound healing leading on to the third and last phase: laboratory work.

Figure 4-1 provides a visual representation of the mixing and the sequential flow of the data collection methods employed in this mixed methods study while the next sections (4.4.1 and 4.4.2) provide a working definition of the mixed methods approach and illustrate the application of this approach to this study.

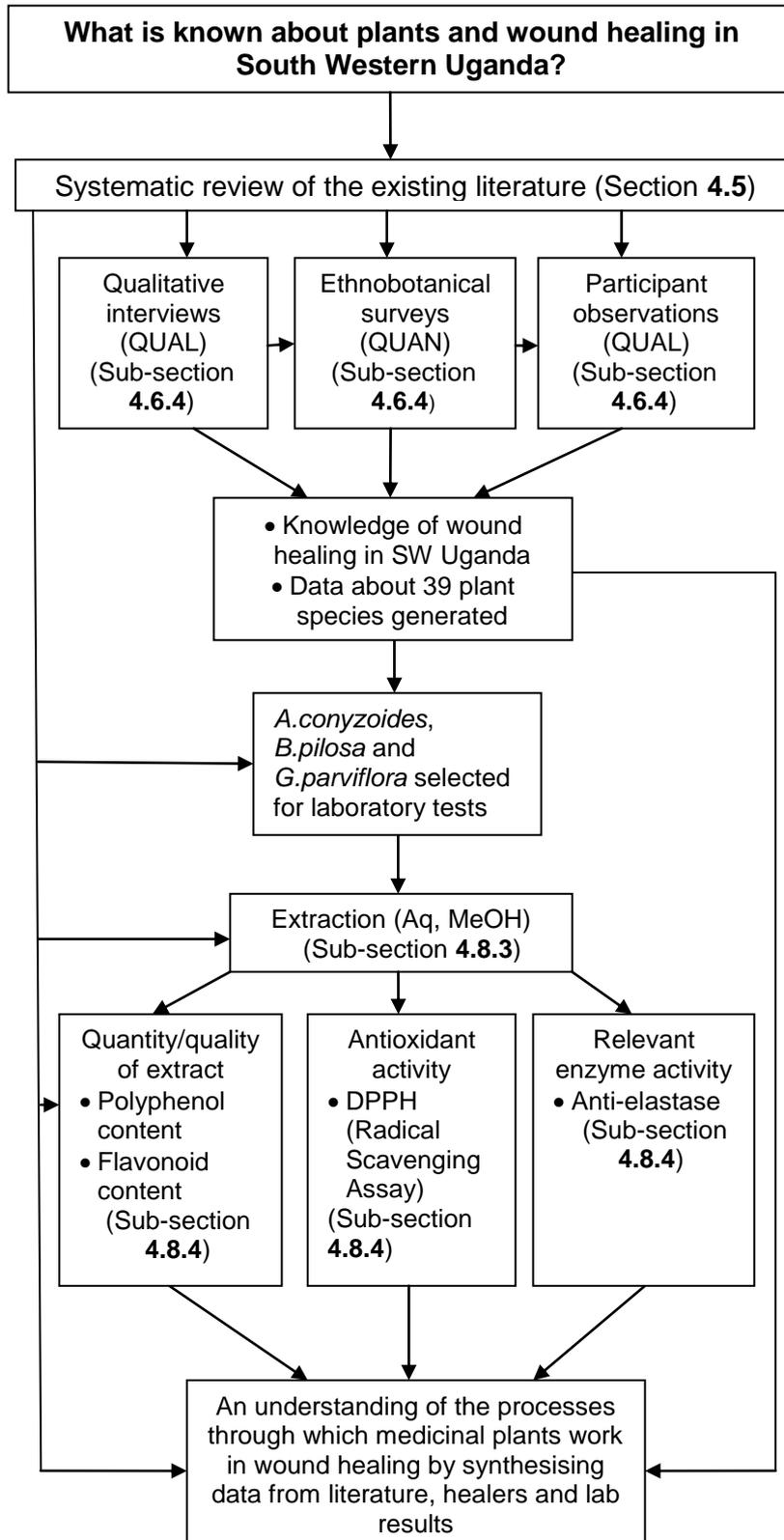


Figure 4-1: Sequence of mixed data collection methods

4.4.1 A working definition of the mixed methods design

The mixed methods approach was chosen because the overall research question could not be answered in proper depth and detail by one method or design on its own. Each method was dependent upon the other, for example the interviews informed the laboratory work and the lab work corroborated the narratives from the healers during the interviews and the survey. Denscombe (2008) asserts that the mixed methods approach has developed ideas, practices and concepts that set it apart and offer it as an alternative to qualitative or quantitative approaches and it is suggested that this approach should be recognized as the *third major paradigm* (p270). Mixed methods research is therefore generally speaking, an approach to knowledge (theory and practice) that attempts to consider multiple viewpoints, perspectives, positions, and standpoints (always including the standpoints of qualitative and quantitative research) (Johnson et al., 2007) (p113) in a single study or set of related studies.

According to Creswell and Tashakkori (2007) and Bergman (2011), differing perspectives exist on the legitimacy of the mixed methods approach. Those who hold and write from the paradigm viewpoint (Mertens, 2007, Morgan, 2007, Tashakkori and Teddlie, 2003) argue that mixed methodologies are less about methods or the process of research and more about the philosophical assumptions that researchers bring to their inquiries. Whilst others, like (Tashakkori and Teddlie, 1998) hold that one cannot separate methods from the larger process of research, yet another perspective exists among those who hold that the need to use mixed methods strategies may emerge during the investigators' ongoing research projects (LeCompte and Schensul, 1998), as part of efforts for finding answers to research questions. This study employed the latter, termed the 'practice perspective' (Creswell and Tashakkori, 2007), because the initial plan was to conduct interviews and a survey and this would then inform the laboratory work phase. However, during fieldwork it became obvious to the researcher that the study would benefit greatly from the inclusion of a period of participant observation and transect walks (section 4.7.4). This therefore provided an additional rationale for the choice of the mixed methods approach, as it provided the greatest flexibility for inclusion of any emergent methods that were required to provide a richer and fuller understanding of plants and wound healing in South Western Uganda.

Morse defines a mixed method design in (Johnson et al., 2007) as a plan for a scientifically rigorous research process comprised of qualitative (QUAL) or quantitative (QUAN) *core component* that directs the theoretical drive, with qualitative (QUAL) or

quantitative (QUAN) *supplementary component(s)* (QUAL/QUAN + QUAL/QUAN) (p120). For the purposes of this study a mixed method is represented as inquiry into a question using different methods and techniques in a way that helps to support triangulation, clarification, elaboration, enhancement and further understanding of the findings. The design must contain both qualitative and quantitative components; initially, it will have some form of structure but will be allowed to evolve with the progress of the research (Tashakkori and Creswell, 2007).

The mixed methods approach broadens “the scope of inquiry by accessing a wider range of data” (O’Cathain and Thomas, 2006, Leech and Onwuegbuzie, 2009) and ensures not only a more varied data set but also enhanced external validity. For example when conclusions drawn from unstructured interviews can be cross-checked with direct observations and formal surveys (Etkin, 1993) as in this thesis where phase I informs phase II which then determines the plants investigated in phase III; this will eventually lend confidence for transferability of the findings to other cultural contexts and settings. The mixed methods approach also serves to provide a better understanding of the findings, provide a fuller picture of the phenomenon under study and how it is affected by different factors and also serves the purpose of corroboration (Johnson et al., 2007).

Most researchers have at least one methodological technique they feel most comfortable using, which often becomes their favourite or only approach to research. Because of this researchers sometimes fail to recognize that methods impose certain perspectives on reality (Berg, 2007). For example when a researcher goes into a community and conducts only interviews regarding medicinal plant use; a theoretical assumption has been made that reality is fairly constant and not affected by any other outside factors. Each method thus reveals a slightly different facet of the same symbolic reality because each of them has a different line of sight directed towards the same point. By combining several lines of sight, researchers obtain a better, more substantive picture of reality; a richer, more complete array of symbols and theoretical concepts; and a means of verifying many of these elements. The use of multiple lines of sight is frequently called triangulation (Berg, 2007).

Within the mixed methods approach, triangulation has been used by researchers to combine multiple methods, empirical materials, perspectives and observers in a single study with the purpose of adding rigor, validation, breadth and depth to an investigation (Flick, 1992). Denzin (1978) recommends the use of between-method triangulation, contending that by utilizing mixed methods, “the bias inherent in any particular data

source, investigators, and particularly method will be cancelled out when used in conjunction with other data sources, investigators, and methods” (p. 14) which enhances reliability. In this study triangulation through the mixing of methods led to thicker, richer data and stimulated the development of creative ways of collecting and interpreting data. In addition, the laboratory studies served as a litmus test for the findings from the fieldwork thus serving to validate fieldwork data.

4.4.2 Application of the mixed methods approach in this study

The mixing of methods in this study evolved at all stages of the research but was more pronounced both at the data collection and data analysis stages. This tri-phasic project was divided into a series of investigations which together served to answer the overall research questions:

Phase I: A literature review of the existing evidence

Phase II: Field work to identify who uses what plant, for what purpose, and how

Phase III: Lab work to identify the biological activity of commonly used agents for

wound healing. Table 4-1 shows the phases and the how mixing of methods was used to answer the overall and specific research questions.

Table 4-1: Overview of how mixed methods answered the study questions

What is the relationship between plants and wound healing in South Western Uganda?			
Research questions	Phase of the study	Methodology and rationale selection	Method of data collection
What is the existing available literature on plants and wound healing in Uganda and what does it tell us about the plants already used?	PHASE I (Section 4.5)	Literature review to identify published accounts of the medicinal plants used for wound healing.	Systematic search of the published evidence on plants and wound healing
What is the therapeutic goal of wound healing with medicinal plants in South Western Uganda?	PHASE II (Section 4.6)	Pilot study to test the interview guide, survey instrument and sampling method.	Semi-structured interviews
How are medicinal plants prepared and administered for wound healing in South Western Uganda?		Qualitative methodology chosen to obtain information which will inform the quantitative survey	
What is the relevant phytochemical activity of plant extracts used for wound healing in SW Uganda?	PHASE III (Section 4.7)	Quantitative methodology chosen because this phase focuses on plants and numerical data are expected.	Semi-structured interviews and Participant observations Survey Transect walks
		Qualitative to elaborate and clarify the results obtained in the initial qualitative interviews	
What is the relevant phytochemical activity of plant extracts used for wound healing in SW Uganda?	PHASE III (Section 4.7)	Quantitative to provide convergence, validation and corroboration of results from the healers' responses in the interviews and findings from the participant observations.	Phytochemical assays

According to (Etkin, 1993), ethnographic data regarding expectations of therapeutic outcome suggest the most reasonable experimental disease models through which to

test pharmacologic action. Then, through benefit of knowledge regarding collection, preparation and administration, the relevant plant parts, preparations, and combinations can be isolated for analysis. In this study, the qualitative data plus the ethnobotanical survey revealed when and how plants were used and with which specific expectations, while the lab data helped to predict and assess biological activity. The methods involved in the three phases are presented sequentially in the next sections.

4.5 Phase I: Literature review using systematic methods

WHO (2000a) recommends the evaluation of literature reports as the first step in assessing the safety and/or efficacy or in this case the use of a herbal medicine, whether derived from a single plant or from a defined mixture of plants. In line with this recommendation, this evaluation was carried out to review the existing and available literature in order to identify published accounts of the medicinal plants used in Uganda for the management of unintentional injuries and to identify published accounts of the different injuries for which the medicinal plants are used in Uganda.

Greenhalgh (1997) defines a systematic review as an overview of primary studies containing an explicit statement of objectives, materials, and methods and has been conducted according to explicit and reproducible methodology. In This PhD study a literature review was performed systematically rather than a formalised systematic review of the literature because among their many other features systematic reviews specify the information to be obtained from each primary study in the form of a study design framework including quality criteria by which to evaluate each primary study prior to actually reviewing the literature which this study did not do(2004). Therefore the objective of this review was to identify what is already known about plants used for wound healing in Uganda using systematic methods and to provide a cross reference for use in selection of plants for phytochemical studies.

Literature reviews are very important for assisting the evidence base because they focus on such characteristics as replicability and transferability since they use standardised techniques. Thus, any conclusions made are more reliable and accurate because of the methods used. In agreement with Chalmers and Altman, (1995) the results of different studies can be compared to establish generalisability or lack of heterogeneity of results and the reasons for the heterogeneity or inconsistency in

results across studies can be identified and new hypotheses generated. This section therefore presents an overview of the standardised literature review techniques: the questions, objectives, eligibility criteria for either inclusion or exclusion of papers from the study, the search strategy employed to obtain the literature and the methods of data extraction. The findings from the literature review are presented in the results section in Chapter Five of the thesis (Section 5.2).

4.5.1 Eligibility Criteria

Types of studies

All qualitative and quantitative studies were retrieved for study providing they reported empirical research into the use of medicinal plants in Uganda. This was done to include all possible sources of information on the types of plants used medicinally in order to capture the breadth of the plants used in Uganda.

Inclusion criteria

All studies related to the use of medicinal plants for any type of injury in Uganda were eligible. It is noteworthy, that the WHO classification for injuries is very wide and this review was therefore very inclusive. The quality of the studies was not considered as part of the initial inclusion or exclusion criteria. No language restrictions were applied as this is a known risk factor for bias in the results of systematic reviews of complementary or alternative medicines (Moher et al., 2003).

Exclusion criteria

Studies related to use of medicinal plants in or for animals were excluded.

4.5.2 Search methods for identification of studies

Between November 2009 and January 2010 four online databases were searched: PUBMED (all years), AMED (1985-2010), EMBASE classic + EMBASE (1947-2010) and MEDLINE (1950-2010) through the OVID platform. The key words were Uganda*, Ethnobotany, Ethnopharmacology, pharmaco*, plants, medicinal, plant extracts, phyto*, medicine, traditional, plants, medicine, herbal and medic* and exploded MeSH headings. Two other online sources were searched namely Web of Knowledge (all years) and Interscience to find literature not captured in the other four databases. An online search of other key journals was performed. These were the Journal of Ethnobiology (1981-2010), African Journal of Traditional and Complementary Medicine (2004-2010), Journal of Ethnobiology and Ethnomedicine (2005-January 2010),

Journal of Medicinal Plants Research (2007-January 2010), African Journal of Pharmacy and Pharmacology (2007-January 2010), African Health Sciences (2001-2010) and Ethnobotany and Research Applications (2003-2010). Index to theses and proQuest databases of theses and dissertations (all years) were also searched. The search was repeated in January 2011 and March 2012. The reference lists from the final selected full text studies were visually scanned for any other relevant texts.

4.5.3 Sifting, data extraction and analysis

The titles and abstracts of potentially relevant studies were screened by the first reviewer (PM), who removed studies that were clearly ineligible. Further information was sought from the authors of those papers which contained unclear or insufficient information. Inclusion was checked by a second reviewer (KT).

Data were extracted for the following elements: author, title, study setting, population, data collection methods, the families and species of plants identified for treatment of injuries, local names of the plants, different injuries for which the plants were administered and the administration methods of the therapies. Injuries were categorised using the International Statistical Classification of Diseases and Related Health Problems (ICD) chapters XIX S00-T98 Injury, poisoning and certain other consequences of external causes and XX V01-Y98 External causes of morbidity and mortality (WHO, 2004).

4.6 Phase II: Fieldwork phase

This section presents the different methods employed within the fieldwork phase; each of the components of the research design (methods, population, sampling, data collection, and data analysis) will be described.

4.6.1 Methods employed

4.6.1.1 What is the therapeutic goal of wound healing with medicinal plants in South Western (SW) Uganda?

In this PhD study the exploratory design and ethnography designs helped to meet the objectives of determining the local definition and classification of wounds in SW Uganda and to explore the objectives of therapy for each plant based remedy. During the initial reflections upon the qualitative approach to adopt for this study,

phenomenology, and grounded theory were considered but later discarded in favour of the exploratory and ethnography approaches because their characteristics which are presented in the proceeding sections made them more suited to the type of data needed to answer the research questions and the characteristics of the population under study.

Creswell in (1998) defined a phenomenological study as one which describes the meaning for several individuals of their lived experience of a concept or phenomenon (p57) which would have been applicable to describe the phenomena of the healers' experiences of the practice of using medicinal plants for wound healing, however this approach was discarded because phenomenology requires an initial understanding of the broader philosophical issues. In addition the participants chosen need to be carefully selected as participants who have all experienced the phenomenon in question so that the researcher can forge a common understanding. However, this was not possible because the research study was being carried out in an area with limited existing evidence in the literature and thus the researcher would not have had sufficient base from which to understand the broader philosophical issues, secondly the nature of the study participants and the methods that had been chosen to identify them would not have led to the careful selection of participants who have experienced the phenomenon which is a requirement in phenomenology. This was followed by a careful consideration of the grounded theory design which was defined by Strauss and Corbin (1998) as a qualitative research design in which the investigator constructs a general explanation of a process, action or interaction shaped by the views of a large number of participants. This definition alone was clear enough for the researcher to know that this approach was not the way for to go because it called for a large number of participants and this study set out to use a smaller number to explore a new phenomenon and also because of the nature of the research timeline and insecurity in the study area. The grounded theory approach was rejected because according to Creswell (1998), the primary outcome of a grounded theory study is a theory with specific components like a central phenomenon, causal conditions, strategies, conditions, context and consequences (p68). These categories felt too restrictive for this study, which was seeking designs that offered greater flexibility, to allow for the inclusion of any new dimensions to the mixed methods involved in this study and therefore felt that the exploratory and ethnography designs offered this flexibility.

4.6.1.1.1 Exploratory design

The exploratory design was chosen because it helped the researcher to shed more light on an area in which little is known (Sim and Wright, 2000, LoBiondo-Wood and Haber, 2002). This was considered to be appropriate as the literature review found limited evidence of studies on plants and wound healing in Uganda especially regarding phytotherapeutic evidence for most of the treatments used. Thus ethnobotanical studies are required to confirm the validity of properties attributed to these plants for evaluation of their therapeutic potential.

This design was employed to help answer the first research question about the therapeutic goal of wound healing with medicinal plants in South Western Uganda. The literature review laid the foundation for the exploratory design and the findings obtained using this design were then used to assist the quantitative component of the study by influencing the development of the data collection instruments. The findings from the exploratory design were also used to develop a checklist for the key items to be observed during participant observations employing the ethnography design.

4.6.1.1.2 Ethnography design

Ethnography can be defined as a way of studying a culture-sharing group as well as the final, written product of that research (Harris, 1968, Agar, 1986, Creswell, 1998). The aim of the ethnography was to elaborate on and compare the healers' accounts with the findings from the qualitative interviews. This design served to answer both the first and second research questions: the therapeutic goal of wound healing and preparation and administration of medicinal plants respectively in more detail and depth.

4.6.1.2 How are medicinal plants prepared and administered for wound healing in SW Uganda?

The descriptive design was chosen because it helped to meet the objectives which were to identify the plant species used in wound healing and to determine the preparation and administration of each plant remedy used in wound healing in SW Uganda.

4.6.1.2.1 Descriptive design

This first quantitative aspect in phase II, employed the descriptive survey approach to help build upon the knowledge gained from the exploratory design and answered the research question regarding the different plant species used to treat wounds in South Western Uganda. During the exploratory phase (Subsection 4.7.1.1.1.), participants were required to identify some plants commonly used for treating wounds and from this information an in depth descriptive survey was then designed and conducted.

4.6.2 Study population

The participants included traditional healers and key informants in the community. For the purpose of this study, a traditional healer was a person recognised by the community in which he/she lived as competent to provide health care by using vegetable, animal and mineral substances (Sofowora, 1982). Key informants were individuals who had special knowledge or status (LoBiondo-Wood and Haber, 2002) and for this study were people recognised by the community as knowledgeable in the use of medicinal plants for treatment of various illnesses including wounds although this distinction between a traditional healer and a key informant can sometimes be arbitrary.

The difference between the two is that traditional healers are recognised as professionals who offer and are paid for health care services. Whereas, key informants, also known as key *respondents* or *consultants* or *local knowledge experts* (Etkin, 1993) are individuals regarded as having a more extensive vocabulary about local social and cultural systems than others in the community and will not charge clients for their services but may be given gifts in appreciation of the health services rendered. So the key informant will know about healing but will have a wider knowledge of the social and cultural systems within the community and use that knowledge while administering any herbal remedies. Both traditional healers and key informants were used in this study to gain a holistic view of medicinal plant use for wound healing within the same community.

The same sample participated in both the qualitative semi-structured interview and the quantitative survey. It is important to note here that the sampling unit of analysis for the quantitative survey were the plants not the participants; however, the information was obtained from the same healers and local knowledge experts. The data from the qualitative interviews was used to inform the quantitative aspect of the research.

4.6.3 Sampling and recruitment

Two counties of Rugaga and Ruyonza were purposively selected from Isingiro district of South Western Uganda since traditional healers are suggested to be found in rural rather than urban areas (Tabuti et al., 2003a) largely due to the location of plants and also due to the rapid urbanisation. It is worth noting here that close to 80% of the Ugandan population live in rural areas. The research team comprised of a botanist, a village guide, a research assistant, a physician and the researcher (PM), who held meetings with local leaders in the selected counties to gain access to the population and have village guides allocated to them.

The total number of potential study participants (healers and informants) in the population was unknown. Therefore, the sample was not intended to be statistically representative (Ritchie et al., 2003). Therefore, a sample size of up to 20 traditional healers and the same number of key informants was sought on the assumption that 20 participants from each group would likely reveal the sufficiently important healer perceptions. However, the researcher also understood that this potentially increased the risks of missing other healers' perceptions that may have been worth knowing.

According to Mason (2010) as a result of the numerous factors that can determine sample sizes in qualitative studies, many researchers shy away from suggesting what constitutes a sufficient sample size. In addition to this, other researchers have tried to suggest some kind of guidelines for qualitative sample sizes. As an example, Charmaz (2006) suggests that 25 participants are adequate for smaller groups but does not explain why 25 and not for instance 50. For this particular study, recruitment of participants was stopped when demonstrable information saturation on core questions was achieved (Bowling, 2009) or when no new plant was mentioned for the treatment of wounds.

4.6.3.1 Reputation sampling

The initial identification of the key informants employed reputation sampling using 'Brownian motion methods'. This is a concept borrowed from physics which describes the macroscopic seemingly random movement of particles suspended in a fluid. A worked example of reputation sampling as used in this study is presented in tables 4-2 and 4-3. It was chosen as a type of purposive sampling suited to the question and location to identify local knowledge-holders in a community. The villages in Isingiro district do not have maps or census lists therefore the options for identification of the

initial respondent were very limited. Initially, the research team arrived at a village and by randomly walking around down any visible paths, (random walks) selected 40 households whose members were then helped in the identification of the initial respondent through reputation sampling (the use of the word random is non-probabilistic and is of no statistical significance here).

Members from each of the 40 households were asked to mention the names of three people they considered knowledgeable and skilled in the use of medicinal plants. This method of using key informants based on the community's recommendation is known as reputation sampling (Hamill et al., 2000) (See table 4-2).

Table 4-2: Worked example of reputation sampling

<i>Respondent number</i>	1	2	3
1	John	Phillip	Margaret
2	Mary	Margaret	Jane
3	John	Peter	Phillip
4	Mary	Jasper	John
5	Jane	Moses	John
6	Jane	John	Margaret
7	Margaret	John	Peter

The key informants' names were rank-ordered with respect to the number of mentions received, thereby providing a road map for interview sequencing. That is, the people whose names were mentioned the most were approached first for recruitment into the study (See table 4-3).

Table 4-3: Worked example of ranking of study participants

<i>Rank</i>	<i>Name</i>	<i>Number of mentions</i>
1	John	6
2	Margaret	4
3	Jane	3
4	Phillip	2
5	Mary	2
6	Peter	2

This method ensures that the findings produced represent the breadth and depth of the local medicinal knowledge in that community by the inclusion of the 'experts' in the study (Davis and Wagner, 2003). In this context expert refers to the best known or the most popular within that particular community.

4.6.3.2 Purposive sampling

Uganda has a largely rural population with only 12-15% of the population residing in urban areas (WHO, 2007). It is common for a select few to be the 'keepers of knowledge', thus making random surveys largely impractical (Edwards et al., 2005). Therefore, purposive sampling methods were used to identify the traditional healers. According to Ritchie (2003), in this method, units are deliberately selected to reflect particular features of or groups within the sampled population. The first three traditional healers were chosen in this way because they have particular skills and knowledge which are recognized by the community. The researcher and guide approached potential participants and explained about the study. Consent for participants was sought prior to their participation and a convenient time was arranged for an interview.

4.6.3.3 Network sampling

The first few traditional healers then identified others they considered knowledgeable in the use of medicinal plants; this method is known as snow-ball or network sampling (Mason, 2002). It was selected because there was no sampling frame for this particular group of participants so the network sampling in essence created the sampling frame for the researcher. Thus, one only needs to make contact with a few healers who will then help in identification of the others through the use of networks (LoBiondo-Wood and Haber, 2002, Kumar, 1999).

4.6.4 Data collection

Data was collected with the help of a multidisciplinary team composed of a botanist, a village guide, a research assistant, the researcher (PM), and a physician. The physician correlated the clinical names of the wounds being described by the respondents with the conventional medical terms (Ssegawa and Kasenene, 2007, Inngjerdigen et al., 2004). The Botanist oversaw the collection of proper herbarium specimens for easy identification (Prance, 1991). The research assistant aided in interpreting the cultural norms and meanings behind the comments expressed during the interviews. He was also important in winning the trust of respondents and establishing rapport; respondents are reported to be less suspicious of the motives of the research when interviewed in the presence of someone they know (Tabuti et al., 2003a). The entire length of fieldwork was 49 weeks (table 4-4).

Table 4-4: Length of data collection

	N	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J
Pilot study	■																			
Participant interviews							■	■	■	■										
Community observation										■										
Participant observation & transect walks											■	■	■							
voucher specimen collection													■	■						
Identification and collection of plant samples													■	■						
Drying of plant samples													■	■						
Phytochemical studies																		■	■	■

4.6.4.1 Pilot study

A pilot study (see table 4-1) was conducted in Mbarara district among the Banyankore people to identify any poorly worded questions, questions with offensive or emotion-laden wording and questions revealing the researchers own biases or personal values (Berg, 2007, Sim and Wright, 2000) in the topic guide. This allowed testing of the sampling methods and assessment of the research team, test equipment and establish the length of interviews in order to facilitate planning and effective execution of the fieldwork phase. The findings from the pilot study are presented in chapter 5 (section 5.3).

The first step involved screening of the proposed protocol by experts in the study's subject matter. These included a principal investigator of a similar study on medicinal plants used in local veterinary practice, a professor of botany, a community development officer (CDO), a local community leader and a medical doctor who practiced herbalism. Some changes were made to the topic guide especially by the professor of botany and the CDO.

The second step involved conducting five practice interviews to assess how effectively the interviews captured information especially in light of the relatively large research team and whether the information of interest was actually going to be obtained.

4.6.4.2 Interviews

The interviews were used to collect data to answer the question ‘What is the therapeutic goal of wound healing with medicinal plants in South Western (SW) Uganda?’ and this method was chosen because the researcher sought to gain a deeper understanding of the practice of traditional medicine in SW Uganda. The semi-structured interview method was chosen because it allowed for more flexibility (Sim and Wright, 2000) by use of further probing questions when participants answers were not clear or did not elicit the desired information.

The initial qualitative data was collected through face-to-face semi-structured interviews (see table 4-1) with the aid of a topic guide (see appendix 5). The topic guide included questions about the goals of treatment using medicinal plants and the recognition and classification of wounds. It was translated into the local Runyankore language. The interviews were tape recorded with the participant’s permission and then transcribed verbatim. For sample excerpts of field notes, see appendix 12.

4.6.4.3 Ethnobotanical Surveys

The primary quantitative data addressing the question of ‘How are medicinal plants prepared and administered for wound healing in SW Uganda?’, was collected through face-to-face ethnobotanical surveys with the aid of an interviewer administered questionnaire (see appendix 2). Here, the survey method is used to study how and why people use and conceptualize plants in their local environments. In this method, the interviewer asks a set of pre-determined questions using the same order and wording for each participant (Kumar, 1999). This ensured that the same required information was obtained from the participants and gave the respondents little chance of discussing issues not addressed in the study (Sim and Wright, 2000). This method was best suited to obtain information as the number of plant species was unknown, so the issue of numbers did not arise because surveys are good for describing the characteristics of large populations. In addition, surveys can allow many questions to be asked about a given topic, providing considerable flexibility for the analysis (Creswell, 2008).

For this stage (See table 4-1), a questionnaire was used to collect information about the preparation and administration of the medicinal plants and the characteristics of the actual plants used in wound healing. The existence of a prior framework compiled from several ethnobotanical studies and the data obtained from the exploration enabled the researcher to develop a detailed data collection instrument. Additional questions were

assembled from components of different profiles employed in studies on medicinal plants which served to guide and to validate the questionnaire used in this study (Sofowora, 1982, Hamill et al., 2000, Mahonge et al., 2006, Ssegawa and Kasenene, 2007). These included questions about the local name of plants used, parts used, methods of preparation and the mode of administration and application. (See appendix 3). The questions were later translated into the local *Runyankore* language by the researcher (PM) and a specialist in *Runyankore* from the Institute of Languages at Makerere University; one of the Universities in Uganda.

The survey served to determine the preparation and administration of each plant remedy used in wound healing in SW Uganda. It also added to the knowledge obtained from the interviews regarding the local definition and classification of wounds and the healers' ethnobotanical rationale for the plants used.

4.6.4.4 Field visits

Following the interviews and surveys, the research team and the traditional healer made a field visit to collect botanical specimens of medicinal plants reported to treat wounds. The data collected during these visits helped to answer the question 'How are medicinal plants prepared and administered for wound healing in SW Uganda?' but with the precise objective of identifying and collecting plant species used in wound healing in SW Uganda. The botanist observed and confirmed that each plant was collected by the person who normally prepares the remedy in order that a different specimen is not obtained through variation in local names (Sofowora, 1982).

In order to confirm that the correct plant had been identified and selected, a field specimen was shown to at least one other key informant for verification as suggested by (Browner, 1985). In cases where there was more than 75% disagreement between key informants on the identity or name of the selected plants, those plants were removed from the list.

The plants or voucher specimens collected were identified, labelled and deposited in the herbarium in the Faculty of Science at Mbarara University of Science and Technology for further identification by experienced taxonomists (Ssegawa and Kasenene, 2007). It is a standard requirement that plant specimens be deposited in an internationally recognized herbarium before research work on their constituents etc. can be carried out or published (Sofowora, 1982). In the Ugandan context there was

also the need to be mindful of the ecological value of the plant and the research was given permission to proceed on the basis that they would be deposited thus.

4.6.4.5 Participant observation

The participant observations played a slightly different role to that of the interviews, surveys and field visits in that they collected similar data as these other methods and answered the same research questions but the data collected served to corroborate and lend credibility to the data already collected using those methods. The period of the researcher participant observation sought to answer the questions 'What is the therapeutic goal of wound healing with medicinal plants in South Western (SW) Uganda?', and 'How are medicinal plants prepared and administered for wound healing in SW Uganda?'.

Participant observation is the principal anthropological method of obtaining data/information about a particular culture or phenomenon that exists within a culture (Berg, 2007). In participant observation, the researcher is immersed in the day to day lives of the people and observes and interviews the groups of participants (Creswell, 1998, Bolton, 1995); the main objective being the observation of subjects or participants in their social contexts. Participant observation facilitates the collection of data on social interaction; on situations as they occur rather than on artificial situations (as in experimental research) or constructs of artificial situations that are provided by the researcher (as in survey research) (Ellen, 1984). Singer (1977) argues that the cultural model always puts the people first and presents their cultural practices as meaningful. It also supports existing social orders by interpreting what is observed as positive and functional and thus traditional remedies are viewed as good and positive even when they may be dangerous. It is important to note, that with this method the researcher seeks not so much a corroboration of what respondents say they do, but more importantly through first-hand experience a substantiation that the researcher has understood what was told to him (Etkin, 1993). The observations served to substantiate what the healers had mentioned during the interviews and allowed the researcher to gain a personal experience of the preparation and administration of plant remedies for wound healing.

For this PhD project, the researcher only observed situations related to wound healing practice which included but was not limited to attendance at patient consultations, reviews, collection, preparation and administration of herbal remedies, patient home

visits and general patient care. This may represent a form of limited participant observation.

Up to five (5) traditional healers from the original twenty (20) were selected for inclusion in the participant observation segment. In order to decide on the number to involve in the participant observation, the time and funds available were taken into consideration.

The researcher undertook this stage of the data collection alone and as such, the participants were included based on their closeness to the researcher's accommodation and security services (as the data collection occurred during a time of some political unrest in Uganda), their consent to participate and geographical accessibility.

4.6.4.6 Modified transect walks

In this study modified transects were conducted with the traditional healers during the participant observations (see table 4-1) in more informal interactions for example while going to the market, or on a home visit, or when the healers went out to collect herbal remedies. The data collected during the transect walks helped to answer the question 'How are medicinal plants prepared and administered for wound healing in SW Uganda?' but with the particular objective of confirming the plant species identified during the surveys and interviews as used in wound healing in SW Uganda and the aim of collecting any new plants that were mentioned during the participant observations.

A transect walk is a mobile interview in which the research team walks from the centre of the village to the outer limit of the territory accompanied by several local informants who are especially knowledgeable about natural resource issues (Thomson and Freudemberger, 1997). During these walks, more questions were asked about the plants and a lot more information was gained during these discussions as they were slightly more informal than the interviews and the surveys. Sometimes during the walks the healers caught sight of plants that had not been mentioned during the interviews and these were also collected. These conversations were all tape recorded and transcribed verbatim.

4.6.5 Data analysis

4.6.5.1 Analysis of literature review studies

Data from the papers selected for inclusion in the literature reviews were tabulated according to categories that emerged from the data as important in order to gain a personal 'feel' of the information. The findings were then compared and conclusions drawn from the data contained within the studies.

4.6.5.2 Inductive content analysis

The qualitative data was analysed manually using the thematic content analysis method. The use of Nvivo; a qualitative analysis software computer package was considered but rejected on the grounds that the researcher wanted a personal and closer feel of the data. On the other hand the researcher could have benefited from the attributes of Nvivo which are easier management of data and ideas, querying of data, graphically modelling the data and producing a report from the data (Bazeley, 2007). Many researchers are under the impression that using the computer ensures rigour but in this study, rigour was achieved by allowing one of the research supervisors' to query the process and ensure objectivity and allowing the themes to emerge from the data.

In this method of analysis, themes are derived from the data without imposing a prior framework (Holloway, 2008) as is the case in framework analysis. After careful and thoughtful consideration of framework analysis as the potential method for the analysis of the qualitative data in this study, it was discarded because this type of analysis is better suited to applied policy research with specific questions, a limited time frame, a pre-designed sample and a priori issues that need to be dealt with (Srivastava and Thomson, 2009, Furber, 2010)

Although framework analysis and content analysis have similar steps for analysing the data, inductive content analysis was chosen because there is very little evidence in this research area. It was also chosen because the existing literature did not provide sufficient information to guide the creation of a theoretical framework for use in data analysis thus the use of inductive content analysis in this study. Content analysis offers several advantages in that it looks directly at communication via texts or transcripts, and hence gets at the central aspect of the phenomenon under study while allowing for closeness to text (Colin, 2011). On the other hand, it can be extremely time consuming and can easily disregard the context that produced the text.

Inductive content analysis comprises the following steps;

1. The interview data was **transcribed verbatim** and field notes typed up immediately upon completion of each interview. The researcher then read through each transcript to obtain a general sense of the information and to reflect on its overall meaning (Creswell, 2008). Each transcript was read through by two members of the research team and then after translation it was cross checked by a Runyankore specialist from the Institute of Languages at Makerere University.
2. Detailed analysis began with a **coding process** which entailed organising the material into chunks or segments of text for each participant without bringing meaning to information (Creswell, 2008, LoBiondo-Wood and Haber, 2002).

Excerpts from verbatim interview transcriptions.

“So how does this plant work?”

- **R5**

“It is mainly used for the fresh or cut wound which is bleeding. It makes blood stop flowing quickly and prevents the wound from getting dirty and smelling.

- **R18**

“You get the fresh leaves, crush them and apply them securely in a dressing onto the wound, usually this is done to remove pus and clean the wound. It takes long for the wound to heal since it is caused by cancer but at least this keeps flies away and also reduces the patient’s pain”.

- **R33**

“my herbs make the ends of the wound come nearer to each other then unite. It is as if it has some force that pulls the edges together and blood becomes thicker faster so the person does not loose a lot of blood. For the wounds which are not bleeding, the dressing helps to keep the wound clean”

3. Significant phrases in each segment were **specified using the participant’s own words**. Each significant phrase was broken down to express its central meaning in the words of the researcher.

Significant phrases		
<ul style="list-style-type: none"> • <i>It makes blood stop flowing quickly and prevents the wound from getting dirty and smelling</i> R5. • <i>no dose, the more the better</i> R5 • <i>careful not to finish the plants all at once”</i> R5. 	<ul style="list-style-type: none"> • <i>remove pus and clean the wound.</i> R18 • <i>this keeps flies away</i> R18 • <i>reduces the patients pain</i> R18 	<ul style="list-style-type: none"> • <i>make the ends of the wound come nearer to each other then unite</i> R33. • <i>force that pulls the edges together</i> R33 • <i>blood becomes thicker faster</i> R33 • <i>keep the wound clean</i> R33

4. Segments that contained similar central meanings from each participant were **grouped together into researcher-identified categories** with a focus on the essence of the phenomenon being studied (Holloway, 2008).

Significant phrases	Researcher identified Categories
<ul style="list-style-type: none"> • <i>It makes blood stop flowing quickly</i> R5 • <i>blood becomes thicker faster</i> R33 • <i>prevents the wound from getting dirty and smelling</i>R5 • <i>remove pus</i> R5 • <i>keeps flies away</i> R18 • <i>make the ends of the wound come nearer to each other then unite</i> R33, <i>force that pulls the edges together</i> R33 • <i>clean the wound.</i> R18, R33 • <i>reduces the patients pain</i> R18 	<ul style="list-style-type: none"> Stops bleeding Reduces bleeding time Prevents sepsis Covers wound Closes wound Cleans wound Reduces pain

5. Categories that contained similar meanings from all the participants were then **grouped together into sub-themes**. These sub-themes were used to generate themes.

Significant phrases	Researcher identified Categories	Sub themes	Themes
<ul style="list-style-type: none"> • <i>It makes blood stop flowing quickly R5</i> • <i>blood becomes thicker faster R33, It makes blood stop flowing quickly R5</i> 	Stops bleeding Reduces bleeding time	Hemostasis	Therapeutic goal of wound care
<ul style="list-style-type: none"> • <i>prevents the wound from getting dirty and smelling R5</i> • <i>remove pus R5</i> • <i>clean the wound. R18, R33</i> • <i>keeps flies away R18</i> 	Prevents sepsis Cleans wound Covers wound	Infection prevention	
<ul style="list-style-type: none"> • <i>make the ends of the wound come nearer to each other then unite R33.</i> • <i>force that pulls the edges together R33</i> 	Closes wound	Wound closure	
<ul style="list-style-type: none"> • <i>reduces the patient's pain R18</i> 	Reduces pain	Pain control	

6. Finally interpretations and meaning were constructed from all the findings and conclusions drawn regarding plants and wound healing in South Western Uganda. The description and themes are presented in a qualitative narrative (section 5.5-5.7) (Creswell, 1998) which included excerpts from the data such as direct participant quotes to enable the reader to evaluate the connection between what the participant said and how the researcher labelled what was said (LoBiondo-Wood and Haber, 2002).

4.6.5.3 Descriptive statistics

The data pertaining to type of plants used for wound healing in South Western Uganda including their vernacular names, botanical names and other plant biology information were tabulated into meaningful patterns (Mahonge et al., 2006) in the survey instrument (Appendix 5).

Descriptive statistics were carried out for the study participants' demographic characteristics using SPSS version 17.0 (Chicago IL) and are presented in tables and graphs in chapter 5. Data about the plants correlated to the types of wound treated, the parts used in the method of preparation, administration and cultivation were also

entered into SPSS and analysed to be able to help in drawing conclusions regarding use of these plants for wound healing.

4.7 Phase III: Phytochemical studies

4.7.1.1 Materials

Except where mentioned, all standards and reagents were obtained from Sigma-Aldrich (UK Ltd).

Folin-Ciocalteu reagent (FC), Sodium carbonate (Na_2CO_3), Gallic acid (Santa Cruz Biotechnology, USA), Methanol, 2,2-Diphenyl-1-picrylhydrazyl (DPPH), L- Ascorbic acid, Sodium Nitrite (NaNO_2), Aluminium Chloride Hexahydrate (AlCl_3), Sodium Hydroxide (NaOH), Catechin hydrate, Quercetin, tris(hydroxymethyl)aminomethane (TRIS) (Melford lab, UK Ltd), Porcine pancreatic elastase, N-Succinyl-Ala-Ala-Ala-p-nitroanilide (AAPVN), N-methoxysuccinyl-Ala-Ala-Pro-Val-chloromethylketone, Collagenase from *Clostridium histolyticum*, N-[3-(2-Furyl)acryloyl]-Leu-Gly-Pro-Ala (FALGPA), Tricine, Sodium chloride (NaCl) (Fisher Scientific, UK) , Calcium chloride (CaCl_2) (BDH chemicals, UK Ltd) and Ethylenediaminetetraacetic acid (EDTA) (Fisher Scientific, UK).

4.7.2 Selection of Methods

This was a pilot/ feasibility phytochemical study of selected medicinal plants reported as useful for wound healing in South Western Uganda. The assays chosen for the phytochemical analysis of the selected plants were informed by accounts of traditional healers recruited into the study, and guided by reference to established methods and procedures derived from the literature. A crude extraction procedure and establishment of phytochemical content was initiated as a preliminary step to exploring wound healing utility of plants and as a starting point and provide an initial marker of extraction efficiency.

4.7.3 Plant material preparation and extraction

Extraction is the separation of medicinally active portions of plant tissues using selective solvents through standard procedures (Tiwari et al., 2011). According to Sasidharan *et al.* (2011), extraction is the crucial first step in the analysis of medicinal plants, because it is necessary to extract the desired chemical components from the

plant materials for further separation and characterization. Tiwari *et al* (2011) assert that the effect of extracted plant phytochemicals depends on the nature of the plant material, its origin, the degree of processing, the moisture content and the particle size.

In this study, air dried samples of the leaves of selected plants were broken into small pieces between the fingertips and stored in the dark in sterile polystyrene containers prior to grinding into fine particles with a cryomill (cryomill Spex Sampleprep 6770). Briefly, freeze resistant capsules suitable for the cryomill containing plant material were immersed in liquid nitrogen, milled following a programme of: 15 cycles per second (cps) for 2 minutes at 1 cycle to generate an ultrafine dry particulate, later confirmed by environmental scanning electron microscopy (Esem). Photographs illustrating this process are presented in figure 4-2.

Figure 4-2: photographs showing the preparation of plants prior to extraction

Ultrasonification of biological tissue is primarily associated with cell disruption (lysis) or disintegration (Allinger 1975). Sound waves result in alternating high pressure and low pressure cycles (Suslick, 1998). The resulting shear forces break the cell envelope mechanically and improve material transfer (Mokkila *et al.*, 2004). Relatively low temperature (50⁰C) extraction in water or methanol served to protect thermo-labile substances, but did risk limited extraction of other substances. Although sonification also creates heat, this was limited by using the bath type sonicator rather than the probe type. The bath type sonicator is gentler, but probably much less efficient and also avoids local high temperatures; this was done by careful monitoring of the temperature of the water in the bath.

Crude aqueous and methanolic extracts of each plant species was prepared by adding 5g of milled plant material to 50ml of fresh deionized water or methanol in 100ml glass bottles and agitated for 3 hours in an ultrasonic bath for 0, 30 and 60 minutes. The temperature of the bath water was maintained at 50⁰C using an orbital incubator (Stuart S150). Both aqueous and methanolic samples were then filtered using Whatman number 91 filter paper.

The filtered extracts were aliquoted into 20 ml polyethylene centrifuge tubes and briefly centrifuged for 5 minutes at 400g in a Megafuge 1.0 Heraeus Sepatech centrifuge to pellet any remaining particulate matter. The supernatant was transferred into clean 20 ml tubes and further aliquoted into duplicate pre-weighed 1.5ml eppendorf tubes.

The methanolic extracts were evaporated overnight at 37°C in an incubator (LEEC Ltd). The aqueous extracts were dried in a Thermo Savant ModulyoD freeze dryer at 52°C and a pressure of 197bar for 72 hours. All the dry extracts were weighed and stored at -20°C until required for phytochemical assays. Figure 4-3 shows photographs of the aqueous and methanolic extracts before and after drying.

Figure 4-3: Photographs showing aqueous and methanolic extracts before and after drying

4.7.4 Resuspension procedure

The methanolic extracts were resuspended in 100µl of Dimethyl sulfoxide (DMSO), then sonicated for 5mins and made up to volume with Phosphate buffered saline (PBS) at a concentration of 1mg/ml. DMSO was selected because it is less toxic than methanol in cell based experiments and is a useful solvent for many organic compounds. The aqueous extracts were dissolved in phosphate buffered saline at a concentration of 1mg/ml.

4.7.5 Phytochemical assays

The extracts were assessed for total phenolic content, total flavonoid content, and antioxidant activity by the method of DPPH inhibition. Plants contain a wide variety of compounds including polyphenols such as flavonoids, phenolic acids tannins and tocopherols (Thring et al., 2009), and polyphenol assays (including flavonoids) provide us with a simple and useful marker of extraction efficiency because they are ubiquitous and convenient. According to , the wound environment involves pro/antioxidant processes , which makes polyphenols an obvious candidate for plant use in wound healing and for the action of plants on health generally (Mukherjee et al., 2011). They represent a large group of secondary plants metabolites which bind strongly to proteins and the crude extracts may contain other reactive compounds.

Flavonoids are a diverse group of naturally occurring polyphenolic compounds found ubiquitously in vegetables and fruits. It has been suggested that these compounds demonstrate potent antioxidant and anti-inflammatory effects in a variety of *in vitro* and *in vivo* models using endogenous or exogenous oxidant stress (Haramaki et al., 1994, Gao et al., 1999, Sakano et al., 2005). The overall aim of both these assays was to

establish a simple efficient extraction method upon which to base further investigations. In order to make a final decision on which plant extracts to use for the next stage of the lab analysis, the extracts were assayed for the presence/absence of antioxidant activity.

4.7.5.1 Total phenolic Assay

Total phenolic compounds in the plant extracts was determined according to an adapted Folin-Ciocalteu procedure described by (Ainsworth and Gillespie, 2007). Briefly, 100 μ L (25 μ g/ml) of plant extract was added to 200 μ l of Folin-Ciocalteu's reagent, vortexed and then incubated for 8 minutes at room temperature (RT). Sodium carbonate (800 μ l/ 700mM) was then added, briefly vortexed/spun and incubated in the dark for 2 hours at room temperature RT. To a 96 well flat-well plate, 200 μ l of the reagents were added in triplicate and the absorbance of each sample read at 765nm in a Thermolabsystems Multiskan spectrophotometer. The concentration of polyphenols was calculated with reference to a standard curve generated with Gallic acid (μ g/ml) and expressed in units of mg per Gallic acid equivalents (mg/GAE).

4.7.5.2 Flavonoid assay

Serial dilutions of Quercetin (0-1000mM) or extract (500 μ l, 25 μ g/ml) was added to 500 μ l of 2% Aluminium Chloride Hexahydrate (AlCl_3) in methanol and incubated for 1 hour at room temperature (RT). Triplicate 200 μ l of extract samples, standards and blank were placed into a 96 well plate and absorption read at 420nm in a Thermolabsystems Multiskan spectrum plate reader.

4.7.5.3 2,2-Diphenyl-1-picrylhydrazyl (DPPH) Radical scavenging activity assay

Some researchers suggest that two-thirds of the world's plant species have medicinal value; in particular, many medicinal plants have great antioxidant potential (Krishnaiah et al., 2011). Redox chemistry is essential for living processes and antioxidants protect against oxidative stress and are therefore useful among other chemotherapeutics in the management of many human diseases, including cancer, cardiovascular diseases and inflammatory diseases. Infected wounds attract high levels of phagocytic cells which release reactive oxygen species in an attempt to fight infection; however these molecules can damage the host cells and delay the healing process.

The radical scavenging activity of the plant extracts was determined by the 2,2-Diphenyl-1-picrylhydrazyl (DPPH) assay (Chizzola et al., 2008, Adetutu et al., 2011) and percentage inhibition was calculated as oxidant or antioxidant status of wounds is an important parameter, influenced by factors like infection and infiltrating leucocytes among others. The DPPH inhibition assay was employed as a measure of the antioxidant potential of extracts of *A. conyzoides*, *B. pilosa* and *G. parviflora*. DPPH is a stable free radical that reacts with compounds that can donate a hydrogen atom. This method is based on the scavenging of DPPH through the addition of a radical species or an antioxidant that decolourises the DPPH solution (Krishnaiah et al, 2011). The antioxidant activity of plant extracts was compared to ascorbic acid (0-1000mM). In this study, 100µl of ascorbic acid or extract (1mg/ml) was added to triplicate wells and DPPH 200µM added. When not in use, the DPPH solution was kept in the dark at -4°C. This was incubated for 30 minutes in the dark, and then the decrease in absorption measured at 517 nm every 30 minutes until there was no further change in absorbance.

Radical scavenging activity was calculated by the following formula:

$$\text{Percentage Inhibition (\%IP)} = [(Abs_{S_B} - Abs_{S_A}) / Abs_{S_B}] \times 100.$$

Where: Abs_B represents absorption of blank sample

Abs_A-absorption of tested extract solution

4.7.5.4 Anti-Elastase activity

Eighty percent of skin dry weight is collagen which is responsible for the structural support and tensile strength of the skin. Elasticity is due to the elastin fibre network making up 2–4% of the extracellular matrix (ECM) and glycoaminoglycans (GAG's) are involved in the hydration of the skin (Jenkins, 2002). Elastase secreted from leukocytes especially neutrophils, plays a part in leukocyte infiltration, tissue modelling and antimicrobial effects. Fibroblasts also release elastase which is involved in remodelling and is thus useful in the context of wound healing. Elastase and its substrates could be affected by plant extracts and provide some evidence of how they might influence wound healing. The anti-elastase activity of the three selected plants was assayed *in vitro* not confirmed in any another model e.g. cell or *in vivo* and while it only allows us to draw limited conclusions, it provides an initial step indicating potential for future work.

Secondary metabolites including polyphenols and flavonoids and whole extracts from plants have been investigated and found to have anti-elastase activities (Yamaguchi et al., 2009, Sultana and Lee, 2007). Collagenase from the bacteria *Clostridium*

histolyticum (ChC) (Kim et al., 2004) and both collagenase and elastase from endogenous sources like fibroblasts and immune cells have been shown to degrade the ECM. This bacterial collagenase hydrolyses triple-helical collagen in both physiological conditions and *in vitro* conditions using synthetic peptides as substrates (Vanwart and Steinbrink, 1981). Preliminary screening of *B.pilosa*, *A. conyzoides* and *G. parviflora* demonstrated evidence of potential anti-elastase. Plant activity is reported to be sensitive to antioxidants and the demonstrable evidence of anti-elastase activity might suggest that these plants influence wound healing in humans through the inhibition of the serine protease enzyme, elastase.

This assay was performed in 0.2M Tris-HCL buffer (pH 8.0) using the method developed by Rao et al in 1997. Porcine pancreatic elastase maintained on ice was placed into triplicate wells of a 96 well flat well plates (20µl of 0.45 U/ml), then 80µl of plant extract (sample) was added and incubated for 15 minutes at room temperature (RT). The chromogenic substrate N-Succinyl-Ala-Ala-Ala-*p*-nitroanilide (AAPVN) (100µl) suspended in 0.2M Tris buffer (pH 8.0) was then added to each well to make a final volume of 200µl. This was then incubated at RT for 20 minutes. To negative control wells, 20µl of substrate buffer replaced the enzyme. A specific elastase inhibitor (N-methoxysuccinyl-Ala-Ala-Pro-Val-chloromethylketone) acted as a positive control. This was added in place of buffer (60µl) to selected positive control wells containing the enzyme 15minutes prior to the addition of substrate. Absorbance was then read in a Thermolabsystems Multiskan spectrum plate reader at 410nm.

The percentage inhibition of elastase was calculated with the following formula:

$$\text{Enzyme inhibition activity (\%)} = \left[\frac{(\text{OD}_{\text{CONTROL}} - \text{OD}_{\text{SAMPLE}})}{\text{OD}_{\text{CONTROL}}} \right] \times 100$$

4.8 Ethical approvals

The research protocol, the participant information sheet, consent form and draft interview schedule were submitted to the School of Healthcare Research Ethics Committee (SHREC) for ethical approval which was granted [SHREC/RP/183], (20/05/2010). A fieldwork risk assessment was carried out in conjunction with the School of Healthcare Health and Safety officer (University of Leeds) and clearance obtained. Further approval for data collection in Uganda and materials transfer to the University of Leeds was sought from the Uganda National Council for Science and

Technology (UNCST) [HS 936] (30/01/2012) and Mbarara University of Science and Technology Institutional Review Committee (MUST-IRC) [No 28/06-08] (15/07/2010) in accordance with the guidelines for research involving any Ugandan natural resources such as plants (see appendices 7-9 for approval letters). A Materials transfer agreement (MTA) was drawn up to allow the researcher import selected plant specimens to the UK, as the Food and Environment Research Agency (UK) confirmed that there was no need for plant health 'phytosanitary' certificate.

Written permission to carry out interviews in the field was sought from the Chief Administrative Officer (CAO) and the District Director of Health Services (DDHS) of Isingiro district. Written and verbal Informed consent was obtained from all participants prior to inclusion in the study. The dignity, rights, safety and wellbeing of participants were observed at all times. Following article VII and VIII of the World Medical Association (WMA) declaration of Helsinki (WMA, 1964), ethical principles for medical research involving human subjects, consent was requested after providing information regarding the aims of the research, confidentiality and what was involved for the participant. Participants were also informed that they could ask any questions regarding the study during the course of the interview and were free to withdraw their participation at any time. (Appendices 4 and 5).

To ensure confidentiality, no participants' names were recorded but were substituted by ID numbers (Holloway, 2008) and data was stored in a locked box that only the researcher had access to. All electronic data was stored on a secure server with a password protected computer and files. The data generated in the field was transported in password protected USB stick in accordance with the UK data protection act of 1998 (The National Archives, 1998).

Chapter Five

5 RESULTS

5.1 Introduction

The previous chapter described the processes used to generate and analyse the data in this study. This chapter will sequentially present the findings of the research in order of the three phases in which they were carried out; literature review phase (section 5.2), field work phase (section 5.3-5.7) and the laboratory work phase (5.8). Section 5.9 will integrate the findings. Examples of direct quotations from qualitative interview and participant observations in the field work phase are presented in order to illustrate how data were reduced and key elements synthesised with the aim of constructing an understanding of plants and wound healing in Uganda. The chapter starts with findings from a review of the literature systematically (Section 5.2) which answered the question 'What is the existing available literature on plants and wound healing in Uganda?'.

5.2 Results from phase I: Literature Review

The systematic search of the literature for the evidence to include in the review was conducted between November 2009 and January 2010 and was repeated in January 2012.

5.2.1 Study Selection

Initially 156 citations were identified through database searching and 15 from other sources including key journals, index to theses and proQuest databases of theses and dissertations as described in section 4.5.2. After duplicates were removed, 114 citations were screened using titles and abstracts. Of these, 91 records were excluded because they were clearly not relevant to the review on the basis of inspection of title and abstract, leaving 23 full text articles for assessment of eligibility. These included those that were clearly relevant to the review and those where a definite decision could not be made by reading the abstract alone. Studies presenting pharmacological

evaluations of plants (n=6) and studies unrelated to injury (n=8) were excluded because the focus was on ethnobotany. This left nine studies for inclusion in the review (Figure 5-1). A repeat search of the literature in January 2012 led to the inclusion of two more studies bringing the total number of studies for review to eleven (n=11).

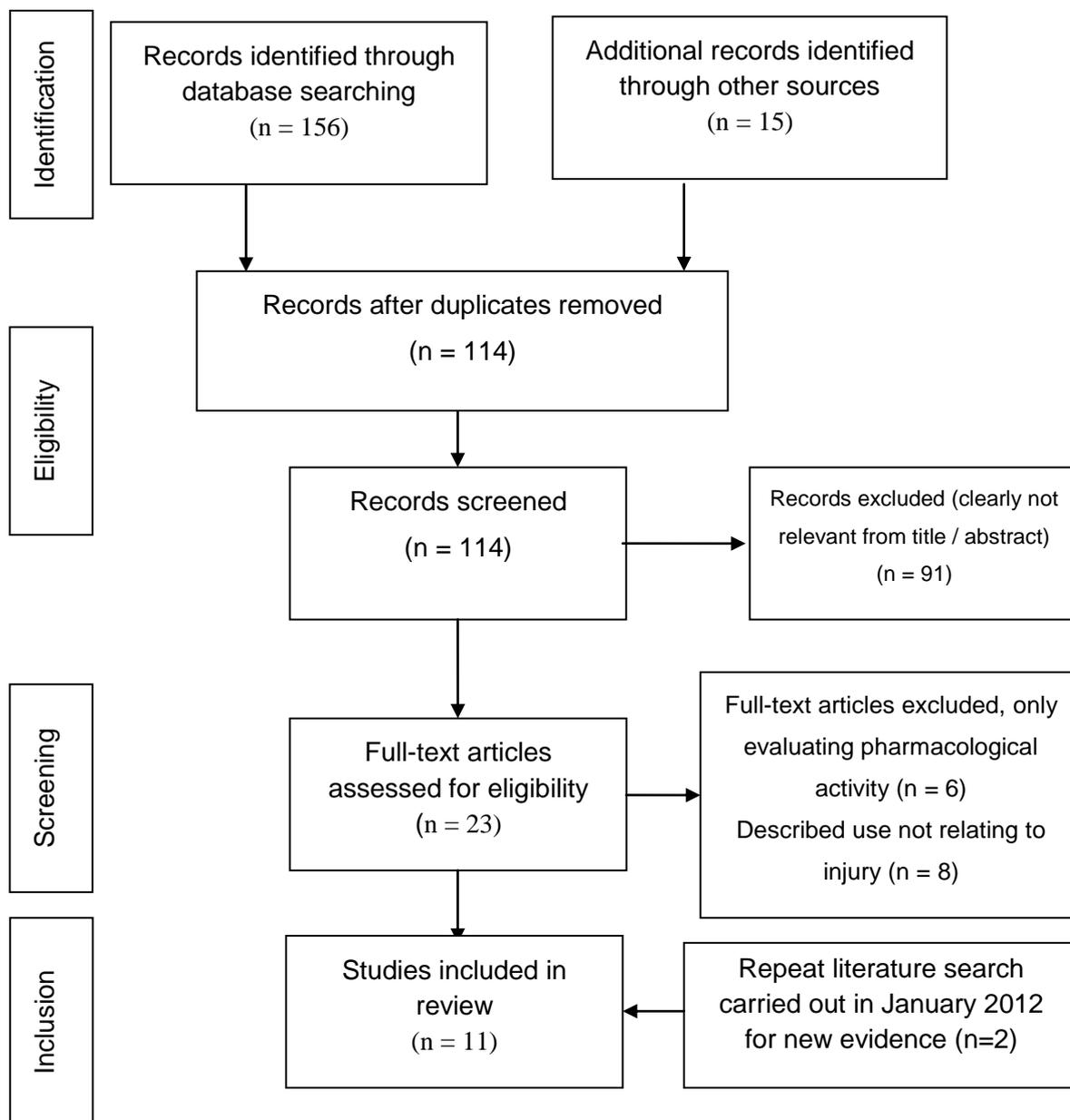


Figure 5-1: PRISMA flow diagram of published studies adapted from (Moher et al., 2009)

5.2.2 Summary of included primary studies

The first study by Hamill et al (2000) was aimed at presenting an ethnobotany of traditional herbs used among three southern Ugandan tribes. This was undertaken through a research agreement between the Ugandan Ministry of Health's Natural Chemotherapeutics Research Laboratory (NCRL) and the University of Illinois as part of a strategy to improve cooperative efforts between modern and traditional healthcare workers in Uganda. This study used the data collection method of interviewing a few individuals whose skills in medical herbalism were recognised by members of their tribes. This study yielded 104 plant species used for traditional healing in Southern Uganda and of these only 29 were not found referenced in the NAPRALERT database. The authors assert that the determination of the presence of a specific chemical with known bioactivity may support the traditional use of a medicinal plant and this study identified several plants from the literature which possess chemicals that are already known. However, they caution against measuring the value of a medicinal plant solely by potential to bring a pure compound but also "by its history of having alleviated suffering through the ages"(Hamill et al., 2000).

Following on from this study, Hamill et al (2003a) conducted field interviews with the Baganda tribe only and 124 plant species were added to those identified in the previous study. In keeping with their methodology from the first study (Hamill et al., 2000) these were followed by literature searches to provide support for the ethnomedical claims for a number of these species in the true ethnopharmacological approach style. The findings from this literature search also provided criteria for species classification and also helped to guide the selection of species for recollection and antimicrobial assays. This systematic study found that the use of traditional medicine was a job particularly for the women in the household. The laboratory investigations of the biological activities of reported anti-infective species indicated the presence of antimicrobial compounds which served as the basis for crude and fine susceptibility testing to determine these species' effectiveness as inhibitors of the growth and spread of micro-organisms.

Another study that resulted from a literature review was conducted by Orwa et al (2008) with the aim of collecting ethnomedical information for a commonly used plant *Toddalia asiatica*. This plant was chosen because it is widely available and used in East Africa. The population comprised traditional health practitioners from three East African countries and the majority were 41-60 years old. The authors therefore

concluded that they had extensive experience of traditional healing and were a useful source of authentic ethnomedical information. They also presented a number of regulatory initiatives introduced by the government concerning the regulation of traditional medical practice. The challenges faced by the practitioners in their practice included lack of or poor storage facilities, long distances to travel for plant collection, inadequate conservation skills, lack of adequate tools and skills for post harvest processing, non-compliance of patients with the treatment regimen and the lack of designated areas for traditional practice. The healers in this study reminded the researchers about their interest in receiving feedback at the end of the study.

Okello and Ssegawa (1999) based their study on the fact that although medicinal plants were used for treatment of various diseases, there was little or no effort made to document this information which was threatened with loss due to the herbalists being elderly and also due to over-harvesting. In their study the majority of the healers were between 70 and 79 years and all the healers interviewed remarked about the changes in the abundance and occurrence of medicinal plants harvested which supports the authors' earlier supposition. This was the first study where the healers mentioned the use of sound hygiene practices during the preparation, handling and administration of the medicines. The authors reported that over harvesting of the medicinal plants was evident from their habitats and recommended that ethnomedical surveys be conducted as part of the strategies to initiate both *in situ* and *ex situ* plant conservation programmes.

Similarly, Namukobe et al (2011) conducted a study to establish the traditional plants used for medicinal purposes by local communities around the Northern sector of Kibale national park in Uganda. The authors noted that there is a lot of valuable information about the use of medicinal plants which is lost from one generation to another and that with the increasing rate of habitat destruction, plant resources including medicinal plants were getting depleted or threatened and therefore suggested the need to conduct a study to document this knowledge to serve as a platform for the development of conservation and management interventions of plant resources as well as to provide baseline information for scientific studies leading to the isolation of bioactive compounds that may serve as starting materials in the discovery of new plant based drugs.

While conducting a survey of the use of medicinal plants and other traditional medicine in Kasese district in Uganda, Challand (2005) reported the widespread knowledge of,

availability of and use of medicinal plants in Kasese, but lesser use of invasive traditional practices. He asserted that the true figures were probably higher but that there was probably an underlying fear of admitting to using traditional practices to Western-trained health workers. Challand (2005), also reported that knowledge of the use of common plants for common problems was not restricted to the traditional healers which agrees with findings from a study by Ssegawa and Kasenene (2007). This study also identified a possible under reporting of the use of plants for HIV/AIDS due to fear of admitting to the presence of HIV/AIDS in the family in the public arena. The author suggested other possible reasons which may include lack of knowledge about the ways in which HIV/AIDS presents and confusion over the difference between treating the HIV virus and treating the opportunistic infections. This study was unique in that the questionnaire included 12 plants, which were thought to be commonly used or useful instead of the usual method where participants were asked to mention the plants used for treatment of various diseases.

The study by Namukobe et al (2011) recorded 131 plant species belonging to 121 genera and 55 families which were used to treat different diseases, the authors noted that some of the plants were only cited once which they attributed to the possible rarity or their disuse because of cultural adaptations. Asteraceae stood out as the most commonly cited plant family with most of the herbal remedies made from leaves. The authors suggested that leaves were used because of their potency as well as their fast regeneration. This study therefore established that traditional medicinal plants contribute significantly to the treatment of several diseases and also recommended the need for validation of the use and effectiveness of the plants that have not yet evaluated.

Namukobe et al (2011) asserted that most of the medicinal plants collected are not cultivated and face a risk of depletion and they offered the recommendation of identification and selection of the efficient wild plants for cultivation in medicinal gardens. However in their study of Medicinal plants of Erute county, Oryema et al (2010) found that ex situ conservation of medicinal plants was considered as a source of confusion in the home. They also found that wild plants were reportedly unable to grow normally when domesticated because of the change of habitat and that collection from the wild was reported to consume less time than growing them at home. Their study revealed 180 medicinal plant species used for the treatment of mainly stomach ache, cough, wounds, worms, venereal diseases and malaria/fever. They did not

attempt to authenticate the remedies since these remained secret and the main focus of their study was on the conservation of medicinal plants.

In contrast to the findings from Oryema et al (2010), the study by Tabuti et al (2003b) on traditional herbal drugs of Bulamogi in Uganda reported that all TMPs cultivate some medicinal plants, especially fast growing ones around their homes and shrines in order to have them within easy access. This study recorded a total of 229 medicinal plant species belonging to 168 genera and 68 families. The authors postulate that the large number of species recorded points to a dependence on a diversity of plant species and also alludes to the existence of a substantial amount of local healing knowledge among the community.

Another study concerned with the threats to plant species was conducted by Ssegawa and Kasenene (2007). Their study was based on the observation that a large number of medicinal plants and associated indigenous uses still awaited proper documentation. Their main aim therefore was to find ways of sustainably utilising medicinal plant species and ensuring the documentation and transmission of traditional knowledge. Gastro-intestinal and psycho-spiritual problems were among the most frequent ailments treated with medicinal plants and most people were familiar with the species for treatment of common ailments (symptoms) like cough, fever and headache. Interestingly, knowledge of the treatment of a few ailments such as epilepsy, hypertension and syphilis was generally restricted to the elders and traditional medicine practitioners. This could be equated with the knowledge of over-the-counter drugs in western medicine which are known by many people and the prescription drugs which are the domain of the trained health care practitioners.

Ssegawa and Kasenene (2007) reported that a high portion of the vegetation of Uganda has been modified by cutting, cultivation, burning, grazing and other actions which has reduced the quality and range of these vegetations over time. This agrees with findings from Eilu and Bukenya-Ziraba (2004) who studied the local use of climbing plants of Budongo forest reserve in Western Uganda. This study was based on the observation that assessments of plants used by local people in Uganda often lump together various growth forms and fail to highlight the contribution of climbing plants, yet each growth form requires specific management strategies. Their findings revealed that trees were the highest ranked in terms of importance to local livelihood and climbers were ranked second. One of the reasons for the popularity of the climbers was for making ropes and for hunting. None of the respondents acknowledged taking

part in any hunting activities possibly because this is illegal in forest reserves in Uganda. The authors suggest putting mechanisms that allow local communities to harvest selected non-timber resources from the forest reserves in a regulated manner as a means of conserving rare species.

In summary, the main threads emerging from these studies are about presentation of ethnobotanies of plants used for traditional medical practice in Uganda, the potential threat to plant diversity and the need for further phytochemical studies to support their use in traditional medicine.

5.2.3 Study Characteristics

The included studies all reported on medicinal plant use for one or more injuries according to the WHO International Classification of Diseases (ICD). Each of the studies published between 2000 and 2011 were carried out in different regions and districts of Uganda. The study participants were traditional medical practitioners, men and women from randomly selected households, harvesters, processors and retailers of medicinal plants (Oryema et al., 2010). The general characteristics of the studies included in the review are presented in table 5-1. The reasons why the 14 studies were excluded from this review are presented in a table in Appendix 1.

Author	Sample size	Region of Uganda	Sampling and population	Methodology	Findings
(Hamill et al., 2000)	7	Southern, Western and Central	Reputation sampling of people whose skills in medical herbalism were recognized by members of their own tribes.	Continuous informal question-and-answer interviews (semi-structured) during hikes in the forests.	Presented an inventory 104 medicinal plants of Southern Uganda and a review of the literature in preparation for further collections, and for collaborative laboratory validation of in vitro antimicrobial activity.
(Hamill et al., 2003a)	Not specified	Southern	Reputation sampling of people whose skills in medical herbalism were recognized by members of their own tribes.	Continuous informal question-and-answer interviews (semi-structured) during hikes in the forests.	Conducted a literature analysis to help guide the selection of species for recollection, for chemical extraction and further testing.
(Tabuti et al., 2003b)	173	Eastern	Reputation and stratified sampling of Traditional medicine practitioners (TMPs) and household respondents	Semi-structured interviews guided questionnaires, direct observation and transect walks.	Presented an inventory of the medicinal plants of Bulamogi county in Uganda, including their medicinal use, preparation and administration mode. 229 plant species belonging to 168 genera in 68 families with medicinal properties were recorded.
(Eilu and Bukenya, 2004)	18	Western	Sampling method of Heads of households unclear.	Questionnaires and in-forest interviews	Investigated the use of climbing plants, in and around Budongo Forest Reserve (BFR). Of the 142 species of climbers known to occur in mature forest of BFR the local people use 63 species (44%) from 52 genera and 36 families.
(Challand, 2005)	23 groups with a mean sample	Western	Unspecified sampling of Pre-existing community groups e.g. support groups for people living with HIV/AIDS, mother and child	Focus group discussions.	Quantified how widespread the use of medicinal plants was, where people got information on how to use them, what sort of illnesses were treated,

	size of 21. (492)		clinics and health clinic staff		which plants were commonly used and from where the plants were obtained.
(Okello and Ssegawa, 2007)	30	Northern	Stratified sampling of Local people and traditional healers	Questionnaires or interviews depending on their level of education	60 medicinal plant species belonging to 51 genera and 38 families were identified.
(Ssegawa and Kasenene, 2007)	205	Central	Stratified random sampling of men and women	Structured questionnaire pre-tested using focus group discussions.	One hundred and eighty-six plant species belonging to 163 genera and 58 families with medicinal values were recorded. Remedies from these plants are prepared mainly as decoctions and infusions and administered in a variety of ways.
(Orwa et al., 2008)	60(not clear if it was from each country).	East Africa	Unspecified sampling of Traditional Health Practitioners	Questionnaire and consultative discussions.	Investigated and discovered that <i>Toddalia asiatica</i> is collected in the wild, prepared mostly as decoctions or concoctions and administered orally. It is used for the management of a number of disease conditions.
(Oryema et al., 2010)	Not specified	North Eastern	Unspecified sampling of specialists (elders, traditional healers), harvesters, processors and retailers of the medicinal plants.	Questionnaires, interviews (group and single) and discussions.	Documented local names, parts used and diseases treated and the conservation status of 180 plant species belonging to 144 genera and 57 families of medicinal plants in Erute county.
(Kamatenesi et al., 2011)	84	Northern	Local population, health workers, renowned herbalists, and local leaders.	Interviews, formal and informal discussions and field excursions	71 plant species reported for use in the treatment of various diseases in Ngai and Otwal Sub Counties in Oyam district

(Namukobe et al., 2011)	35	Western	Network sampling of homesteads and individual herbalists alluded to.	Open interviews, semi-structured questionnaires	131 plant species belonging to 121 genera and 55 families were established for treatment of different diseases in the northern part of Kibale National Park
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Table 5-1: Characteristics of included studies

5.2.4 Types of injuries treated with medicinal plants

The literature review found that plants were employed for the treatment or management of 9 classes of injury, predominantly wounds (60) and snakebite (58), followed by burns (8) and poisoning (8) among others (Table 5-2).

Table 5-2: Types of injuries for which different plant species are used.

Injury treated	Frequency of plant use for the treatment of injuries
Wounds	60
Snakebite	59
Burn wounds	8
Poisoning	8
Insect bites	4
Joint Dislocation	4
Broken bone	3
Bleeding including nose bleeding	2
Dog bite	1
Total	149

5.2.5 Plants used for wound healing from the literature

Following this finding, the plants used for wound healing were then identified. Seventy eight plant species belonging to 28 families were identified for use in the treatment of wounds in Uganda from the eleven relevant studies that were systematically reviewed (Appendix 2). The five families with the largest number of species being used for treatment of wounds included: Asteraceae (18 species), Euphorbiaceae (9 species), Fabaceae (8 species), Vitaceae (5 species) and Poaceae (5 species).

5.3 Results from Phase II: Fieldwork

This section presents the results from the fieldwork phase including those from the pilot study of participant recruitment, the interviews, surveys, field visits, participant observations and transects walks.

5.3.1 Pilot study of participant recruitment

This section presents the results from the pilot study of participant recruitment. The aim of conducting this pilot study was to test the sampling methods, assess the strengths and weaknesses of the multidisciplinary team, test the electronic equipment and establish the length of interviews in order to facilitate planning and effective execution

of the fieldwork phase. The pilot study was conducting prior to conducting the interviews.

5.3.1.1 Demographic characteristics of pilot study participants

There were 5 participants in this pilot study. One was male and the rest were female, two were married, one was separated and the other two widows. They were all over 40 years of age and only one of the participants had attained an education beyond the primary school level. Three of them were traditional medical practitioners and two practiced herbalism as a secondary occupation to farming.

5.3.1.2 Results of the instrument assessment

The instruments in this study included the interview guide (Appendix 4) and the survey questionnaire (Appendix 5). They included all of the questions necessary to answer the research questions. The questions elicited the type of responses that were anticipated by the team thereby supporting face validity. The order of the questions was changed to make the interview flow better in terms of the sequence of questioning. Both instruments were assessed by conducting interviews with the pilot study participants in a way similar to the way that would be done with the actual study participants.

The interview guide was written in such a way that the language was meaningful to the different age groups and the team were required to insert different versions of the questions to apply to the local dialect of the youth and to the more formal speech patterns of the more elderly participants. The newly created versions of the interview guide were presented to older and younger members of the community and each age group clearly validated the guide with questions specific to either the older or younger generations.

There was a question about 'rituals performed before the treatment is administered'. The meaning of this was intended to denote something done or practised regularly but the respondents took it to mean any spiritual practices and no matter how we tried to explain, that meaning could not be avoided. We decided to retain the question in order for it to form part of the discussion of the practice. This is because we were seeking to understand the local practice and if the participants felt that this was an important aspect of traditional medicine then this question was vital to the study.

The question 'How do you administer it?' was irrelevant because when asked about preparation of the herbs participants automatically talked about preparation and administration together. This might point to issues of cultural meaning, language or even generalisability to the Uganda population. However, the decision was made to

retain that question because it was a very important variable in the study and to combine it with the preparation question.

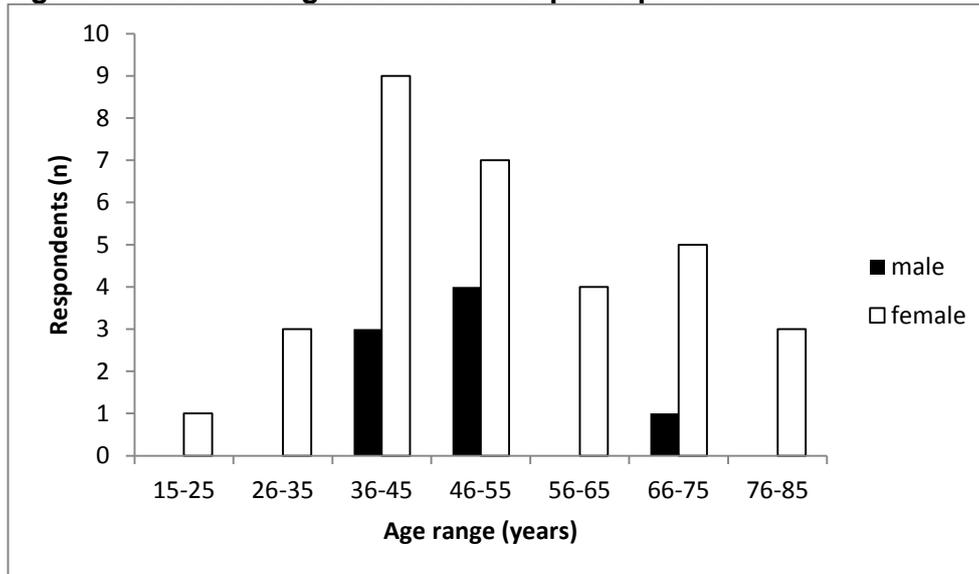
5.4 Demographic characteristics of study participants

This section presents data on the demographics of the 40 study participants that were collected during the interviews with healers and key informants. They were recruited into the study based on a reputation ranking by members of their community and by network sampling. The biographic characteristics of the participants in this study included: gender, age of respondents; level of education and sources of income. (Table 5-3) This data was collected using the interview guide (Section 4.7.4.2).

Table 5-3: Participants' demographic characteristics

Characteristic	Frequency (n=40)	Percent
1. Gender		
Female	32	80
Male	8	20
2. Age		
15-25	1	2.5
26-35	3	7.5
36-45	12	30
46-55	11	27.5
56-65	4	10
66-75	6	15
76-85	3	7.5
3. Level of education		
None	15	37.5
Primary	21	52.5
Secondary	3	7.5
Tertiary	1	2.5
4. Major occupation		
Farmer	18	45
Farmer/Housewife	12	30
Farmer/TMP	3	7.5
Housewife	2	5
Trader	1	2.5
Primary teacher	1	2.5
TMP	1	2.5
Retired typist	1	2.5
Farmer/Trader	1	2.5

The majority of the participants were female 32 (80%) and more than 50% were 36-55 years old (Table 5-3). The youngest participant was in the 15-25 years category and the oldest were in the 76-85 age category. The respective sex and age distribution of the participants is shown in figure 5-2 below.

Figure 5-2: Sex and age distribution of participants

Slightly over half the participants had attained a primary level of education 21 (52.5%) and 15 (37.5%) had not undergone any elementary training in the formal education system (Table 5-3).

Traditional healing is widely acknowledged as an occupation in Africa. This study indicates that close to 75% of the respondents regarded themselves as subsistence farmers and other trades. Although these particular respondents all used medicinal plants to treat ailments and were recognized by their communities as traditional health care providers, only 4 (10%) confirmed that they were traditional medicinal practitioners as a sole occupation of a combined population of TMPs and key informants. The majority of the participants thus indicated that farming is their main source of income, with only 1 participant indicating use of medicinal plants as their main source of income.

5.5 The knowledge of wound healing using medicinal plants

The following section presents selected findings from the interviews and observations (section 5.5.1 to 5.5.3) element of the fieldwork phase (II) of the study under the theme *knowledge of wound healing using medicinal plants*. The direct quotes from the interviews are presented with the interview respondent number e.g. R5, while the quotes from the observations are presented with an observation number e.g. PO1, any probing question from the researcher are presented with PM. This section also included results from the quantitative survey in sections 5.5.4 to 5.5.13, however there will be some integration of findings where applicable. Table 5-4 presents a summary of the subthemes.

Table 5-4: Representation of subthemes regarding the knowledge of wound healing using medicinal plants

Researcher generated sub-themes
Definition of a wound
Classification of wounds
Types of wounds
Plants used for wound healing
Part of plants used
Ethnobotanical rationale of action of plants
Preparation of remedies
Method of administration of plant remedies
Dosage of remedies
Infection prevention and control
Place from where plant is harvested
Extinction and plant diversity

5.5.1 Definition of a wound

The participants were asked to give their definition or understanding of what a wound was during the interviews and the respondent data was examined to reveal commonalities in themes and sub themes which are classified as opening on the skin, result of injury, discharge and eruption, these are shown in table 5-5.

Table 5-5: Categories and participant quotes for 'definition of a wound' subtheme

Category	Participant quotes
Opening on the skin	A wound is an open skin from any cause R10 and one which is open R5 A wound is any open skin or abscess R2
Result of injury	<i>When you get a cut or pierced by a sharp object or an accident R17, R21, R22, R23, R28, R30, R37</i> <i>A wound is like when you get a cut, tear during childbirth, ear infections or accidental injury. Anyway it is hard to actually say what exactly it is but it must come as a result of something disturbing the skin. For example something cuts you or a child's head in childbirth or you disturb the ear and get an ear infection. Wounds never come alone, something invites them. PO3</i>
Discharges pus or blood	<i>A wound is one which discharges pus and one which is open R5 Anything painful which may itch around the edges or with a pus discharge or with blood R19 ear infections R41</i>
Erupts spontaneously	<i>Spontaneous or may come by itself R9, R40, A wound can come alone like when you have syphilis R38</i>

5.5.2 Classification of wounds

After defining what a wound was, the healers were asked how they classified different categories of wounds. The methods of categorising wounds was not defined *a priori*, but emerged from the interview transcripts of the participant responses. (Table 5-6)

Table 5-6: Categories and participant quotes for 'classification of a wound'

Researcher identified categories	Participant quotes
Appearance	<p><i>Depends on how it appears</i> R9 <i>Can be categorized as either clean, dirty, new or chronic</i> R10 <i>When you look at it you can obviously see what type of wound it is. Sometimes they come to see you when the wound is dirty and smelling and full of flies. One time a boy came and had maggots growing on the wound. But many times the wound is clean.</i></p> <p><i>What do you mean by clean?</i> PM <i>A clean one does not mean it looks like it has been washed with soap...Laughs your questions are so funny. It is usually fresh and may have blood, but has no pus or is drying up. A wound can also be 'new' or old'.</i>PO1</p>
Cause	<p><i>By the cause e.g. a cut or spontaneously occurring e.g. following an abscess</i> R1, R2 <i>A wound due to an accident (RTA) or a chronic wound</i> R24</p>
Duration	<p><i>a fresh wound may be bleeding and one which is not fresh will have pus</i> R4, R18, R40, <i>To me a fresh wound is one which has just occurred while a chronic wound is one that has lasted more than a week. I believe that a wound should have healed in one or two weeks so when a client comes and says he has had that wound for over two weeks, I just put that in the chronic wounds. Sometimes there are patients who come with wounds that they have had for over one month and they have been getting treatment either from the hospital or from another healer with no improvement. For such patients, I usually advise them to first purify themselves because the ailment might be spiritual.</i> PO4</p>
Location	<p><i>Can be external like a syphilitic wound or internal e.g. inner wounds in the stomach (ulcer)</i> R11 <i>Wounds can be divided into external or internal.</i> <i>How do you know that there is an internal wound?</i> PM <i>You know when you see a wound on the skin you either see blood or pus so when you see blood coming out of the urine or the stool then there must be a wound in there. Would that blood just come out of nowhere? No! There must be a wound. It is the same thing when some one has pus coming out their ears or blood from the nose or from 'down there'.</i> PO5</p>
Body surface area covered/Depth	<p><i>Whether it is extensive or localised</i> R25, R33, <i>Usually wounds appear in small areas but sometimes they can be really big especially when it is a child who has been burnt with a hot liquid like porridge. The bigger the area with a wound the more severe it is and the more seriously you have to look after this client. On the other hand sometimes the wound can be in a very small place but be very deep which is also bad because it can cause damage to inner body parts. So don't just look at the size of the wound to judge also look at how deep it is</i> PO1.</p>

5.5.3 Types of wounds

Following the definition and classification of the wounds in the interview, the participants were then asked to name any types of wound that they knew. They mentioned a chronic ulcer '*ekisebe*' R34, R38, abscess '*ekironda*' R5, internal sores '*Amajuta gomunda*' R27, R29, fresh cut wound '*obuhuta*' R3, R7, scalp fungal infection '*Okucweka omutwe*' R30, birth tear '*obwate*' R41, osteomyelitis '*one which involves the bone*' '*enzizi*' R2, R35, R36, dermatitis '*ekiho*' R31, R40, burns and scalds '*amatsya*' R33, and syphilitic sores '*ebinyoro*' R26. The English translations of the types wounds mentioned were provided by the physician on the team and these were confirmed and validated by two other fluent speakers of the Runyankore language.

During the ethnobotanical survey, they were specifically asked to mention the different types of wounds for which they use the medicinal plants and the majority use them for fresh wounds 54 (51.9%); their responses are shown in Figure 5-3. The list was shown to different people of different age groups in order to validate the meaning of these terms and consensus was obtained.

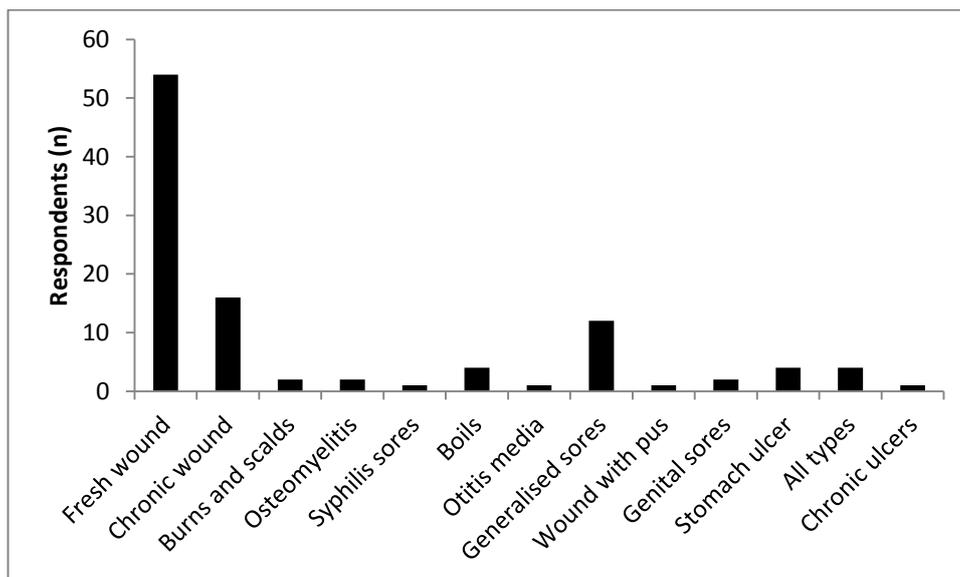


Figure 5-3: Types of wound treated by medicinal plants

5.5.4 Plants used for wound healing

In order to be considered for inclusion in this study, the specific use of a particular species of plant had to be reported by at least two key informants' or by one recognised traditional healer. Initially a list of 62 herbal remedies mentioned by all informants was compiled. Those which could not be identified because examples of

samples could not be found were deleted at this stage, leaving 47 plants (Browner, 1985).

There was low consensus between TMPs in the plants mentioned for wound healing hence the criteria for entry into the ethnobotanical survey data was more than one mention by the healers or if the plant was immediately recognised by another healer as being used for wound healing. Thirty eight plant species belonging to 18 botanical families were recorded as wound healing agents (Table 5-7). The most frequently mentioned species were from the family Asteraceae (10 species [26.3%]), followed by Solanaceae (6 species [15.8%]), Lamiaceae and Fabaceae (each with 3 species [7.9%]).

Family	Plant Species	Collection number	Local name	N	Types of wounds
Agavaceae	<i>Aloe sp. Wild sp.</i>	PMA6	Rukaka	3	Burns and scalds, Generalised sores
Anacardiaceae	<i>Mangifera indica L</i>	NC	Omuyembe	1	Chronic and new wounds
Asteraceae	<i>Bidens pilosa L</i>	PMA 1	Enyabarasana	17	Fresh wounds, Osteomyelitis, Generalised sores
Asteraceae	<i>Ageratum conyzoides L.</i>	PMA 2	Butabuta	7	Fresh wounds, Chronic wounds, Generalised sores
Asteraceae	<i>Sonchus oleraceus L.</i>	PMA 7	Entahutara	1	Fresh wounds
Asteraceae	<i>Solanecio mannii</i> (Hook. F.) C. Jeffrey	PMA 10	Omusununu	1	Chronic wounds
Asteraceae	<i>Siegesbeckia orientalis L.</i>	PMA 11	Omuzirakironda	2	Fresh wounds, Genital sores
Asteraceae	<i>Microglossa pyrifolia</i> (Lam.) Kuntze	PMA 19	Akabindizi	4	Chronic wounds, Generalised sores
Asteraceae	<i>Crassocephalum vitellinum</i> Benth.	PMA 21	Ekyomoro	3	Fresh wounds
Asteraceae	<i>Guizotia scabra</i> (Vis.) Chiov	PMA 37	Ekiterankuba	1	Fresh wounds
Asteraceae	<i>Bothriocline longipes</i> (Oliv. & Hiern) N.E. Br.	PMA 38	Ekyoganyanja	3	Genital sores, Stomach ulcers
Asteraceae	<i>Galinsoga parviflora</i> Cav.	PMA 40	Kafumba	5	Fresh wounds, Osteomyelitis
Caricaceae	<i>Carica papaya L.</i>	PMA 29	Ipapari	1	Fresh wounds
Convolvulaceae	<i>Ipomea batatas (L.) Lam.</i>	NC	Ekitakuri	1	Chronic wounds
Euphorbiaceae	<i>Tetrorchidium didymostemon</i> (Baill.) Pax & K.Hoffm	PMA 9	Omuziranfu	2	Chronic wounds, Generalised sores
Euphorbiaceae	<i>Clutia abyssinica</i> Jaub. & Spach	PMA 25	Omubarama	3	Fresh wounds, Chronic wounds, Syphilis sores

Fabaceae	<i>Rhynchosia viscosa</i> Roth DC.	PMA 15	Omutegansi	2	Chronic wounds, Boils
Fabaceae	<i>Pseudarthria hookeri</i> Wight & Arn.	PMA 24	Omukongorani	5	Fresh wounds, Chronic wounds, Generalised sores, Stomach ulcers
Fabaceae	<i>Acacia hockii</i> De Wild	NC	Obugando	2	Fresh wounds, Chronic wounds
Lamiaceae	<i>Solenostemon latifolius</i>	PMA 14	Marwa	5	Fresh wounds, Chronic wounds, Generalised sores
Lamiaceae	<i>Hoslundia opposita</i> Vahl	PMA 16	Esitimu	3	Fresh wounds, Osteomyelitis
Lamiaceae	<i>Ocimum lamiiifolium</i> Benth.	PMA 33	Omwenyi	1	Fresh wounds
Musaceae	<i>Musa paradisiaca</i> L. Var. <i>Paradisiaca</i>	NC	Emborera	6	Fresh wounds, Generalised sores
Myrtaceae	<i>Psidium guajava</i> L.	NC	Ipeera	2	Chronic wounds, Stomach ulcers
Oxalidaceae	<i>Oxalis corniculata</i> L.	PMA 28	obunyanyambuzi	3	Fresh wounds, Chronic wounds, Generalised sores
Papilionaceae	<i>Indigofera spicata</i> Forssk.	PMA 23	Kibwankurata	2	Generalised sores, wounds with pus
Poaceae	<i>Brachiaria spp</i>	PMA 32	Emburara	1	Fresh wounds
Poaceae	<i>Zea mays</i> L.	NC	Ekikyoli	1	Boils
Polygonaceae	<i>Rumex usambarensis</i> Dammer	PMA 13	Omuka	2	Fresh wounds
Rubiaceae	<i>Rubia cordifolia</i> l.	PMA 20	Oburamata	1	All types
Solanaceae	<i>Solanum anguivii</i> Lam. Cultivated	PMA 3	Obutura – cultivated	2	Fresh wounds
Solanaceae	<i>Solanum incanum</i> wild	PMA 8	Entobotobo (Wild)	1	Fresh wounds
Solanaceae	<i>Solanum nigrum</i>	PMA 12	Eshwiga	1	Fresh wounds
Solanaceae	<i>Solanum gilo</i>	PMA 46	Entuura	3	Fresh wounds, all types

solanaceae	<i>Nicotiana tabacum</i> L	NC	Etaabe	1	Stomach ulcers
Solanaceae	<i>Physalis peruviana</i> Mill.	NC	Entuutu	1	Fresh wounds
Verbanaceae	<i>Lantana trifolia</i> L.	PMA 6	Omuhuki	2	Fresh wounds, Chronic wounds
zingiberaceae	<i>Zingiber officinale</i>	NC	Ntangawuzi	2	Boils

Table 5-7: Medicinal plants used for wound healing from the ethnobotanical surveys

N=Number of mentions

5.5.5 Comparison of literature review and survey results

The ethnobotanical survey identified thirty eight (38) plant species belonging to 18 families as being used as wound healing agents in the study area. These plants were then cross-referenced with those identified in the literature review in order to investigate whether these species are already used for wound healing in Uganda. The literature review had identified seventy eight (78) plant species mentioned for wound healing and following the cross referencing, 9 plants found in this PhD study were already described, from the literature, as being used for wound healing in Uganda. These are *aloe sp.* Wild sp., *bidens pilosa* L., *Ageratum conyzoides* L., *Siegesbeckia orientalis* L., *Crassocephalum vitellinum* Benth., *Galinsoga parviflora* Cav., *Hoslundia opposita* Vahl, *Oxalis corniculata* L., *Indigofera spicata* Forssk.

5.5.6 Part of plants used

The survey also sought information about the parts of plants used for wound healing. The healers mainly used the leaves (80.8%) and one of them specified the use of mature leaves (1%) to prepare their remedies (Table 5-8).

Table 5-8: Part of plant used for wound healing

Part of plants used	Frequency	Percent
Leaves	84	80.8
Roots	6	5.8
Stem Bark	6	5.8
Rhizome	2	1.9
Flowers	1	1.0
Fruits	1	1.0
Branch	1	1.0
Mature leaves	1	1.0
Sap	1	1.0
Root tubers	1	1.0
Total	104	100.0

5.5.7 Ethnobotanical rationale of action of plants

During the interviews, participants were asked about the rationale of using each plant remedy for wound healing. Several subthemes emerged from the interview data and these are: cleaning the wound, controlling haemorrhage, preventing infections, wound closure and an unknown reason (Table 5-9). The names of the sub themes were derived from the interpretations of the physician on the research team.

Table 5-9: Purpose of plant use

Sub themes	Direct participant quotes
Cleaning	<i>Makes the wound clean and heals quickly R20, R19, R32, and removes pus R32 removes pus and dirt R34</i>
Controls haemorrhage	<i>When you put a band of herbs on a bleeding wound, it will stop bleeding R6 The herbs stop the bleeding and keep the wound clean because a dressing is applied R14</i>
Antiseptic	<i>The drugs which treat syphilitic ulcers remove germs that cause syphilis R3</i>
Wound closure	<i>it burns the wound edges and brings them together R10, makes the edges come together R24</i>
Unknown	<i>I don't know how it works but I think it burns the wound edges and brings them together. I surely can't say exactly how they work but I can testify that when I use them the patients get better. As long as I know that they work there is no need to know why. The patients never ask how the plants work; when you go to your doctor does he always explain how each drug works? You just take the medicine they give you and trust that you will get better. They have their book knowledge and I have my experience. That is all I have to say about that. PO2 I don't know how it works but I found it being used by elder people R15 and people have been using it for a long time R17, R28, R30</i>

While conducting the ethnobotanical survey, the participants were asked the same question about the rationale of using each plant remedy for wound healing and the highest reported were promotion of healing (17.3%); stopping bleeding (11.5%) and keeping the wound clean (9.6%) (Table 5-10). During the survey they were asked to simply list the rationale for wound healing, thus these are translations of directly reported responses from the participants.

Table 5-10: Reported method of action of medicinal plants

Mechanism of action of plants	Frequency	Percent
Promotes healing	18	17.3
Stops bleeding	12	11.5
Keeps wound clean	10	9.6
Dries the wound	7	6.7
Removes pus and makes wound clean	7	6.7
Stops bleeding and promotes healing	6	5.8
Unites edges and closes wound	5	4.8
Treat sores	5	4.8
Stops bleeding and unites edges	5	4.8
Kills germs	3	2.9
Stops bleeding and keeps wound clean	3	2.9
Supernatural	1	1.0
Unknown	22	21.2
Total	104	100.0

5.5.8 Preparation of remedies

During the interviews, the healers were asked about the preparation of remedies and who was specifically responsible for their preparation. Some of the healers were happy to let anybody prepare the remedies, while others did it themselves and others still were specific about being the ones to harvest the plants but let anyone apply them to the wound.

Findings from the quantitative survey regarding the actual method in which the plants are prepared indicate that the most common method of preparation is crushing or grinding (31.7%), boiling (11.5%), pounding in a mortar (9.6%) and drying then making a powder (8.7%) (Table 5-11).

Table 5-11: Method of preparation of plant remedy for wound healing

Method of preparation of remedy	N	%
Crush or grind	33	31.7
Clean and boil	12	11.5
Squeeze or pound in a mortar	10	9.6
Clean, dry and grind to make a powder	9	8.7
Crush and squeeze out fluid	8	7.7
Obtain decomposing inner flesh and squeeze out fluid	7	6.7
Pound in mortar and put in hot water	5	4.8
Pound in mortar	4	3.8
Chew or pound	4	3.8
Slice	3	2.9
Put in water	2	1.9
Chew	3	1.9
Roast and grind	1	1.0
Peel fruit and crush	1	1.0
Pack in banana leaves, cover it under fire for some minutes	1	1.0
Clean the wound	1	1.0
Total	104	100.0

5.5.9 Method of administration of plant remedies

The most common method for the treatment of wounds with plants appeared to be application directly onto the wound (25.0%), either as a wash (8.7%), or as a powder (8.7%) and the majority as fresh plant parts secured with a dressing (30.8%) (Table 5-12).

Table 5-12: Administration of plant remedies for wound healing

Administration of plant remedies	Frequency	Percent
Apply to the wound and secure with a dressing	32	30.8
Apply directly to the wound with no dressing	26	25.0
Apply powder to wound	9	8.7
Squeeze juice onto the wound	9	8.7
Give patient to drink (cold)	9	8.7
Put in a basin and Bathe	6	5.8
Allow fluid to flow onto the wound	4	3.8
Smear onto the affected part	3	2.9
Put in a basin and sit for sometime	2	1.9
Drink as tea (hot)	2	1.9
Hang the branch from the roof	1	1.0
Allow warm fluid to flow into the ear	1	1.0
Total	104	100.0

5.5.10 Dosage of remedies

The largest number of remedies did not have a fixed prescription or dose; 36.5% of the plants did not require a dose, whilst for 28.8% of the remedies it was the healer's personal judgement and for 18.3% one just keeps applying the plant as necessary until the wound heals (Table 5-13).

Table 5-13: Dosage of plant remedies for wound healing

Dosage to administer	Frequency	Percent
No specified dose	38	36.5
Personal judgement	30	28.8
As necessary until wound heals	19	18.3
daily	4	3.8
1 mug a day	2	1.9
Depends on size of wound	2	1.9
Fluid should cover whole wound; daily	2	1.9
1Table spoon three times a day	2	1.9
One branch	1	1.0
Adult 1-2 Tablespoons/ children 1teaspoons three times a day	1	1.0
Change dressing daily	1	1.0
Change dressing when soiled	1	1.0
2-3 times a day	1	1.0
Total	104	100.0

5.5.11 Infection prevention and control

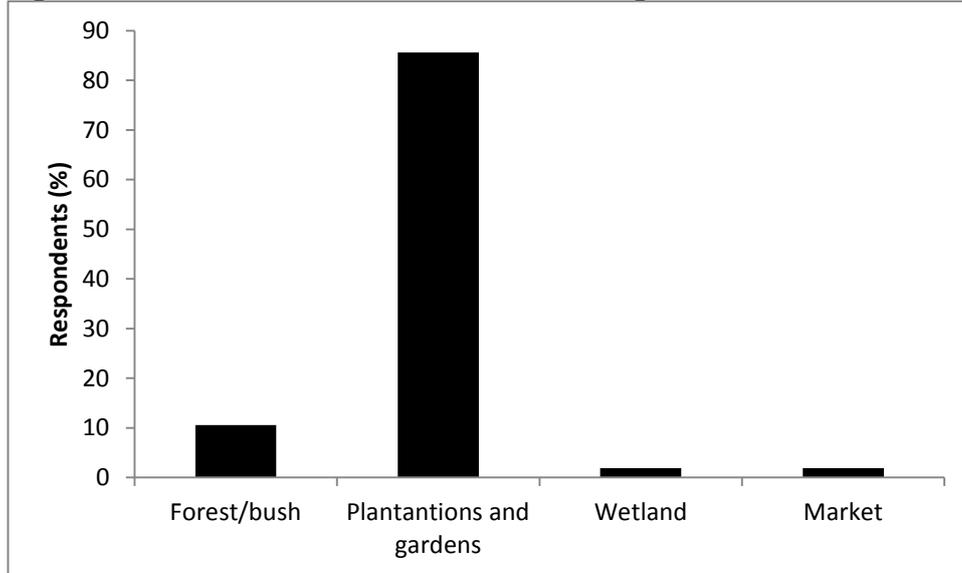
The healers cited the prevention and control of infections as one of the most important aspects of treatment of wounds with medicinal plants.

*Wounds should first be cleaned **R21** and use a clean cloth or fibre for the wound dressing **R17**- wash hands first, pick the leaves, grind them then apply directly to the wound after thorough cleaning. **R8***

*Today MM received a patient who had a nasty looking wound. It had jagged edges and was about three days old, it looked as though an animal had bitten him or torn a chunk out of his thigh but he insisted that he had slipped and fallen down. MM accepted this and continued with the consultation, she asked him several questions about the wound and it turned out that he had stayed at home hoping it would get better but this morning he woke up feeling hot. She finished the questions and sent out for a bowl of water from which she washed her hands before touching his forehead presumably to measure his temperature. She eventually decided to give him a remedy that would help with healing the wound and one that would help with making him 'cool' again. She told him that he had to wash the wound regularly with the herb and make sure that it stays clean and that the heat was coming because of the wound. I later asked her how come she had not touched the wound yet she was one of those who clearly mentioned examination as one of the ways of wound diagnosis but she said that the young man in question had a 'bad story with girls' around the village and as she had nothing to use to cover her hands with, she was reluctant to touch the wound to avoid HIV. **Field notes December 5 2011.***

5.5.12 Place from where plants are harvested

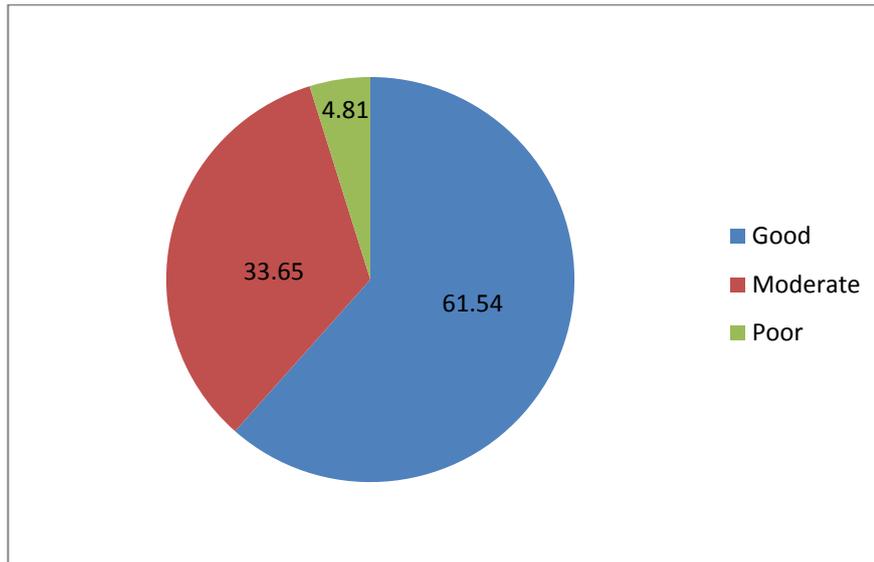
During the ethnobotanical survey, participants were asked where/how they locate their herbs. The majority (85.6%) grew them in their gardens or found them as weeds in their plantations so they are to a large extent cultivated not wild (Figure 5-4).

Figure 5-4: Source of herbs for wound healing

Some healers bought their herbs from the market (1.9%) though several augmented their supplies by growing their own common herbs. This was further explained during the participant observations.

*I usually buy my plants from the weekly market. There is a traditional healer from another district who comes and sells them on the market day. I like buying from him because he has been a healer for a longer time than me so I am sure that I am getting the real thing. Sometimes, I am a little unsure of my remedy but I know he will always bring the correct one. I also use the opportunity to ask him questions if I have a very difficult client. But in addition to his, I also grow my own in the garden just in case I get an 'accident'. Once I asked him for some seeds for some very good plant and I planted it in my garden –it is this one here (*clutia abyssinica* Jaub. & Spach) so now I don't need to buy that particular herb from him anymore **PO2**.*

The majority of the medicinal plants were readily accessible and available (Figure 5-5). Availability to the healers meant they were able to go for example to their gardens and harvest the herbs.

Figure 5-5: Availability of medicinal plants

They considered plants for which they had to travel long distances as not readily available, the scale of good moderate and poor availability was generated by the healers depending on the distance covered. This was explained better during the participant observations where one healer commented that '*Good means that the herbs are within a walking distance; moderate means that they can be obtained by bicycle and poor means that you have to travel by car in order to collect the remedies*' **PO3**.

5.5.13 Extinction and plant diversity

When asked what they were doing to ensure that the future generations have access to these plants as well, some of the healers mentioned teaching their children about the plants, planting herb gardens while others said they had not thought about it.

I think the best thing I can do is to teach my children about the herbs and get them interested in this business. R3

It would be a good idea to get together with the other healers in the community and get some land and have a garden although I can imagine it would be hard to organise something like that. PO1

I have actually never thought about it, I imagine they are plants so they will keep growing forever R17

During the participant observations, one of the healers mentioned deforestation, farming and pollution as having an impact on the availability of some of these plants.

*Some of these plants are no longer seen and we have to travel long distances to get some of them because they have been finished in this area. Many people now know them so they just pick and pick but do not plant more. Also these are very hard days and we have to use more area for farming to survive so the land where we used to let the herbs grow freely is no longer available. Also I think there are so many cars on the road these days and aeroplanes passing above, they blow bad smoke onto the plants and weaken them.***PO5**

As a point of clarification related to the land available, in the past the communities were largely pastoral and each homestead owned large pieces of grazing land where they harvested the herbs since many of them grow naturally as weeds but that land is not available because many farmers have had to sell off part of their land for various reasons. A typical village in Uganda is comprised of 1000 people (see figure 2-1).

5.6 The practice of wound healing using medicinal plants

This sub-section presents findings from the observational aspect of the study related to the actual practice of wound healing using traditional medicine under the theme *practice of wound healing using medicinal plants*. It brings to light what is involved during the patient-healer interaction, diagnosis of wounds, how the remedies are prepared and applied or administered, the recommended dosages and infection prevention and control. It also highlights some observations made regarding the general practice of wound healing medicinal plants; a summary of these findings is presented in table 5-14.

Table 5-14: Tabular representation of subthemes and categories regarding the practice of wound healing using medicinal plants

Researcher generated sub-themes	Categories
The Healer- Client interaction	Introduction Assessment Communication Review Payment Length of consultation Premises Working hours Number of patients treated
Diagnosis of wounds	History Observation Examination Results from hospital diagnostic tests
Traditional healers charges for treatment	No charge for well-known local knowledge No charge but payment received in kind Determined by the nature of the wound Unwilling to reveal the charges Depends on the patient
Peculiar aspects of TM in SW Uganda	Referral to higher ranking healers Hierarchy of treatment among plants Inter-practice cooperation with biomedical practitioners Covert 'secrets' of the trade 'Unusual' practices Herbal medicine as an alternative therapy Local pharmacological theories of how plants work Use of <i>in vivo</i> animal testing for 'remedy' development
Misconceptions about TM	Only dangerous if ingested No danger of overdose with natural remedies No danger in mixing of remedies

5.6.1 The Healer- Client interaction

5.6.1.1 Introduction

This subsection presents selected observations from participating in client consultations with 5 traditional healers (Section 4.7.4.5). These healers were 5 of the recognised traditional healers who were involved in the initial interviews and consented to be observed during their practice of TM. Some of these observations were made during healers' consultations with patients who presented with wounds while others were for patients with different kinds of ailments but the observations apply to the general practice of traditional medicine.

5.6.1.2 Assessment

The initial assessment consisted of mainly establishing rapport with the patient. When a patient came in, it was easy for the healer to know what to say to each other as they knew most of the clients and already had built a rapport. The assessment comprised of taking the history of the wound, observations and examination before finally making a diagnosis and administering the treatment or giving instructions on the administration.

5.6.1.3 Communication

The local Runyankore language was used as the form of communication and the healers used non-verbal cues such as touching the patient's hand, the softly commanding tone of their voice, gestures, eye contact, and open body posture. During a consultation, they focused completely on the client and at some point even appeared to forget that I was there in the room. Initially the patients were uncomfortable with me sitting in the room but eventually when talking with the healer they appeared to relax. There were no interruptions once a consultation was going on except when the healer sent for water to wash their hands. The healers usually have a person who acts as an assistant and is used to carry out menial tasks like carrying the healer's bag, bringing water for hand washing. When I asked more about the significance of this person, they said this was person was employed as a healer's assistant. This person was not an apprentice as they were not being mentored or trained by the healer but simply helping to ease the healer's work.

5.6.1.4 Review

The healers administered the plants with the expectation that they would have an effect and usually did not expect the patient to come back for a review. They were asked to come back if their supply of the remedy ran out or if they felt the wound was getting

worse or when the wound had finally recovered. For some other ailments such as malaria or mental illness, the patients were sent home and checked on every two days until they either got better or were referred to the care of another herbalist or hospital, or they died.

5.6.1.5 Payment

For most of the consultations the researcher was allowed to observe i.e. 6 out of 10, no financial transaction or discussion relating to money took place in my presence. It is possible that the respondents had a hidden way of discussing this that was not obviously clear to an outsider. Alternatively it could have been discussed at a later date. The healer mainly focussed on finding out the problem and ensuring that the patient recovered their good health back. An increase in the number of animals and millet (the staple grain) outside the healers' homes was noted several days after a patient fully recovered. The origin of these items was not clear and the healer did not offer any explanation.

5.6.1.6 Length of consultation

Two of the consultations lasted 45 minutes while four lasted an hour. The length of the consultation depended upon, whether the patient was a new referral or review patient and, the severity of the presenting complaint. The healers spent some of the time during the consultation on discussing social issues and catching up on news completely unrelated to the chief complaint. Sometimes the atmosphere felt like attending a counselling session as opposed to the experience of being in a conventional doctor's office.

5.6.1.7 Premises

All of the herbalists who allowed the researcher to work with them (n=5) practised from their home and had a section of the building with a separate entrance and this section was kept apart from the home by its specific function as a consulting room. For two of them it was either a separate room while for three, it was a small hut at the back of the house that looked like one of the huts they use to store grain. Each of those rooms had all the tools of the trade and usually had a fireplace with firewood; this is used for boiling formulations and also for preserving some of the herbs by smoking.

5.6.1.8 Working hours

The herbalists did not normally have set working hours, mostly because many of them had other jobs that they considered their main occupation and also because they could never predict when a client will come. There is usually a child or children at home who

are there to call the healer when he/she is needed; these are usually the ones who end up as the healers' apprentices. These children are usually children of close relatives but not necessarily the children of the healer. The healers are also expected to attend to a patient at any time of the day or night and will either have patients brought to them or will be called out to go to someone's house.

*One of the things I do not like about being a traditional healer is that you are always supposed to be available for the patients whenever they need you. I have heard that in the hospitals, doctors work in shifts and when they go off duty, they do not have to see their patients. For us here, you can be in the middle of family time or even in the middle of the night and people will come and knock on your door and you cannot say no. This job is one you cannot run away from. **PO4***

5.6.1.9 Number of patients treated

Regarding the number of patients with wounds seen in a month, the responses ranged from uncountable to 8-10.

*I can't really tell how many I treat in a day or a month because wounds occur very frequently here. **R10**, I get many patients that I cannot estimate the number especially children with sores **R38***

*I see about seven patients in a month and sometimes they even come from as far as the capital city; Kampala **R4**, I don't get patients frequently unless an accident occurs **R14**, It is not often but about 10 a month when I have the herbs **R36***

5.6.2 Diagnosis of wounds

When asked about the way they assessed or made the diagnosis of a wound, the healers responded that they use the history, observation, examination and results from diagnostic tests carried out in hospital such as blood tests, xrays and CT scans.

5.6.2.1 History

Healers generally stated that they asked the patient how the wound occurred, the anatomical location, the characteristics and how long it has been there among others.

*I diagnose by history of how it occurred and how it looks. **R6***

Diagnosis can be reached at by asking questions about how it occurred. You know when you look at a wound, it is not just a wound but is related to so many other things and you do not just give the same plant for all the wounds, each wound type has a different remedy. So you have to ask when it came, how it came about, where it is, if there is any pain or itching, if there is anything coming out of it, what it looks like, also if they have applied anything else to the wound before coming here. If the wound has taken a very long time like over a month we also have to find out about more about the person themselves because they could have been the ones who caused it to come maybe through some fighting or disagreement with family or neighbours

Is this very common? **PM**

*Oh yes, these days people are so wicked, they can send you curses for something as simple as greeting their wife/husband. **R38***

5.6.2.2 Observation

Observation was mentioned by all the healers and experts as the main way of making the diagnosis of a wound.

*By looking at it, you can categorise it as fresh or chronic **R3, R10, R11, R17, R28, R34***

*I make diagnosis by looking at the wound since for me I deal with wounds which are due to cancer. A wound is a wound, it cannot be anything else which is quite different to things like fever or cough which may mean so many different things but for the wound you just see it, it is now left for you to decide whether it looks fresh or not, clean or dirty or infected or not. **R4***

5.6.2.3 Examination

A few of the healers mentioned examination as a method of diagnosis of wounds.

*By touching it (carefully) **R26, R29***

*I have to touch the wound to be able to tell what type of wound it is. Sometimes it is obvious and is bleeding but especially for the ones that have a layer that has formed over them you need to touch it a little to see what is going on. You know our eyes are in the hands so without actually touching it you cannot be sure. **PO4***

So how do you do this? **PM**

Well I used to use my hands before and for some patients I still do but we were told these days that you can catch 'slim' (HIV/AIDS) by doing that so I just use a polythene bag and I don't touch it directly. If I don't have one then I do not touch.

PO4

5.6.2.4 Results from hospital diagnostic tests

One of the challenges mentioned by healers was their inability to carry out diagnostic tests like x-rays, simple blood tests and basic assessments such as, blood pressure, or weight and height. They said that when they need to gain any information like this which they feel will help them; they send their patients for tests in the hospital.

*I mainly deal with cancer and sometimes work on bones (bonesetter) and one of the things my patients know about me is that they cannot come to see me without an x-ray or without proper blood tests from the doctor. I also ask them to make sure that they ask the doctors what those results mean because I do not understand their English. So they are required to receive their results with a relative who understands English very well and this person can then come and let me know what the doctor said. I like this method because it means you are surer of what you are dealing with but also it prevents you from making big mistakes especially with the bones. Those days our elders used to use spirits to help guide them to where the fracture was and what type of fracture it is but times have changed and since things are now a little easier why complicate them? **R4***

5.6.3 Traditional healers' treatment charges

The participants were asked about how much it would cost for the treatment of wounds with medicinal plants and many of them were reluctant to give an actual fixed price. Some of them do not charge anything, others would like to but do not because it is local knowledge, and for others it depends on the nature of the wound and the patient.

5.6.3.1 No charge for well-known family/local knowledge

Close to half of the healers felt that some of the herbs were well known in the community i.e. locally known so there is no point in charging for them since almost each home will have some of these herbs in their garden. They only charged when the herb was not well known, or when they have to buy it from the market or travel long distances to get it.

*These herbs are known by every one in every household **R39**, I don't charge because these herbs are known everywhere so it is useless. But if I travel far or buy it from the market then I have to charge and I will include my transport in the cost of the medicine. **R28***

5.6.3.2 No charge but payment received in kind

During the interviews, five of the healers typically received payment in kind and one of them mentioned that she does not charge anything for her services but will accept gifts.

*My sister usually charges a goat or a sheep **R2***

*I don't charge anything for the services but accept gifts **R1, R21** (when they recover)*

5.6.3.3 Determined by nature of wound

For close to half of the traditional medical practitioners, the charge for the services rendered is determined by the nature and size of the wound and the extent of their appreciation for the services.

*The price depends on the nature of the wound and the stage of cancer since I mainly deal with cancer patients **R4***

*They usually pay me money before I pick the medicine and the full price will depend on the size of the wound **R8***

*If I get a patient, I charge 5000 shillings for the first visit, the rest of the pay will depend on the nature of the wound and extent of the appreciation **R3***

5.6.3.4 Unwilling to reveal the charges

Five of the participants were unwilling to reveal their charges for treatment.

*I won't tell you how much **R38***

5.6.3.5 Depends on the patient

For about 10 healers, the charge depends on who the patient is, family members get a different price from non-family.

*I don't usually charge family members but non-family members pay 1000 (50p) shillings and later 5000-10000 (£3-5) after full recovery **R12, R36** non family members pay an unspecified amount **R36***

5.6.4 Peculiar aspects of TM in SW Uganda

5.6.4.1 Referral to higher ranking healers

The traditional healers state that they are interested in the patient's welfare and will refer a patient to the hospital when they observe that the wound is not healing as it should.

*Use plant remedies alone but in case wound fails to heal then I send patient to the health centre **R24** apply the herbs to the wound and put a clean dressing. If there is no improvement then one can go to the hospital. **R19***

5.6.4.2 Hierarchy of treatment among plants

The healers have a hierarchy of treatment based on presumed potency similar to the first or second line system in Biomedicine.

*I use omuzirakironda (Siegesbeckia orientalis L) but when that fails I use obugando (acacia hockii De Wild) as the next in strength. I would never start with Obugando because if it failed then I would have limited options to turn to. Most of us through experience have learnt which plants are stronger and which ones are weak so when someone comes with a simple wound you know what to use and when someone comes with a complicated one you also know which one to use. It gets complicated when a patient comes after visiting another healer and the healer started on the strong medicine already, that is not a good practice, try all medicines getting to the stronger ones slowly by slowly. The people of today want to rush things; that is not how things are done. **R4***

5.6.4.3 Blended approach of health care

The participants expressed an overt inter-practice cooperation with western medicine. For some they require some diagnostic tests and results from a hospital while others said they manage emergencies and send those with chronic wounds to the health centre for injections which they are unable to provide.

*My medications work alone but the patient must have confirmed cancer from the hospital before they come **R4***

*In most cases chronic wounds are taken to the health centre for injections but when one gets injured I get my herbs and apply immediately and one will get healed without going to the clinic. **R14***

5.6.4.4 Covert 'Secrets of the trade'

The healers reported that they kept their medicinal plant knowledge secret. They further revealed that free transfer of knowledge could only take place along the family line, usually from parents to sons.

I do not tell what medicines I use because people pay a lot of money for them. They come from as far as Kampala (5 hour drive away) for treatment so I have to be very careful **R4**

*I can tell my children or immediate family members only but you just don't go around telling everybody what you use in your business just in case people 'pass' you. **R38*** To 'pass someone' is a literal translation from the local language which means to overtake one in life or in business.

5.6.4.5 'Unusual' practices

Some practices employed by the healers in wound healing using medicinal plants can best be described as unusual or unconventional ranging from prayers to supernatural healing and use of decomposing plants.

*Get the pus from wound using fur from a sheep and a small branch of esitimu (*Hoslundia opposita* Vahl) smear pus on a stone and hung the branch from front of the roof of the house; you will see the wound beginning to heal in a few days.* **R2**

No rituals involved because I am saved, I just pray or bless the medicine **R3**

Use the innermost part of a decomposing stem, squeeze out the fluid directly onto the wound and secure with a dressing. **R8**

5.6.4.6 Herbal medicine as an Alternative therapy

When asked about whether they thought that herbal medicine was an alternative or complementary therapy, they considered the traditional medicine as the conventional one and answered the question in that light.

Only herbs are enough to make a wound heal **R6**

Herbs can be mixed with other local remedies or used alone **R8**

Can be used alone or combined with others like salt solution **R26**

What about using them with Western medicine? **PM**

Herbs are used alone because if you combine with western medicine you will never know which medicine worked and people will always be quick to say it was the tablets which worked. R29

So which type of medicine do you think works better? PM

Plant remedies as good as western drugs or even better but must be used consistently and the instructions from the healer followed completely. Someone also needs to ensure that they check their lives to make sure that any social problems they are having do not affect the working of the herbs R29

5.6.4.7 Local pharmacological theories of how plants work

The healers had theories about the way the plants work in the body.

*For a chronic ulcer, get leaves of akabindizi (*Microglossa pyrifolia* (Lam.) Kuntze), pound in a mortar and then get a leaf of kibwankurata (*Indigofera spicata* Forssk.) put some holes in it and place it on top of the wound then place the pounded akabindizi on top and secure with a firm dressing. The kibwankurata leaf is to prevent burns from the akabindizi and allows slow release. PO3*

5.6.4.8 Use of *in vivo* animal testing for remedy 'development'

Two of the healers have learnt about which remedy works and which does not by carrying out crude *in vivo* animal tests.

Do not often get patients but I have learnt about many of these plants by using them on animals. For example when I take my animals out grazing and they sustain a cut, then I use these plants on them. Or sometimes use them on my dogs R37

Have some of the animals ever died as a result of the herbs that you used? PM

Yes, sometimes animals die and I suspect that it was from the plants I have used for treatment. It is often sad when that happens but at least I know not to use that particular plant again R37.

5.6.5 Misconceptions about TM safety

The healers had some misconceptions about TM and the safety of medicinal plants.

5.6.5.1 Only dangerous if ingested

Regarding contraindications when using medicinal plants, the participants feel that there is only a problem with medicines that are ingested but those applied topically are completely safe.

No contraindications because the herbs are locally applied **R25**

No contraindications because these herbs are just applied on top of the wounds
R32

5.6.5.2 No danger of overdose with natural remedies

As above, they mentioned that it was not possible to have an overdose with externally applied herbs.

No prohibitions or contraindications to plant medicines because there is nothing like overdose **R27**

*No overdose is anticipated because they are for external use***R28**

5.6.5.3 No danger from mixing of remedies

The healers did not have any trouble with the mixing of formulations.

Each herb can be used alone but if combined, they do not cause any problem
R29

5.7 Challenges faced in practice outside the formal healthcare system

One of the themes that came out clearly through the interviews and the participant observation sessions was that the healers faced several challenges in their practice. (Table 5-15)

Table 5-15: Representation of subthemes regarding the challenges faced in the practice of wound healing using medicinal plants

Researcher generated sub-themes
No Reciprocation of referral from western practitioners
Harassment of their clients by health professionals
Difficulty in public differentiation of types of traditional healers
Lack of continuing traditional education (CTE)
Inability to write Death certificates
Poor or lack of Record keeping
Fear of blame for death
'Fake healers'
Age related factors
Poor storage facilities for plant specimens

5.7.1 No Reciprocation of referral from western practitioners

The healers complained that they give their best care to their patients and when they feel that they cannot do anymore or when they would like their patients to undergo some diagnostic tests they send them to the health centres and hospitals but the doctors do not return the favour.

There are some cases that are clearly spiritual especially the chronic wounds and mental illnesses where we can help these doctors but they do not send these patients to us R5.

5.7.2 Harassment of their clients by health professionals

Another pertinent issue that arose was the harassment their patients face at the hands of the health workers.

And even when we send our patients to them they ask them to stop using their herbs and shout at them severely when they discover that they have been to see us. This has caused some of my patients to stop coming here because they fear the wrath of the health workers at the health centre. It is really not fair. We should be able to work together if we are both interested in the patient getting well PO2.

5.7.3 Difficulty in public differentiation of types of traditional healers

Although there are several types of traditional medical practitioners in Uganda, as highlighted in Chapter 2, the healers complained that many Ugandans don't know about the different types and think all of them are witchdoctors.

Not all of us are witchdoctors. I am sure you came here very worried that you were going to be taken to a shrine; it is not like that at all. People should learn that there are different types just like I see different types of doctors in the hospital, those who cut people, those who handle deliveries, those who work with diseases like malaria and others so we are also not the same. Make sure when you go to your meetings and tell people what you have found here, you let them know that we are not all the same **PO3**.

5.7.4 Lack of continuing traditional education (CTE)

Another challenge that some of the practitioners face is the lack of continuing education.

I have been using the same remedies for a long time without knowing how or why they work and sometime the other 'older' healers are not willing to share their secrets with me. I wish there was a place where we could go monthly or every three months to improve on our skills find out about any new plants and methods to improve on the way we do things. I heard that in Mbarara Hospital they use ghee for burn wounds then I also heard that they were using honey, it would be good to know because if the doctors are using these local products it means they have done science on them and they work therefore we would be more confident using them **R23**

5.7.5 Inability to write Death certificates

One healer shared a sad story where one of her patients died and had been receiving care from her after the hospital sent her home with advanced cervical cancer saying they could not do anything more for her. After the patient died, the family went to try and claim her pension since she had been a government teacher and were told to bring a letter or death certificate from the health care provider who certified the death. This is important because it means that when the healer senses that the patient is about to die, he/she must refer them to a Western practitioner so that they will be able to get a death certificate which will allow them to claim any money or benefits from the Government.

I did not really go to school much so I cannot write and even if I could someone to write it for me and I put my thumb print, I have no stamp, they would never accept anything from me. From that experience we have now learnt to care for

people until we feel that they are at peace and ready to die then we send them to the hospital so that at least when they die their family will not be left stranded. This looks really bad because many people do not understand this so when the patient gets to the hospital sometimes they are not given proper treatment because they are being 'punished' for coming to us in the first place PO2.

5.7.6 Poor or lack of record keeping

The healers raised a significant concern about their lack of record keeping and not only the lack of records but also lack of knowledge on how to keep the records.

I see so many patients but I never write down anything. Next time the patient comes I must remember everything I have done for them and all the medications I have given them. This means if I die, anyone who takes over from me will not what I have done and will have to start afresh also this means when I feel that the case is too hard to handle and I send them to another healer I have to go with them otherwise they will not be able to explain the treatment so far. This could be part of the training that they can give us in order for us to improve on our services R23.

5.7.7 Fear of blame for death

The fear of blame for death was one challenge that was expressed by many of the healers.

Sometimes I do not even like to call myself a traditional healer and prefer to refer to myself as a farmer. Those who need me will come to me otherwise if you call yourself a traditional healer, when anyone dies mysteriously in the village they will come for you. They have burnt up several healers in their houses in big cities; I don't want to be the next PO4.

5.7.8 'Fake healers'

The healers also mentioned the presence of fake or 'quack' healers among them and in the village who make many mistakes and give their profession a bad name.

There are some people who are not 'real' healers, they are just in this business to make money and they don't even care about the patients. Of course when a patient goes to such a doctor they will think all of us are the same and then spread bad things about us and that will kill our market R18.

5.7.9 Age related factors

Some of the more elderly healers expressed frustration at the inability to perform certain activities related to the practice of traditional medicine because of their age.

I used to get many patients when I was still able but now I am very old and cannot manage to get the herbs from the farm so I just send some people to collect them from me. Sometimes I can see that they have not taken the time to select the best plants or sometimes they bring me something that looks like the actual herb but is not the exact one because they don't know so well but since I cannot go there myself I have to be happy with whatever they bring for me R21.

5.7.10 Poor storage facilities for plant specimens

The healers mentioned lack of proper storage as another formulation problem affecting their herbal preparations.

Sometimes I travel long distances to either buy or collect these plants, then I bring them here and after one or two days I find that they have developed moulds and sometimes you find they have little insects on them and they are rotten and it is a waste of money. Sometimes they are supposed to be used fresh so you do not want to dry them, other times you want to dry them and it is the rainy season and they don't dry completely then when you go to get them from the store to give them to a patient you are disappointed. I would be happy to learn how others store their plants, I get so annoyed PO5.

5.8 Summary

All the traditional healers and key informants who participated in the study reported ethnomedical use of plants for wound healing in their practice of TM. Following the survey, the healers who expressed an ethnobotanical rationale for the plants they used, reported their use for cleaning wounds, removing pus and dirt, stopping bleeding and wound closure. They described the challenges faced in practicing outside the formal health care system. Participant observations of a number of aspects of the healers' practice gave insights into the healer-client relationship, the diagnosis of wounds, and their charges for treatment. The observations also revealed peculiar aspects of TM in South Western Uganda and highlighted more than a few misconceptions regarding the safety of medicinal plants.

5.9 Results from Phase III: Laboratory work

5.9.1 Selection of plants for *in vitro* investigations

In order to select plants for *in vitro* investigation, the plant species identified during the survey were clustered into groups. Group I (mentioned by more than 10 healers), group II (mentioned by 5-9 healers), group III (mentioned by 2-4 healers) and finally group IV (mentioned by only one healer). Table 5-5 comprises all the species from all the groups. The criteria for inclusion into group V was one mention by one healer with corroboration from another healer on the name of the plant and its use in wound healing.

Initially all the plants from group I and II were cross referenced with the plants identified from the literature review in phase I of this study to identify any plants that recorded any wider use in Uganda (section 5.5.5). Following this cross referencing, nine identified plants were then subjected to an intense review concerning details of use given by the healers and 6 species (*Bidens Pilosa*, *Ageratum conyzoides*, *Galinsoga Parviflora*, *Musa paradisiaca*, *Solenostemon latifolius* and *Microglossa Pyrifolia*) were selected for further *in vitro* investigation into their wound healing activity due to the consistency of the healer reports. However, permission was only granted for the investigation into three species as the other two were viewed as potential endangered species by the District office of Environmental protection. *M. paradisiaca* was removed from the list because the healers reported its use as a decomposing stem and it was not considered a viable option to transport rotting stems for investigation to UK to prevent the living material infection risk for plant health, in addition this venture would require transportation in liquid nitrogen and the associated customs permissions. Therefore *B. Pilosa*, *A. conyzoides*, *G. Parviflora* were selected for phytochemical investigations and the tests selected were based on what the healers described as their mode of action (Table 5-16). Figures 5-6, 5-7 and 5-8 show photographs of the aerial parts of *B. Pilosa*, *A. conyzoides* and *G. Parviflora* in situ.



Figure 5-6: Photograph *B. pilosa* in situ



Figure 5-7: Photograph *G. parviflora* in situ



Figure 5-8: Photograph *A. conyzoides* in situ

Table 5-16 Healers accounts of the use of selected plant species

Plant	Significant phrases(verbatim) on the Mode of action
<i>A.conyzoides</i>	<ol style="list-style-type: none"> 1. <i>Helps the wound to dry faster</i>R14 2. <i>Keeps wound clean</i> R1 3. <i>stops bleeding and keeps wound clean</i>R13
<i>B.pilosa</i>	<ol style="list-style-type: none"> 1. <i>"It stops bleeding and dries the edge"</i>R1 2. <i>"Brings the edges together and stops bleeding"</i>R2 3. <i>"It burns the wound edges and brings them together"</i>R3 4. <i>"Stops bleeding and keeps the wound clean</i>R10 because a dressing is applied"R14 5. <i>"Stops bleeding and keeps the wound clean"</i>R16 6. <i>"Makes the wound stop bleeding but the wound should first be cleaned"</i>R17 7. <i>"They stop bleeding and make the wound to heal faster. Healing faster means that it closes much faster than when other things are applied"</i>R19 8. <i>"It makes the wound clean and helps the edges unite"</i>R22 9. <i>"It works like ampicillin powder. Well, that means it works the way those hospital drugs work. It prevents the wound from getting worse, does not allow flies to get into contact with the wound and pus does not form"</i>R23 10. <i>"Stops bleeding and makes the edges come together"</i>R24 11. <i>"Stops bleeding and makes the wound heal. Healing means that the person can stop feeling pain and can then use that area to be able to do work for example if it is on the hand or can walk if the wound is on the leg"</i>R25 12. <i>"Stop bleeding, bring edges together and wound heals quickly. Healing of the wound means that the person no longer feels pain, you know a wound or disease is only present when one feels pain. As long as there is no pain then the person is well"</i>R29. 13. <i>"Makes multiple sores heal and also kills germs"</i> R33 14. <i>"stops bleeding and makes the wound heal by removing dirt and pus from the wound"</i>R34 15. <i>"I usually use them when my animals get injured. Sometimes you are in the forest hunting or grazing and an animal gets injured. The wound stops bleeding and heals quickly as long as you keep it covered or clean"</i>R37 16. <i>"Stops bleeding and promotes wound healing. Wound healing means that you no longer see red blood but the water that starts to come out which is not pus but healing water"</i>R39 when used for stomach ulcers, it takes away the pain and one can then eat any food comfortably. Maybe it covers up the wounds in the stomach "R39
<i>G.parviflora</i>	<ol style="list-style-type: none"> 1. <i>"Makes the ends of the wound come nearer to each other then unite. It is as if it has some force that pulls the edges together and blood becomes thicker faster so the person does not loose a lot of blood. For the wounds which are not bleeding, the dressing helps to keep the wound clean"</i>R33 2. <i>"It is mainly used for the fresh or cut wound which is bleeding. It makes blood stop flowing quickly and prevents the wound from getting dirty and smelling.</i> R5

5.9.2 Particle size of plant samples

The size of the plant particles obtained after grinding was confirmed using Environmental scanning electron microscopy (Esem) the size of plants and confirmed at an approximate diameter of 50µm or less (Figure 5-9). This is important because small particle size increases the surface area of plant material in contact with the solvent, which is likely to improve extraction efficiency.

In this study, a green methanolic extract difficult to resuspend and a brownish yellow aqueous extract were observed. The brownish yellow extract separated on standing which may suggest the presence of unknown compounds such as waxes and saponins etc.

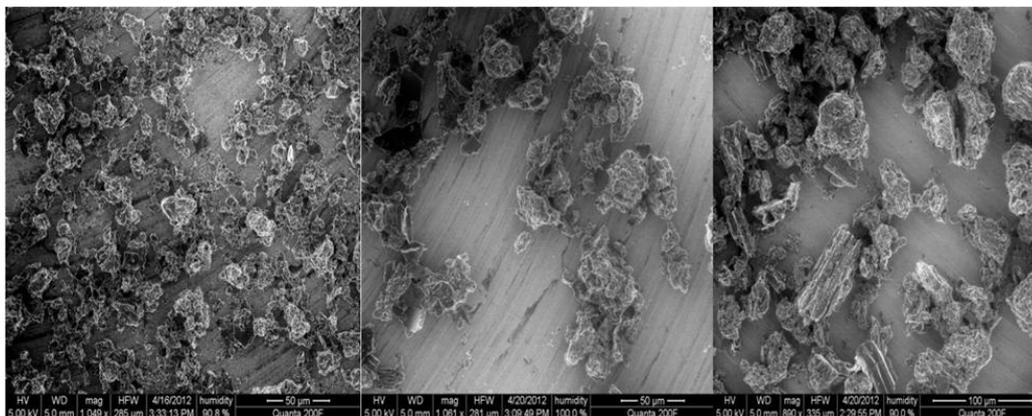


Figure 5-9: Average particle sizes of *A. conyzoides*, *B. pilosa* and *G. Parviflora*

5.9.3 Polyphenol content of plant extracts

A standard curve for Gallic acid (mg/ml) which was used as a positive control and also to approximate phenolic content is presented in figure 5-10. The total phenolic contents, assessed as equivalents of Gallic acid, are shown for the 18 plant extracts in table 5-10.

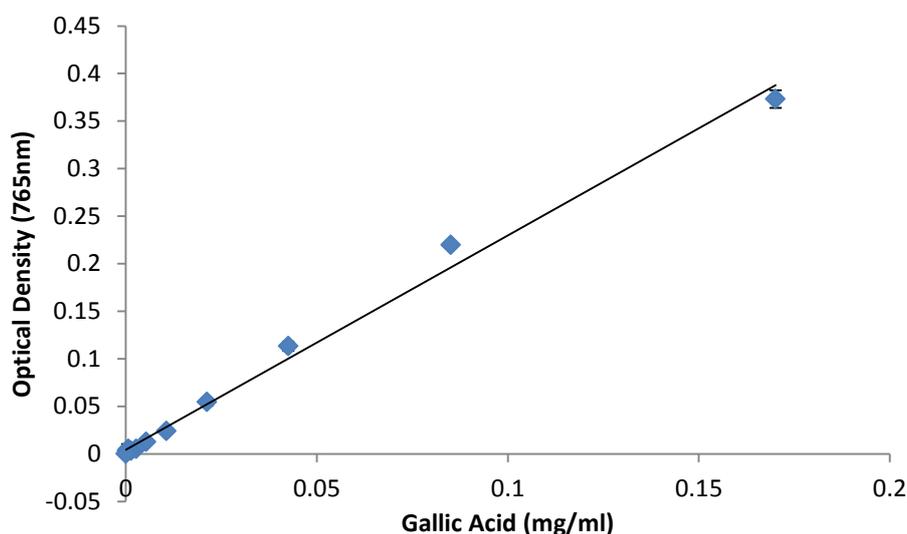


Figure 5-10: Representative standard curve for Gallic acid (mg/ml), values represent mean, error bars represent SD $R^2 = 0.992$.

As expected, all the extracts contained phenolics with the highest observed in aqueous extracts of *B.Pilosa0* (4.02 units/GAE) followed by *B.Pilosa30* (3.60 units/GAE) and

*B. Pilosa*60 (3.53 units/GAE) and the methanolic extract of *B. Pilosa*60 (3.14 units/GAE). These figures are higher than the standard because they were calculated involving a dilution factor and presented as amounts in dry weight of leaves. These findings are presented in table 5-17 and arranged in decreasing order of phenolic content in figure 5-11.

Table 5-17: Effects of extracting technique on the Total phenolic contents (GAEmg/5g of DW) of leaf extracts

Plant extract	Total phenolic content per 5g of DW
acA0	2.59±0.00
acA30	2.87±0.01
acA60	2.52±0.03
acme0	2.24±0.04
acme30	1.61±0.05
acme60	1.68±0.05
bpA0	4.02±0.01
bpA30	3.60±0.01
bpA60	3.53±0.01
bpme 0	3.10±0.01
bpme 30	2.36±0.01
bpme60	3.14±0.01
gpA0	1.22±0.01
gpA30	1.11±0.00
gpA60	1.24±0.00
gpme0	0.82±0.01
gpme30	0.55±0.01
gpme60	0.58±0.00

The values (GAEmg/5g of DW, ±SD) in table 5-17 are based on the average of three samples of each medicinal plant, analysed individually in triplicate; DW=dry weight. bp=*bidens pilosa*, ac=*ageratum conyzoides*, gp=*galinsoga parviflora*, me=Methanol extract, A=Aqueous extract.

The table presents a logical order of plant extracts ordered by sonification time of 0, 30 and 60 minutes. The decreasing order of phenolic content in figure 5-8 reveals that there is no specific advantage in longer sonication time and hence another assay (the DPPH radical scavenging assay) was needed to confirm this. However, these findings should be treated with caution as the amount of phenolics might be independent of the extraction method.

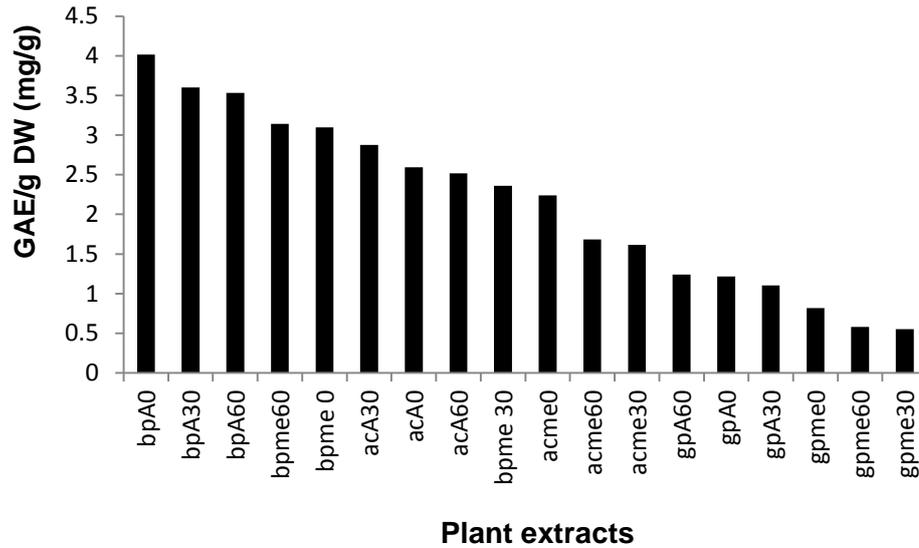


Figure 5-11: Mean total phenolic content of plants extracts screened in triplicates
Bp=*bidens pilosa*, ac=*ageratum conyzoides*, gp=*galinsoga parviflora*,
me=Methanol extract, A=Aqueous extract, DW=dry weight of plant material

5.9.4 Flavonoid content of plant extracts

Total Flavonoid content of three plant species extracted with two different solvent systems and at three different sonication times are given in table 5-18. The flavonoid content was determined as Quercetin equivalents (QE); a representative standard curve for Quercetin ($\mu\text{g/ml}$) is shown in figure 5-12. These figures are higher than the standard because they were calculated involving a dilution factor and presented as amounts in dry weight of leaves. These findings are presented in table 5-18.

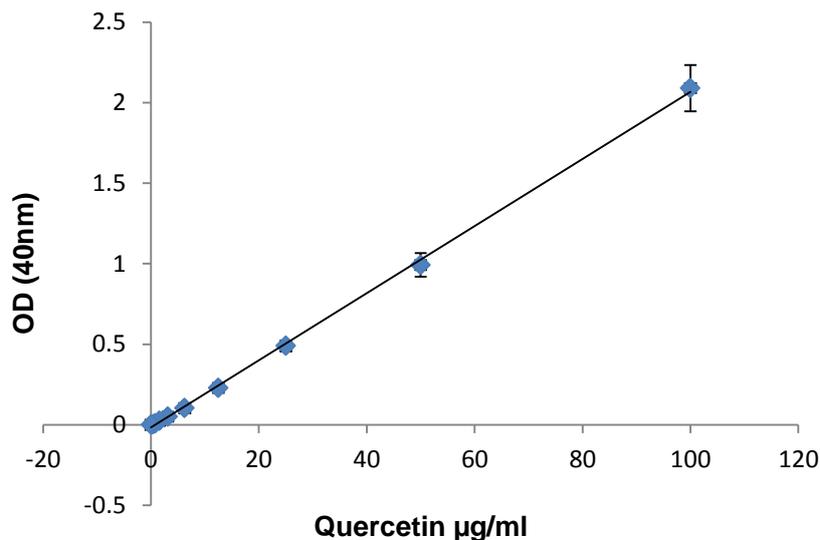


Figure 5-12: Representative standard curve for Quercetin (µg/ml), values represent mean \pm SD, $R^2 = 0.999$, $y = 0.0208x - 0.017$; Error bars represent SD

Among the three different species, aqueous extracts of *B.pilosa* (bpA0 19.16 and bpA30 10.58 QE/5g of DW) offered the highest flavonoid content followed by the aq. extracts of *A.conyzoides* (acA30 8.27 and acA60 7.65 QE/5g of DW).

Table 5-18: Effects of extracting technique on the Total Flavonoid contents (µg/g) of plants extracts

Plant extract	Total Flavonoid content per 5g of DW
acA0	7.31
acA30	8.27
acA60	7.65
acme0	2.67
acme30	3.37
acme60	6.52
bpA0	19.16
bpA30	10.58
bpA60	9.75
bpme 0	7.35
bpme 30	6.10
bpme60	3.80
gpA0	2.89
gpA30	2.67
gpA60	4.76
gpme0	1.64
gpme30	1.68
gpme60	1.17

Values (µg/5g of DW) are based on the average of three samples of each medicinal plant, analysed individually in triplicate; DW=dry weight.

Bp=*bidens pilosa*, ac=*ageratum conyzoides*, gp=*galinsoga parviflora*,

me=Methanol extract, A=Aqueous extract, DW=dry weight of plant material

5.9.5 DPPH radical scavenging activity

All the extracts exhibited anti-oxidant activities in this assay. Significant interference was observed at concentrations of ~ 1 mg/ml; however an absorbance scan revealed no specific interfering peaks at any particular wavelength, but dilution of samples to $500 \mu\text{g/ml}$ allowed inhibition to be calculated. Therefore these results probably represent an underestimation of antioxidant capacity. The standard curve for Ascorbic acid, which was included as a well characterised and reported positive control is presented in figure 5-13 and the results from the assay of the extracts are presented in table 5-19. The extracts which demonstrated the highest percentage inhibition of DPPH were ACMe30 (78.5%), ACMe60 (76%), BpMe60 (56.3%), GPA30 (51.2%) and GPMe0 (51.1%).

During the experiment, the reaction with Ascorbic Acid was complete within a few minutes, but evidence exists for polyphenols reacting slowly, therefore the time for reading was extended until there was no further change in optical density (OD).

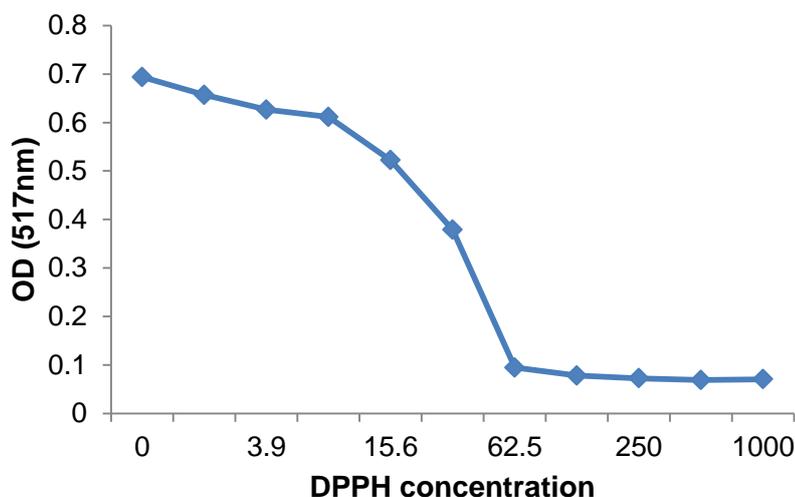


Figure 5-13: Representative standard curve for Ascorbic acid ($\mu\text{g/ml}$), values represent mean

Table 5-19: Effects of extracting technique on the DPPH radical scavenging activity (%) of different medicinal plants

Plant extracts	%Inhibition \pm SD
Ac A0	37.5 \pm 0.01
Ac A30	49.23 \pm 0.01
Ac A60	38.1 \pm 0.01
Ac me0	25.6 \pm 0.01
Ac me30	78.5 \pm 0.02
Ac me60	76.0 \pm 0.04
Bp A0	35.6 \pm 0.02
Bp A30	37.8 \pm 0.07
Bp A60	31.5 \pm 0.03
Bp me 0	35.0 \pm 0.02
Bp me 30	35.0 \pm 0.01
Bp me60	56.3 \pm 0.02
Gp A0	34.1 \pm 0.01
Gp A30	51.2 \pm 0.01
Gp A60	48.5 \pm 0.02
Gp me0	51.1 \pm 0.01
Gp me30	25.6 \pm 0.04
Gp me60	32.2 \pm 0.01

Values represent %, \pm SD and are based on the average of three samples of each medicinal plant, analysed individually in triplicate

5.9.6 Elastase activity

The initial screening assays suggested sonication did not provide a consistent effect upon the extraction of phenolic or flavonoid contents or on DPPH scavenging activity of the plant extracts. Therefore, the 6 plant extracts that were not subjected to sonication were used to perform the elastase assay *bidens pilosa* (Bp0), *ageratum conyzoides* (Ac0), *galinsoga parviflora* (Gp0). The assay was completed twice and the enzyme specific inhibitor N-methoxysuccinyl-Ala-Ala-Pro-Val-chloromethylketone was used as a positive control. Figure 5-14 presents the standard curve for Elastase (U/ml).

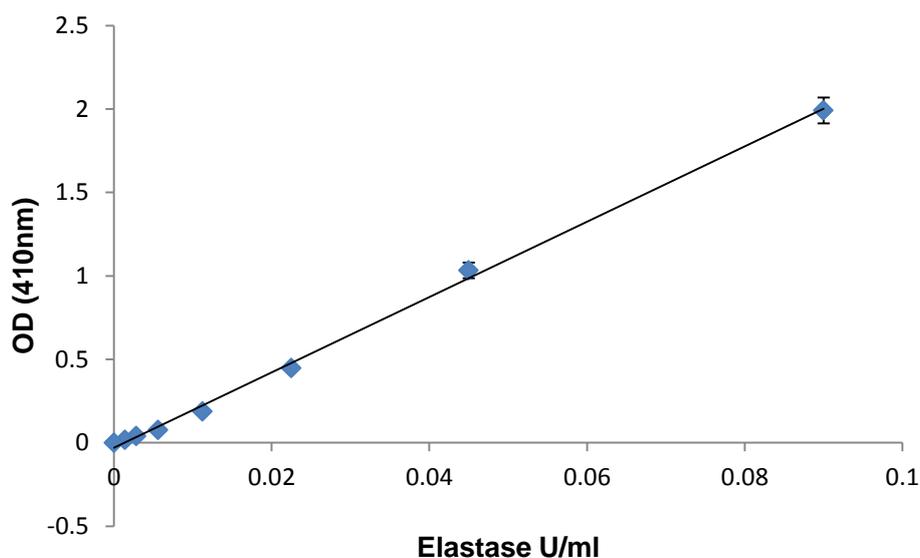


Figure 5-14: Representative standard curve for Elastase (Units/ml), values represent mean Error bars represent SD, $R^2 = 0.998$ incubated on ice.

Following the creation of the standard curve, the experiment was run using 0.045u/ml of elastase at 25g/ml of plant extracts which yielded very high optical densities (OD) when compared to the standard OD for Quercetin which was 1.34, making it impossible to calculate percentage inhibition until further optimisation has been done and any confounding factors identified and allowed for. Table 5-20 presents the values of the optical densities of plant extracts for anti-elastase activity of the enzymes.

Table 5-20: Mean optical densities of plant extracts for anti-elastase activity

Plant extracts	Optical density (OD)
ACW0	1.60
ACMe0	2.04
BPW0	1.79
BPMe0	2.08
GPW0	1.47
GPMe0	1.72

bp=bidens pilosa, ac=ageratum conyzoides, gp=galinsoga parviflora, me=Methanol extract, W=Aqueous extract.

Chapter Six

6 DISCUSSION

6.1 Personal reflections on using the mixed methods approach for this study

6.2 Introduction

This chapter highlights and discusses the findings from the three phases of this study separately before engaging in a general discussion of the overall results, and this discussion weaves together and integrates the findings from the different phases. Drawing evidence from the three phases described in chapter 4 and the data obtained from each phase of study in chapter 5, this chapter aims to conclude this thesis by presenting an overview of the value and utility of the mixed methods approach in ethnomedical research studies (section 6.2). Sections 6.3-6.5 discuss the key findings from each phase of the PhD study followed by a synthesis and integration of the key messages in section 6.6 and the strengths and limitations (section 6.7). The chapter also highlights the contribution of the thesis to the body of evidence on plants and wound healing (section 6.8). The chapter then draws to a close with the identification of new avenues of research arising from these findings (section 6.9) and a general conclusion which draws together the final implications of the three thesis phases (section 6.10).

6.2.1 The value of the mixed methods approach

This thesis set out to answer the overarching question '*What is known about plants and wound healing in South Western Uganda*'; the ensuing questions and objectives provided the rationale for the use and integration of both qualitative and quantitative approaches, thus the mixed methods approach was chosen for this study because it helped to inform the research design and provided a pragmatic approach to answer the multifaceted research question. According to O' Cathain et al (2007), researchers sometimes use images which suggest that any benefit from using a mixed methods approach arises from an additive effect of combining methods. From their vantage

point, the mixed methods researchers are then able to see the big picture after all the pieces are fitted together which can be likened to the putting together of a research jigsaw puzzle.

This study was conducted in a largely unexplored field of study of ethnobotany and phytochemistry which are well established, but not focussed on the local practice of wounds/plants specifically in Uganda. This is of particular interest because it adds onto the existing body of evidence and lays a foundation for further ethnobotanical and phytochemical studies in the traditional medical practice of wound healing. Right from the outset, the overarching research question was clear but the detail of some of the other questions arose from the findings of each preceding phase and required different methods in order to meet the accompanying objectives. Therefore, the mixed methods approach was the best choice for this pragmatic approach.

Figure 6-1 is a diagrammatic representation of how each phase of data collection informed the next and the next section highlights the utility of the mixed methods approach in this study.

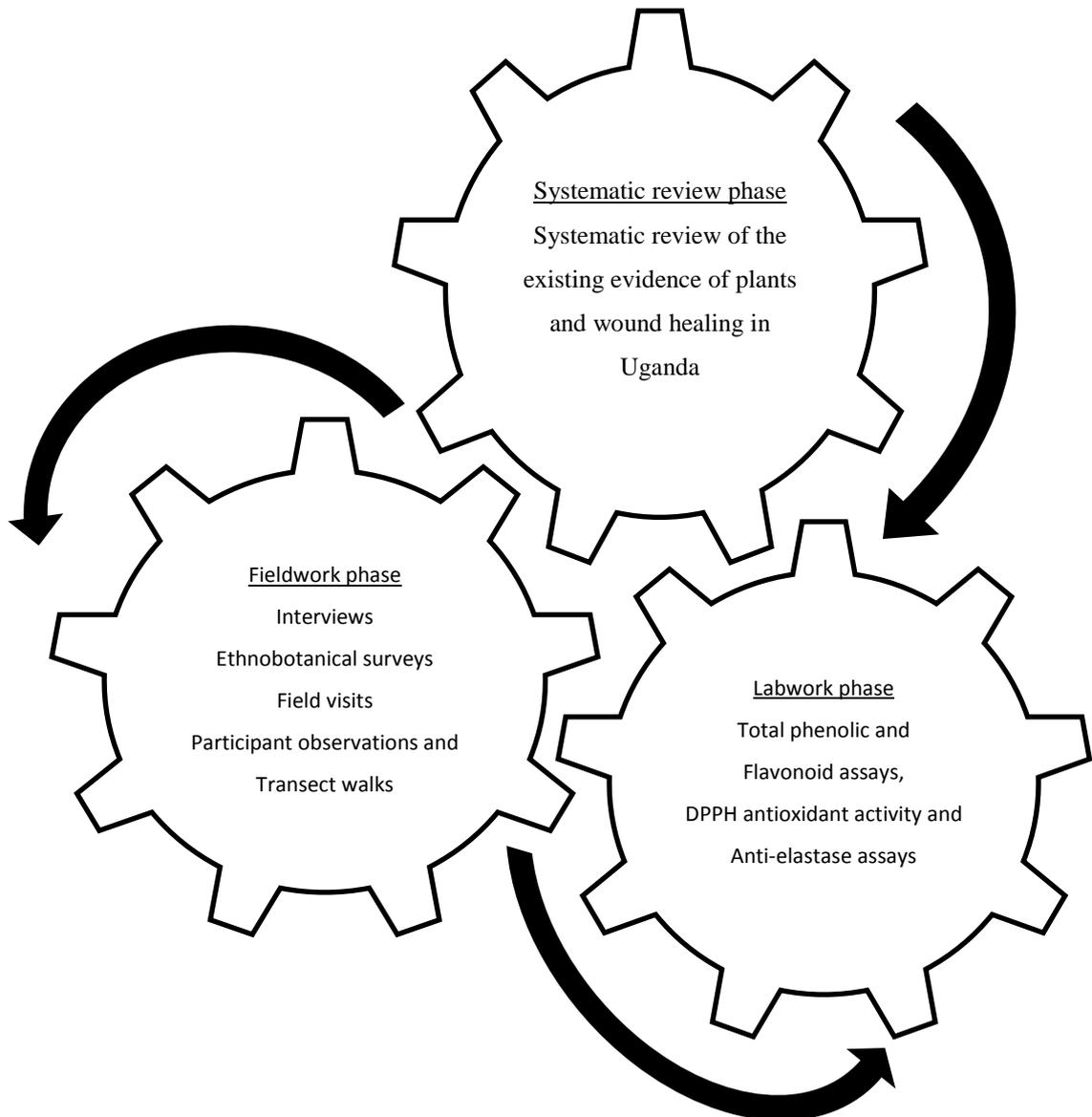


Figure 6-1: Diagram showing how each phase of data collection informed the next

6.2.2 The utility of the mixed methods approach in this study

According to O’Cathain et al (2007), a mixed methods study has the potential to produce knowledge that is unavailable to a qualitative study and a quantitative study undertaken independently. However, a study on barriers to integrating qualitative and quantitative by Bryman (2007), suggested that mixed methods researchers do not always bring their findings together and that the quantitative and qualitative components are treated as separate domains which is one of the greatest challenges

of the utility of the mixed methods approach. O’Cathain et al (2007) suggest that the integration of methods can take place all the way from the study design to the writing up and discussion of findings. They suggest that the findings can be analyzed and presented separately then integrated at the interpretation stage. They suggest approaching it in one of two ways adapted from Teddlie and Tashakkori (2003). The first involves making inferences from the findings of each method, and then these suppositions can be brought together in the discussion for a meta-inference; the second involves bringing the findings together in the discussion for inference. This study has chosen to adopt the first approach of making inferences from each phase then having one meta-inference of all the findings at the end. This section presents a summary of the utility of the mixed methods design employed in this PhD study.

The literature review (phase I) revealed that studies on medicinal plants used for injuries in Uganda reported that wounds were the most commonly treated types of injuries for which medicinal plants were used. However, despite having a very broad question and comprehensive search these studies just focused on the plants used and not on the healers’ knowledge. This is important because ethnobotanical studies should provide information that will eventually be used in ethnopharmacology studies (Etkin, 1993) therefore, the importance of documenting the ethnography of plant use in sufficient detail, to link traditional empirical knowledge with bio scientific research cannot be overemphasised. The literature review also revealed that most of these studies recommended further phytochemical and pharmacological investigations to determine the active properties of these plants and the activities that might explain the choice of these plants for ethnomedical use. This focus on the science has missed the value gained from understanding the healer’s world view; this finding helped to inform the decision to focus the PhD study as an investigation into what is known about plants and wound healing in Uganda. Each phase of this research helped to refine the research questions and provided information that helped in making decisions concerning the subsequent choice of planned and emergent methods. In essence, this approach of each method feeding into decisions about subsequent methods underpins this thesis and was practically achieved using the mixed methods approach.

The literature review data provided the initial information that helped to select the methods and design the instruments used in the fieldwork phase. During this second phase, interviews were conducted with traditional healers and local knowledge experts on plants and wound healing in the community. The findings from the interviews uncovered the knowledge regarding wound healing and revealed several plants used

for the treatment of wounds. An ethnobotanical survey of all the plants mentioned during the interviews was then conducted with the healers to identify the different characteristics of these plants and the way they are prepared and administered for wound healing. After collecting the interview and survey data, the researcher took some time away from the field to look through both these data to look for any obvious areas of agreement and disagreement. From the language used, and the differences in the responses provided by the different healers and the post fieldwork meetings held within the research team, it became increasingly apparent that some of the healers had only shared with what they felt that the team wanted to know. It also became even more clear that some of the participants left out some details of their practice which may be carried out unconsciously but that could only be picked up by an outside observer and so a decision was made to include participant observation in order to gain a deeper understanding of the practice of traditional medicine, to corroborate the findings from the interviews and the survey and also as a form of triangulation.

The interviews, survey and observations provided a list of medicinal plants used for healing and the ethnomedical rationale for the action of the plants. This list of plants was cross referenced with the list from the literature review to identify any plants that are used on a wider scale for wound healing in Uganda (this is discussed in greater detail in section 6.3). After careful consultation of the both the existing literature and the systematically reviewed literature from the first phase of this study, relevant phytochemical studies were chosen to investigate the wound healing activity of three selected plants. The main aim of this lab work phase was to verify the findings obtained during the fieldwork phase from the interviews and surveys where the healers suggested possible actions of the plants used for wound healing.

This narrative demonstrates the use of the mixed methods approach and the way in which each part of the study was informed by the other and recommends the mixed methods strategy when delving into an unexplored area of a range of perspectives and when multiple lenses are needed to answer a research question. The mixed methods approach is suited to this unexplored area in ethnomedical studies mainly because it allows the researcher greater flexibility in the selection of the methods employed for data collection and analysis. In this particular pragmatic mixed methods study, this method allowed us the flexibility to employ whichever data collection method was best suited to answer any emerging research questions. This followed the intended design of this triphasic study where each phase relied on data from the preceding one.

6.3 Literature review, Phase I

The main purpose of this phase was to systematically review the literature to identify existing studies on plants used for injuries in Uganda in order to identify the unintentional injuries that are most frequently treated with medicinal plants in order to give direction to this PhD study. This section summarises the findings from the literature review and compares them with those from this study. In essence, this is akin to an updating of the body of knowledge by adding the findings from this empirical investigation into the literature identified in the review.

6.3.1 Integration of literature review and ethnobotanical survey findings

The literature review conducted in this study identified 78 plant species mentioned for wound healing and following the cross referencing with the ethnobotanical survey findings, 9 plants found in this PhD study were already described, as being used for wound healing in Uganda. This shows that the ethnobotanical survey performed within this study has identified 28 plants not pre-recorded as being prescribed for wound healing in Uganda until now. This might suggest that different localised practices exist in Uganda regarding plant used for wound healing in traditional medicine. It might also mean that the combination of survey, interview and participant observation reveal a richer source of plants used in healing than obtained by a single survey method as practised in the literature identified in the review. This suggestion reinforces the importance of securing oral knowledge and reiterates the role of systematically reviewing literature as the first step in evidence based practice.

Alternatively the plants might be used on a wider scale than in the study area (South Western Uganda). A limited ethnobotanical literature base exists for Africa and a cross reference of the findings from this study and with the already existing evidence base revealed 10 plant species that are used in other African countries and one (*oxalis corniculata*) reported for wound healing in India (Kumar et al., 2007) (see table 6-1). This finding suggests the possibility of the plants being used on a much wider scale, however, this is difficult to determine because of the limited number of existing studies that have been carried out on plants and wound healing (Agyare et al., 2009). The healers in this study reported one of their major challenges as lack of record keeping and documentation of their treatments and remedies. This coupled with the lack of transmission of local knowledge to the next generation demonstrated in this study could be cited as some of the contributors to the limited available documented evidence of the practice of traditional medicine using medicinal plants.

Table 6-1: Cross reference literature of plants used for wound healing

Family	Plant Species	Reported relevant ethnomedical uses	Country of use	Types of wounds treated from the survey
Asteraceae	<i>Ageratum conyzoides</i> L.	New, old wounds and burns (Agyare et al., 2009), wounds and sores (Adetutu et al., 2011)	Ghana, Nigeria	Fresh wounds, Chronic wounds, Generalised sores
Caricaceae	<i>carica papaya</i> L.	New, old, stomach ulcers/sores (Adetutu et al., 2011)	Ghana, Nigeria	Fresh wounds
Lamiaceae	<i>Hoslundia opposita</i> Vahl	Chronic and deep wounds, stomach ulcer (Agyare et al., 2009)	Ghana	Fresh wounds, Osteomyelitis
Musaceae	<i>Musa paradisiaca</i> L. var. <i>paradisiaca</i>	New wounds (Agyare et al., 2009)	Ghana	Fresh wounds, Generalised sores
Myrtaceae	<i>Psidium guajava</i> L	Chronic wounds (Agyare et al., 2009)	Ghana	Chronic wounds, Stomach ulcers
Oxalidaceae	<i>Oxalis corniculata</i> L.	Wound healing (Kumar et al., 2007)	India	Fresh wounds, Chronic wounds, Generalised sores
Poaceae	<i>zea mays</i> L	Boils (Njoroge and Bussmann, 2007a)	Kenya	Boils
Solanaceae	<i>solanum incanum</i> wild	Boils (Taye et al., 2011)	Ethiopia	Fresh wounds
Solanaceae	<i>solanum nigrum</i>	Wounds (Inngjerdigen et al., 2004)	Mali	Fresh wounds
solanaceae	<i>nicotiana tabacum</i> L	Stomach ulcer/sores (Agyare et al., 2009)	Ghana	Stomach ulcers
zingiberaceae	<i>zingiber officinale</i>	Chronic wounds/boils (Agyare et al., 2009)	Ghana	Boils

In this study, the most prevalent recorded species from the ethnobotanical survey were from the family Asteraceae, followed by Solanaceae, Lamiaceae and Fabaceae (Table 5-7). These families frequently feature in medicinal plant inventories and is confirmed by the findings of the literature review which identified Asteraceae and Fabaceae among the top 5 most recorded species of plants used for wound healing from studies carried out in different regions of Uganda (Table 6-1). According to Thomas (2009), the popularity of Asteraceae is thought to be due to the diversity of secondary plant metabolites members of this family possess. Secondary plant metabolites have been defined as organic compounds that are not directly involved in the normal growth, or development of plants (Briskin, 2000). They are of special interest in phytochemistry and TM because it has been suggested that the beneficial medicinal effects of plant materials typically result from the combinations of secondary products present in the plant (Briskin, 2000) which have a defensive role against herbivory and pathogen attack (Kaufman et al., 1999). They also demonstrate protection actions to abiotic stress (Wink and Schimmer, 1999) for example that associated with changes in temperature and UV exposure among others which explains why we are interested in them for their potential effects on the skin in wound healing. They have toxic effects and are usually considered unpalatable to predators (herbivores) which might suggest a reason for their role in healing or toxicity. The absence of these metabolites will not result in immediate plant death unlike for the primary metabolites like carbohydrates, lipids, proteins, heme, chlorophyll, and nucleic acids; however according to (Zhao et al., 2005), plant secondary metabolites are unique sources for pharmaceuticals, food additives, flavours, and other industrial materials. Another simple explanation for the widespread use of plant species from Asteraceae could be their widespread abundance (Hamill et al., 2000) or their pretty appearance e.g. daisies making them more likely to be encountered by people and experimented on.

6.4 Fieldwork, Phase II

The second phase of this tri-phasic study was the fieldwork phase in which data about plants and wound healing was collected in Uganda. This section discusses the key findings from this phase and begins to paint a clearer picture of traditional medical practice in Uganda by engaging in a discussion about the service providers, their knowledge and their practice of wound healing.

6.4.1 General demographic characteristics of healers

The demography of the participants identified as healers is now going to be set in the context of the knowledge about the population in Uganda, and the assumptions made about sources of expert knowledge for healing etc. In this study people were, on average, 36-55 years, and mainly women. One could make the assumption that these findings might have been affected by the age and gender of the researcher. Some of the male healers were not recruited or felt uncomfortable talking to a young woman but this is unlikely because the reputation sampling technique employed in this study involved the community members in identification of people regarded as knowledgeable in the use of medicinal plants. Since the robust sampling method rules out that possibility therefore it might mean that the healers were not identified in proportion of men / women / old and young, and that the observations actually reflect that this local knowledge is owned by middle aged women in South Western Uganda. Another study in several districts in Uganda by (Lamorde et al., 2010) also identified median age of healers as 50 which is counter to the assumption that the local healing knowledge is kept by the elders in a community. Contrasting findings from Tabuti, Kukunda and Waako (2010) in Eastern Uganda reported that the majority of healers were men while this study reported the majority of healers in Isingiro district as women. This could be as a result of the types of communities existing in both Central and South Western Uganda. The people in South Western Uganda are largely cattle keepers while the ones in central Uganda are largely farming communities. The cattle are looked after by the males in the household who spend the greater part of the day away from home while in central Uganda, they usually go to their farms very early in the morning and return early in the day which allows them more time for the practice of TM. It might also just mean that these roles are gendered for those specific genders in each region.

Unlike in a study by Tabuti et al (2010) in central Uganda where all the TMPs stated that TM was their main source of income, the majority of the participants in this study (75%) regarded themselves as subsistence farmers and not as full time TMPs. The healers in this study reported the fear of death and the difficulty in the differentiation between the different types of healers as one of their major challenges. What this means is that the community cannot differentiate between a herbalist and a witchdoctor and when any mysterious illnesses or deaths occur within a community, the healers are usually the first suspects and may be subjected to social 'justice'. Interestingly, the

participants were included in the study because they were identified by the community as providers of traditional medicine, so although they may not consider themselves as TMPs, the evidence from this study shows that the communities in which they live certainly seem to view them as TMPs. Alternatively, the dual professions of farmer and healer might be due to the urbanisation or change in land use of formerly rural communities with improved access to western health care which may necessitate the TMPs having to look for alternate professions.

The World Health Organisation (WHO) estimates that close to 80% of the population in developing nations utilise traditional medicine in one form or the other (2000b) and this study confirms that people in rural populations use traditional medicine but it also gives an insight into the profiles of the traditional medicine service providers. In the study area, the majority of the people to whom community members go for their health care needs do not even consider themselves to be professional traditional healers, the implications of which will be felt if any integration between health professionals and traditional healers is considered.

6.4.2 Healers' knowledge of plants and wound healing

Ethnobotanical knowledge and practice within any culture vary by geographical origin, residence, ethnicity, religion, age, and gender (Cheikhoussef et al., 2011). Traditional folk knowledge is neither found in written form, nor organised and structured in ways easily accessible to science. This knowledge is dynamic and it changes through indigenous creativity and innovativeness and through contact with other knowledge systems (Kakudidi, 2004b) and will not be there for long for us to salvage, therefore, it must be collected and documented before it is lost.

As an illustration, one of the healers reported that their clients know that one of the requirements for a consultation and treatment was the possession of results from hospital tests with an explanation from the doctor. In the past, the healers relied on experience and '*spiritual guidance*' to make a diagnosis (Kubukeli, 1999, Kaplan, 2011) and passed on this knowledge, from this illustration one wonders whether the diagnosis made by the healer is actually the healer's own or is influenced by western practice. This has an impact on local knowledge which is usually passed on by word of mouth (Adewunmi and Ojewole, 2004, WHO, 2005b, Calvet-Mir et al., 2008) and the evolution of cultural knowledge in an increasingly globalised world which will in turn influence the type of knowledge that will be passed on to future generations, which is evidence of an interplay between TM and orthodox medicine.

Johnson (2006) defined intercultural consensus as agreement in which plants are valued for medicinal use, and similarity of reported uses between cultures which are in contact through such activities as trade, feasting and intermarriage. In looking at the relationship between the different plants mentioned for use in wound healing by the traditional healers, this study has borrowed from the concept of intercultural consensus and applied this as inter healer consensus. In line with this, TM involved in this study demonstrated low consensus and little uniformity at genus level in the plants mentioned for wound healing among the healers. This was demonstrated in the number of mentions of plants used for wound healing; many of the healers mentioned a plant only once and it was neither mentioned nor recognised by any other healer. Several other studies that have been carried out on wound healing in Africa, do not discuss the issue of consensus among the healers in their studies, however following on from the participant observations, this might be because of the lack of sharing of local knowledge and the perceived ownership of local knowledge where the healers are not willing to share their remedies amongst each other. In this study, the majority of the TMPs did not even consider traditional healing as their main source of income and, according to Voeks (2007), others are abandoning it. This lack of practice and inability to share remedies with other healers can lead to loss of traditional medicine knowledge and mistakes or inaccuracies in identification of plant species. This agrees with findings from a study in Northern Uganda which reported that 20% of healers interviewed had not passed on knowledge of medicinal plants to their offspring and were unwilling to do so, the authors concluded that this was because they did not want people to know them (Okello and Ssegawa, 2007) which simply supports the findings from this study.

6.4.3 Local definition and classification of wounds

The Oxford dictionary defines a wound as an injury to living tissue caused by a cut, blow, or other impact, typically one in which the skin is cut or broken (Oxford Dictionaries, 2011). In this study, wounds were defined as an opening on the skin either caused by injury or which occurs spontaneously and sometimes has a discharge of blood or pus and classified according to their appearance, the cause, duration, location and body surface area covered by the wound. This definition and classification agree with those from studies on wound healing conducted in South Africa (Grierson and Afolayan, 1999b), Ghana (Agyare et al., 2009) and Mali (Inngjerdigen et al., 2004). This shows consistency among African healers; these findings are also comparable with the definitions and classification of wounds employed by health professionals in the biomedical model. In this model, wounds are defined as the result of disrupted skin integrity (Schreml et al., 2010) or as a cut or break in the normal

continuity of the body structure internally or externally or a cut or break in the continuity of any tissue (Rosdahl and Kowalski, 2008). This definition also allows for the traditional healers' inclusion of stomach ulcers in the types of wounds mentioned.

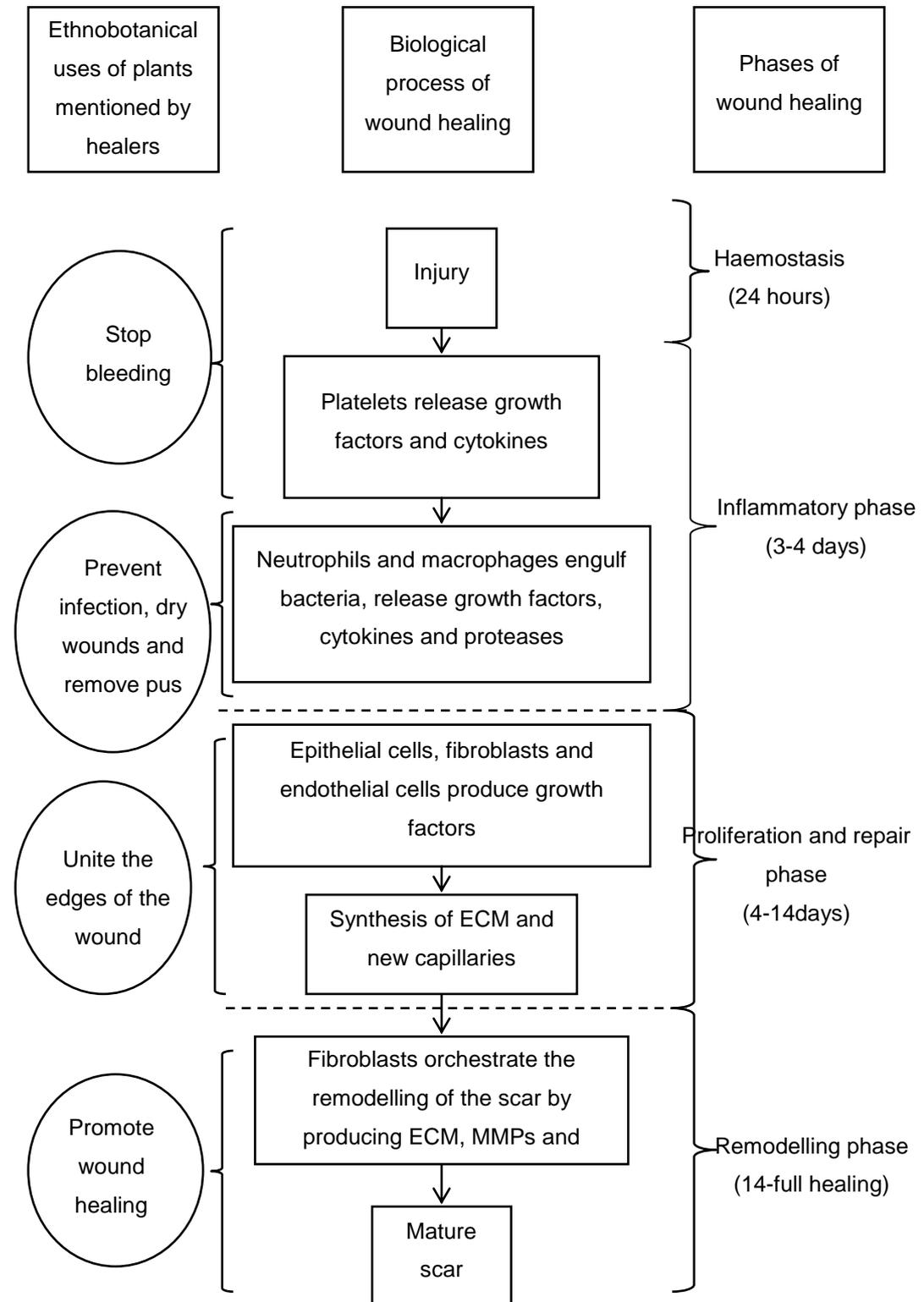
Evidence from the literature demonstrates that wounds are classified based on injury, timing and depth (Percival, 2002) while Kumar et al (2007) and Kumar and Leaper (2008) classify wounds based on the aetiology, morphology, contamination and their complexity. This might provide an insight into the healers' fundamental way of thinking or suggest that their practice is becoming influenced by the Western practice especially for the healers who do not attend to patients unless they have undergone diagnostic tests in a hospital. Alternatively it might suggest an easily observed phenomenon thus little difference across the cultures as demonstrated by the consistency of in the definition among different African healers. On the other hand, it might suggest an observable phenomenon that is shared across cultures therefore a common understanding which reinforces the point about what one sees as evidence.

6.4.4 Objectives of therapy for each plant-based remedy

A significant number of healers reported that although they knew the outcomes of wound healing when they used the plants, they did not know how the plants worked nor had they thought about this before, since their clients do not request this information, therefore the healers did not feel the need to find this out. This could arise out of the local *Nkore* culture of not asking many questions especially because the majority of the healers in the study were women which might suggest that the local knowledge of traditional medicine is gendered, however, it may also demonstrate that the healers are practising TM based on evidence of whether the plants work or not, i.e. empirically. This lack of knowledge about how the plants work should also be viewed in a positive light especially when it comes to integration of TM and western medicine in the future, it is hoped that this will make leave them more open and receptive to new ideas based on one of their challenges being lack of access to continuous traditional education in order to improve their practice.

The responses from the healers regarding the ethnobotanical uses of the plants mentioned were compared with the phases of wound healing described in Western health systems and this comparison is presented in figure 6-1. This figure shows that the healers and the biological processes work towards the same outcomes for wound healing but they demonstrate a different understanding of the complexities involved in

the biology of wound healing. In essence, the healers and western practitioners are not really contradicting each other in their belief system regarding wound healing.



Extracellular matrix (ECM), Matrix metalloproteinases (MMPs), tissue inhibitors of metalloproteinases (TIMPs)

Figure 6-2: Integration of healers' responses regarding rationale for plant use and the biology of wound healing adapted from Enoch and Harding (2003).

6.4.5 Preparation and administration of medicinal plant therapies

The findings from the ethnobotanical survey and the participant observation regarding the preparation and administration of medicinal plant therapies are similar to findings from other studies carried out on wound healing in Africa: Mali (Inngjerdingen et al., 2004), South Africa (Grierson and Afolayan, 1999b) and Ghana (Agyare et al., 2009) which also present a clear description of the preparation and administration of the medicinal plant therapies.

The key finding here is that the dosages of the remedies are largely based on the healer's personal judgement. It is interesting to note that the healers did have unconscious criteria for administering these remedies that are difficult to tease out but they have a system for administration of these plants. Another significant finding is their assumption that because the plants are applied externally then there is no possible internal danger and that the doses are not relevant. This agrees with the criticisms levied against traditional medicine in section 3.3.5 that the potions administered in herbal medicine are not standardized.

6.4.6 Local practice of wound healing using medicinal plants

The local practice of wound healing using medicinal plants in South Western Uganda was not immediately clear during the qualitative interviews but several interesting characteristic of this practice came to light during the participant observations. Figure 6-3 is a diagrammatic representation of some aspects of the practice of traditional medicine in South Western Uganda. Some of these are borne out of the interviews and others from the researcher's observations of the healers in the practice.

The figure presents the healer in his/her role with the healer-client relationship at the heart of this role. This relationship is influenced by several factors which include the healer's knowledge, skills and attitudes, contextual factors, organizational factors and environmental factors. Some illustrations of these factors are also presented to show us at which level they affect the healers' practice.

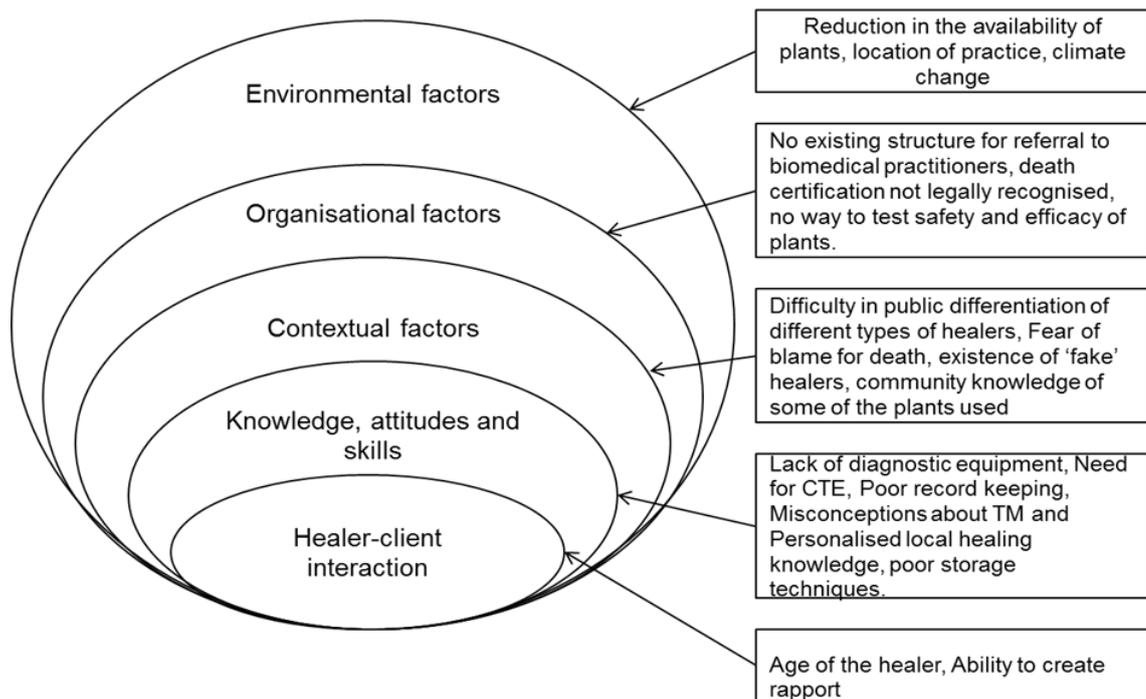


Figure 6-3: Representation of factors influencing the healers' practice of TM

In this study, one of the key issues that came up repeatedly was the lack of appropriate equipment and techniques. Similar findings were reported in a study to identify the plants used for the treatment of TB in Uganda by Tabuti *et al* (2010) who found that TMPs used recycled plastic water bottles to package their formulations which is not in accordance with the National Drug Authority (NDA) standards, they also had similar challenges with preserving their medicines for long periods. Re-used plastic containers and plastic bags were used, raising concerns of possible contamination of the TM preparations in another study in Uganda (Lamorde *et al.*, 2010). This is a big challenge as it might lead to patients receiving remedies in unhygienic containers which might cause people to think that any ensuing illnesses were due to the actual herbal remedy which may be misleading but more importantly, poor storage methods can alter chemical substances in the plants some of which could be toxic to the body thus causing death.

A study in northern Uganda by (Okello and Ssegawa, 2007) reported that all the traditional healers in their study reported that there were changes in the abundance and occurrence of the medicinal plants harvested. They also added that, effort was being made to harvest small quantities of the plant parts to use so as to give these plants time to regenerate. This is a traditional way of enhancing sustainable utilization of medicinal plants given the decreased abundance of medicinal plants. This finding bears some similarity to the findings from the observations in this study where some

healers reported that deforestation, farming and pollution were having an impact on the availability of some of these plants; they however did not mention any actions currently being taken to ensure the regeneration of medicinal plants. This is especially pertinent in areas where medicinal plants are largely harvested in the wild, and conditions for growth in cultivation have not been optimized, however, the majority of the plants mentioned for wound healing in this study were either cultivated or grew as weeds in their farms therefore, as long as they keep planting these crops this will ensure that they always have a supply of the medicines available.

One of the key elements that stood out regarding the practice of traditional medicine in this study was the 'blended' approach to healing. According to Geimer- Flanders, (2009) "Blended medicine" involves the use of complementary and alternative medicine together with biomedical medicine. Some people might call it an integrative approach to healing but that usually refers to a biomedical establishment that offers CAM options as well, however in the blended approach demonstrated during the interviews and observations, it is the traditional healer who does not see the patients unless they have been to a doctor as illustrated below

I mainly deal with cancer and sometimes work on bones (bonesetter) and one of the things my patients know about me is that they cannot come to see me without an x-ray or without proper blood tests from the doctor. I also ask them to make sure that they ask the doctors what those results mean because I do not understand their English. So they are required to receive their results with a relative who understands English very well and this person can then come and let me know what the doctor said. I like this method because it means you are surer of what you are dealing with but also it prevents you from making big mistakes especially with the bones. R4

So without even being aware of it, there is an existing inter-practitioner interaction between practitioners of traditional and western medicine. What is not clear is how this influences the healers' practice and where the line is drawn or who can claim responsibility for the actual patient's healing; is it the one who makes the diagnosis or the one who actually administers the remedy?

6.5 Laboratory work, Phase III

The third and final phase of this mixed methods study was the laboratory work phase which involved the phytochemical analysis of three selected Ugandan medicinal plants

identified during the fieldwork phase as important for wound healing. The interviews, survey and observations provided a list of medicinal plants used for healing and the ethnomedical rationale for the action of the plants. This list of plants was cross referenced with the list from the literature review to identify any plants that are used on a wider scale for wound healing in Uganda. Following this samples of *A.conyzoides*, *B. Pilosa* and *G.Parviflora* were collected and transported to Leeds (UK) for further phytochemical studies. The detailed reasons why these particular plants were chosen were presented alongside the findings from the laboratory work phase in chapter 5 (section 5.8.1). This section discusses the key findings from this phase.

6.5.1 Plant preparation

6.5.2 Solvent extraction

The main aim of the laboratory investigations was to obtain a simple 'crude' extract to be used as a starting point in various plant studies. Many organic compounds are able to dissolve in methanol, but not in water. So both extraction methods were used to gain a broad spectrum of extracted substances and the findings show that the yield is not improved by either methanol or water.

Ultrasonification, was an initial attempt to generate crude extracts of the three selected plants using the dry material which could be a limitation of the method as well because the healers in the villages do not use these techniques for extraction of their medicines and most of their remedies call for the application of the fresh leaves to the wound.

6.5.3 Total phenolic and flavonoid content

The results from table 5-17 and figure 5-11 show that there is no consistency with the results from both assays which suggest that sonification was not required perhaps due to the extremely small size of the particles and other factors which could not all be controlled for like the presence of other compounds in the extracts like waxes and saponins.

6.5.4 Presence of antioxidant activity

The observed percentage inhibition values offered by some of the extracts are comparable with those demonstrated by plant species used for wound healing in other studies for example a study on the antioxidant capacity of edible and wound healing

plants in Oman (Marwah et al, 2007) which had inhibition percentage values ranging from 93-8.4%. The antioxidant activity observed in this study could be one of the possible mechanisms which contribute to the selected plants potential for wound healing but more importantly it helps to confirm that the extraction method did not degrade or render inactive commonly encountered compounds extracted from plant material sonicated for 30 and 60 minutes and as such simple boiling of extracts should be good enough to give an acceptable quantity of extract. Thus the extracts that had not been subjected to sonication were selected for the functional assays for the investigation of anti-elastase activity.

6.6 Integration of the key findings from the three study phases

The next section now summarises the findings of the three phases that have been presented in this thesis, bringing them together to form a conceptual model which may serve as a heuristic device grounded in the data, of plants and wound healing, in order to answer the original research question.

The findings show that the healers possess knowledge regarding plants and wound healing. In some cases, they lack the knowledge or are unable to provide a description that can be understood in scientific terms while in other cases, they have some misconceptions regarding the practice for example the fact that topically applied herbs do not have any internal effects. The healers understanding of the knowledge of wound healing and their practice also stands out as an important finding because knowledge informs practice. The notion that the largest number of healers do not understand the rationale behind their action is very unsettling. However, as previously expressed, this is a different paradigm and context which should be viewed through that lens. On the other hand, some teaching may be required to eliminate some of the misconceptions that the healers hold regarding the safety of TM. These findings reveal that there is a body of knowledge that needs further refinement, development and clarification to ensure that the patients/ clients are receiving correct information in order to make an informed decision. This revelation resulted from an integration of the different phases and methods employed in this study.

Another key finding derived from the mixing of methods, is that the healers display some consensus about the plants used and there is commonality among the families of plants used for wound healing which might suggest that certain families may possess more wound healing activity than others.

The findings from the preliminary screening in the laboratory might suggest that the herbs work in congruence with the rationale suggested by the healers and that the plants are not inert.

The entire success of this project also demonstrates the successful piloting of the research methodology employing the mixed methods approach of inquiry right from the creation of the overarching research question following through to the methods employed in the study.

6.7 Strengths and limitations of the study

This study has three main strengths. First, it used mixed methods – both qualitative and quantitative data – and different types of data – interview, survey, observational and laboratory among others. Each was important in its own right and offered a unique and objective understanding of the practice and an in-depth exploration of the knowledge of the healers. The objective understanding mainly resulted from obtaining data using triangulated methods of data collection and comparing this data to already existing empirical evidence.

The second is the use of the ethnopharmacological approach in the collection of ethnomedical data (Elisabetsky and Demoraes, 1990), which means that each aspect of the study was carried out with the healers' views in mind. This is the recommended way of collecting data in ethnomedical studies as it ensures that medicinal plants being used for wound healing are tested with the rationale for the action of the plant uses stated by the healers in mind. In addition the integration of the different methods employed in data collection and the data collected informing the next step of data collection makes a very strong case for data and methods triangulation.

The novel participant recruitment method employing Brownian motion to identify the healers with the biggest reputation in the community can be viewed as the third strength because it provides a clear and repeatable method of identifying people with best knowledge who are trusted by their community.

On the other hand, this same sample selection method may have affected the quality of the sample and this could have influenced the results. For example, if a healer has fallen out of favour with the community, then they will not be recruited into a study and this method therefore potentially excludes any negative cases and leave out a piece of the whole picture and as such an unrepresentative group of healers.

The study also had a number of limitations, some related to the type of data collected and others related to the design of the study. One major one was that the laboratory work component needed developing and all the assays required further optimisation in order to comprehensively serve the study's research questions and objectives but I plan to continue this aspect of the study in future collaborative work with other interested plant scientists.

Unlike the interpretation of the quantitative data, the qualitative data is, to an extent, subjective as it relies on the skills, beliefs and values of the researcher to discover new or confirm similar existing ideas. To avoid any misinterpretation of these data, the researcher developed a coding frame which was reviewed by one research supervisor. The themes were validated by the results of the observational aspect of the study.

6.8 Contribution to the body of knowledge

This is a novel ethnomedical study guided and underpinned by the mixed-methods approach, a review of the literature on medicinal plant use in Africa revealed that studies like this do not currently exist. The demonstration of the mixed methods approach in action to answer a clearly formulated research question and objectives is a contribution to the body of knowledge, namely a contribution to methodology. In addition, the method used to identify the participants for recruitment in the study which is the reputation sampling method using Brownian motion can be used as an innovative recruitment method for ethnomedical studies especially those carried out in areas which are poorly mapped out or where no sampling frames exist. This method is easy to use and ensures that one obtains a sample approved by the community in which they live.

This thesis also obtained the local definition and classification of wounds and described the therapeutic goal or ethnobotanical rationale for plants used for wound healing in South Western Uganda and provided an insight into the preparation for plants to be administered for the treatment of wounds.

Unlike other studies that simply present an inventory of medicinal plants, this thesis documents plants used for wound healing and has attempted to understand the knowledge of healers and offered suggestions about possible phytochemical mechanisms. Several other studies on wound healing have mainly carried out

antimicrobial tests and animal studies but this thesis has now added the enzyme assays to the growing body of evidence.

6.9 Future work

The findings from this study have identified areas for further research to clarify issues raised during the conduct of the research:

Knowledge of traditional medicine

Regarding the knowledge and practice of traditional medicine, it would be interesting to apply the methods and methodology stated in this study to the treatment of other conditions using medicinal plants. It would be fascinating to note how different the knowledge and practice is when it comes to a pathological condition like HIV/AIDS or malaria.

Further detailed anthropological studies should be carried out regarding the knowledge of healers regarding wound healing especially about contextualising and situating this knowledge within the cultural perspective and also to identify patterns or schemes put in place for gaining and transferring this knowledge.

Practice of traditional medicine

Several misconceptions about the practice of TM emerged from this study and it would be interesting to follow these up in more details in order to trace the origins of these misconceptions and find a source that could be play a key role in demystifying these concepts.

There were also several interesting or unusual practices that emerged from the literature for example the *in vivo* testing of plants on animals or some of the healers attempts at explaining the pharmacology of plants used in wound healing that can give deeper insights into the African pharmacopoeia but can also be followed up and might be useful for drug discovery.

Phytochemical studies on wound healing

Wound healing is a complex biological process and the therapy used for wound healing could work at any of the many stages of the healing process.

Findings from this study suggest possible antioxidant, anti-elastase and anti-collagenase activity. The next step would be to employ cell based studies to assess the

viability of fibroblasts or keratinocytes when exposed to different concentrations of crude extracts of *B.Pilosa*, *A. Conyzoides* and *G.Parviflora*. Other cell work includes other extraction methods, isolation of the chemically active properties of the plant extracts, cell migration assays and collagen lattice contraction assays.

Clotting studies

The reports from the healers during the interviews identified many of the plants for use in fresh cuts or wounds to stop bleeding which suggests the need for clotting studies to determine the effect of the plants on clotting.

6.10 General Conclusions

This discussion has returned to the original research question and has applied the empirical findings of the study to the broader literature. It suggests that evidence exists in the literature regarding plants and wound healing but a lot of it only pays cursory attention to the healers' understanding of their practice of traditional medicine. As mentioned in chapter one, answering the research question of 'What is known about plants and wound healing in South Western Uganda?' is not a simple affair, it involves connecting the findings from the of the literature to the knowledge possessed by the healers to the findings obtained in the laboratory and this PhD study has demonstrated that this can be done using the mixed-methods approach.

The use of plants for healing by any cultural group is integrally related to local concepts of the nature of disease, the nature of plants, and the world view of the culture. Ultimately, this thesis demonstrates evidence of the reported use of selected medicinal plants for wound healing in South Western Uganda. Pilot or feasibility phytochemical tests based on healers' reported ethnobotanical rationale for the use of *B.Pilosa*, *A.conyzoides* and *G.parviflora* for wound healing showed the most effective extraction method as an initial step for future cell based, phytochemical and possible pharmacological studies. The thesis also gives a description of the category of professionals involved in traditional medicine using medicinal plants and draws attention to an already existing blended approach to health care in parts South Western Uganda. This thesis has also been able to integrate findings from both qualitative and

quantitative threads of the thesis to provide a further and fuller understanding of the practice of traditional medicine in Uganda. Furthermore the mixed methods research approach which underpinned and guided this study and the novel reputation sampling method for identification of the sample demonstrate an original, unique and repeatable approach in conducting future ethnomedical studies.

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Appendix 1: list of studies excluded from the review and rationale for exclusion

Author	Aim of the study	Reason for exclusion from review
(Lino and Olila, 2006)	The study looked at the invitro antibacterial activity of <i>Annona senegalensis</i> , <i>Securidacca longipendiculata</i> and <i>Steganotaenia araliacea</i> .	Mentioned use of medicinal plants but assessed for pharmacological activity
(Tabuti et al., 2003a)	This study looked at Traditional medicine in Bulamogi county, Uganda.	Mentioned use of medicinal plants not related to injury.
(Katuura et al., 2007b)	The aim of the study was to investigate extracts of selected medicinal plants used in Western Uganda for antiplasmodial activity	Mentioned use of medicinal plants but assessed for pharmacological activity
(Kamatenesi-Mugisha and Oryem-Origa, 2005)	The aim of the study was to document medicinal plants used in the treatment of sexual impotence and erectile dysfunction disorders in Western Uganda	Mentioned use of medicinal plants not related to injury.
(Tabuti, 2008)	The study was conducted to document herbal medicines used in the treatment of malaria as well as the existing knowledge, attitudes and practices related to malaria recognition control and treatment in Budiope county, Uganda	Presented use of medicinal plants not related to injury. Mention was made of use of wounds as some of the conditions treated with the plants but was not specific about which plants are used for wound healing.
(Hamill et al., 2003b)	This study reported the results of laboratory investigations on biological activity related to ethnomedical uses of a medicinal plant inventory described in two previous papers.	Mentioned use of a medicinal plant but assessed for pharmacological activity
(Kamatenesi-Mugisha et al., 2008)	This paper presented a list of medicinal plants used in the treatment of fungal and bacterial infections in and around Queen Elizabeth Biosphere Reserve, western Uganda	Mentioned use of medicinal plants not directly related to injury
(Kamatenesi-Mugisha and Hannington Oryem-Origa, 2007)	The study was carried out to document indigenous knowledge on medicinal plants used in some gynaecological morbidity ailments in western Uganda	Mentioned use of medicinal plants not related to injury
(Katuura et al., 2007a)	This was an ethnobotanical study of traditional treatment of malaria in Mbarara District, western Uganda.	Mentioned use of medicinal plants not related to injury

(Galabuzi et al., 2010)	The purpose of the study was to document the common TM practices in Central Uganda.	Gave insights in to the practice of TM but did not mention medicinal plant use for management of injuries
(Kakudidi, 2004b)	This study recorded the Folk plant classification by communities around Kibale National Park, Western Uganda	Gave insights in to the practice of TM but did not mention medicinal plant use for management of injuries
(Kakudidi, 2004a)	This investigation recorded cultural and social uses of plants from and around Kibale National Park, Western Uganda.	Presented medicinal plants used for different cultural and social purposes but did not mention their use related to injuries
(Kamatenesi-Mugisha et al., 2007)	The aim of the study was to validate the claimed properties of <i>Luffa cylindrica</i> (L.) M. Roem. and <i>Bidens pilosa</i> Lor inducing labour and childbirth in western Uganda.	Mentioned use of medicinal plants but assessed for pharmacological activity
(Anokbonggo, 1972)	This study presented preliminary pharmacological experimental approach to some Ugandan traditional medicines	Mentioned use of medicinal plants but assessed for pharmacological activity

Appendix 2: List of Ugandan medicinal plants identified for wound healing

Author	Family	Name	Local Name	Type of injury
(Hamill et al., 2000)	Asteraceae	<i>Bidens pilosa</i> L. (Hamill 1011)		
		<i>Carduus kikuyorum</i> R.E. Freis (Hamill 1057)		
		<i>Crassocephalum montuosum</i> (S.Moore) Milne-Redh. (Hamill 1082)		
		<i>Crassocephalum vitellinum</i> (Benth.) S. Moore (Hamill 1073)		
		<i>Galinsoga parviflora</i> Cav. (Hamill 1006)		
	Euphorbiaceae	<i>Flueggea virosa</i> (Roxb. ex Willd.) Baill. (Hamill 1021)	-	Wounds
	Fabaceae	<i>Senna septemtrionalis</i> (Viv.) I. et B (Hamill 1026)	-	Wounds
	Oxalidaceae	<i>Oxalis corniculata</i> L. (Hamill 1002)	-	Wounds
(Hamill et al., 2003a)	Asteraceae	<i>Wedelia mossambicensis</i> Oliver (Hamill 1130)	-	Wounds
	Bignoniaceae	<i>Spathodea campanulata</i> Buch.-Ham. ex DC. (Hamill 1167)	-	Dog bite
	Convolvulaceae	<i>Hewittia malabarica</i> (L.) Suresh (Hamill 1112)	-	Wounds
	Lamiaceae	<i>Hoslundia opposita</i> Vahl (Hamill 1123)	-	Wounds
	Moraceae	<i>Maclura excelsa</i> (Welw.) Benth & Hook f. (Hamill 1227)	-	Wounds
	Nyctaginaceae Portulacaceae	<i>Mirabilis jalapa</i> L. (Hamill 1137) <i>Portulaca quadrifida</i> L. (Hamill 1243)	- -	Wounds BW
(Tabuti et al., 2003b)	Asparagaceae	<i>Asparagus racemosus</i> Willd. (JRST 12)	Mukila gwango	Burn wounds
	Asteraceae	<i>Aspilia kotschyi</i> (Hochst.) Oliv. (JRST 207, 337)	Nzilume	Wounds
		<i>Bidens pilosa</i> L. (JRST 456), <i>Terminalia glaucescens</i> Benth. (JRST 48, 195, 409)	Labika Mukonge/ musasa	Wounds Wounds
	Combretaceae	<i>Jatropha curcas</i> L. (JRST 458)	Kilowa	Wounds
	Euphorbiaceae	<i>Jatropha multifida</i> L. (JRST 61)	Kahumpuli/ Mukama	Wounds
		<i>Phyllanthus nummulariifolius</i> Poir. (JRST 183)		
		<i>Tephrosia vogelii</i> Hook. f. (JRST 220)	Kabalila Muluku	Wounds Wounds
	Moraceae	<i>Vigna unguiculata</i> (L.) Walp. (JRST 60, 263, 285)	Ikote/ mpindi enjahirwa	Wounds
		<i>Milicia excelsa</i> (Welw.) C.C.Berg (JRST 500)	Muvule	Wounds
	Poaceae	<i>Panicum maximum</i> Jacq. (JRST 2) <i>Pennisetum polystachion</i> (L.) Schult. (JRST 17)	Bitinde	Wounds
	Rutaceae	<i>Polygala</i> cf. <i>Sadebeckiana</i> (JRST 148)	Idulyenke Mbajilawo	Wounds Wounds
		<i>Harrisonia abyssinica</i> Oliv. (JRST 64, 88)	Lushaike	Wounds
	Solanaceae	<i>Lantana camara</i> L. (JRST 453)	Kapanga	Wounds
	(Eilu and	Euphorbiaceae	<i>Tragia brevipes</i> Pax. (Eilu 338)	Nyai-nyai/ haka-haka

Bukenya,
2004)

(Okello and Ssegawa, 2007)	Asteraceae	<i>Acmella caulorrhiza</i> Delile	Arere	Wounds
		<i>Conyza sp.</i>	Adiltong-acol	Wounds
	Bignoniaceae	<i>Kigelia africana</i> (Lam) Benth.	Yago	Wounds
	Euphorbiaceae	<i>Flueggea virosa</i> (Wild) Voigt.	Iakara	Burns
	Fabaceae	<i>Erythrina abyssinica</i> Lam.	Iwila-kot	Wounds
	Lamiaceae	<i>Hoslundia opposita</i> Vahl.	Itutu	Wounds
	Poaceae	<i>Setaria sphacelata</i> (Schumach.) Moss	Acananya	Wounds
(Ssegawa and Kasenene, 2007)	Asteraceae	<i>Siegesbeckia orientalis</i> L. (SSEGAWA 929)	Sseziwundu	Wounds
	Labiatae	<i>Indigofera spicata</i> Forsk. (SSEGAWA 974)	Kibwa-nkurata	Wounds
(Oryema et al., 2010)	Aloaceae	<i>Aloe doweii</i> A. Berger	Tolmunu	Burns
	Annonaceae	<i>Annona senegalensis</i> Pers	Obwolo	Wounds
	Asparagaceae	<i>Asparagus africana</i> Lam.	Ogudu	Wounds
	Asteraceae	<i>Aspilia africana</i> (Pers) adama	Obogo/Obuku	Wounds
		<i>Bidens pilosa</i> L.	Nyekmon/Labika	Burn
		<i>Conyza floribunda</i> H.B.K.	Odiltong	wounds
		<i>Guizota scabra</i> (Vis) Chiov.	Ogwarmolo	Wounds
		<i>Tagetes minuta</i> L.	Ogwarmolo	Burns
		<i>Vernonia amygdalina</i> Del.	Yat yamo	Wounds
	Combretaceae	<i>Terminalia glaucescens</i> Benth.	Okelokelo	Wounds
	Cucurbitaceae	<i>Zehneria scabra</i> (L) Sond..	Opok	Wounds
	Euphorbiaceae	<i>Acalypha villicaulis</i> A. rich.	YAt aola	Burns
		<i>Euphorbia hirta</i> L	Orono	Wounds
		<i>Jatropha curcas</i> L	Acak	Wounds
		<i>J. multifida</i> L.	Omaraomara	Wounds
		<i>Piliostigma thonningii</i> (Schum)	Ayadin	Wounds
	Fabaceae	MilneRedh	apote	Wounds
		<i>Tamarindus indica</i> L	Ogali	Wounds
		<i>I. emerginella</i> A. Rich.	Cwao	Wounds
	Malvaceae	<i>Hibiscus flavifolius</i> Ulbr	Etele/ Itele	Wounds
		<i>Ximenia americana</i> L.	Yat pyer	Burns
	Oleaceae	<i>Oxalis corniculata</i> L.	Agweno	Wounds
	Poaceae	<i>Setaria sphacelata</i> (Schumach.) Moss	agweno	Wounds
	Rubiaceae	<i>Crossopteryx febrifuga</i> (G. Don) Benth.	Otyer	Wounds
	Solanaceae	<i>Lycopersicon esculentum</i>	Acanonya	Wounds
		<i>S. incanum</i> L.	Adela	Wounds
	Vitaceae	<i>Cissus adenocaulis</i> Steud. Ex A. Rich	Nyanya	Wounds
		<i>Cissus quadrangularis</i> L.	Ocokock	Wounds
		<i>C yphostemma serpens</i> (A. Rich) Desc.	Anunu	Wounds
		<i>Rhoicissus tridentate</i> (L.f.) Wild & Drumm.	Akeng	Wounds
			Ala kyat	
			dwon	Wounds
			Olok jobi	Wounds (cuts)

(Namukobe et al., 2011)	Asteraceae	<i>Ageratum conyzoides</i> L.	Omunywani	Wounds
		<i>Bidens pilosa</i> L.	we-nkanda	
		<i>Crassocephalum vitellinum</i> S.Moore.	Nyabarasana	Wounds
	Ebenaceae	<i>Diospyros abyssinica</i> (Hiern) F.	Embiribiri	Wounds
			Omuhoko	Wounds
	Euphorbiaceae	<i>Ricinus communis</i> L.	Ekisogasoga	Wounds
	Lamiaceae	<i>Leonotis nepetifolia</i> (L.) R. Br.	Macumu	Wounds
	Orchidaceae	<i>Leucaas martinicensis</i> (Jacq.) R.Br.	Omucunda	Wounds
	Poaceae	<i>Vanilla planifolia</i> Jacks. Ex Andrews	Vanilla	Wounds
		<i>Digitaria abyssinica</i> Stapf.	Orumbugu	Wounds
Rubiaceae	<i>Spermacoce princeae</i> (K.Schum) Verdc	Kisakimu	Fresh cuts	
Solanaceae	<i>Solanum melongena</i> L.	Enjagi	Wounds	
(Lacroix et al., 2011)	Ebenaceae	<i>Diospyros abyssinica</i> (Hiern) F.White	Omohoko	Tropical ulcer
(Kamatene si et al., 2011)	Asteraceae	<i>Bidens pilosa</i> L. AA-47-07	-	Wounds
		<i>Conyza sumatrensis</i> (Retz.) E.Walker AA-35-07	-	Wounds
		<i>Aspilia africana</i> C.D.Adams AA-37-07	-	Wounds
		<i>Vernonia amygdalina</i> Del. AA-46-07	-	Wounds
		<i>Stereospermum kunthianum</i> Cham. AA-55-07	-	Wounds
		Bignoniaceae	<i>Combretum collinum</i> Fresen AA-42-07	-
	Combretaceae	<i>Euphorbia hirta</i> L. AA-71-07	-	Wounds
	Euphorbiaceae	<i>Cassia nigricans</i> Vahl. AA-31-07	-	Wounds
	Fabaceae	<i>Musa spp</i> AA-69-07	-	Wounds
	Musaceae	<i>Termitomyces microcarpus</i> AA-71-07	-	Boils
	Tricholomataceae	<i>Urtica massaica</i> Mildbr. AA-63-07	-	Boils
	Urticaceae	<i>Cyphostemma adenocaula</i> Descoings.	-	Wounds
	Vitaceae	Ex Wild & R.B. Drumm. AA-01-07	-	Boils

Appendix 3: Pre-pilot testing Topic Guide

1. Date of interview.....
2. Respondent number.....

Knowledge regarding wounds and wound healing

3. How do you define a wound?
4. What are the different types of wounds that you know? (For each type mentioned write down the vernacular and English name).
 - a. Vernacular name.....
 - b. English name.....
5. Is there any specific way in which you differentiate between the different types of wounds?
6. How do you make a can you tell what the different types of wounds are before you treat them? I.e. how do you identify the different types of wound? (Explain the diagnosis criteria for each type of wound mentioned in 4 above)
7. Do you use plants for treatment of any of these wounds in people?
 - a. Yes
 - b. No
8. If yes, do you normally use plant based remedies only or do you use them in combination with other remedies?
9. How does each individual plant species contribute to wound healing? (i.e. what is the rationale for wound healing?)
10. Are there any prohibitions involved in using any of these plants for wound healing? E.g. not for use in pregnant women, children e.t.c.
11. Is there any ritual that needs to be performed before the plant is administered?
12. About how many patients with wounds do you treat in
 - a. A day?
 - b. A month?
13. What is the average price charged for healing of each wound type
14. Who normally prepares the remedy?
15. How is the remedy prepared?
16. How is it administered for wound healing?
17. Is it you who usually administers the prescription to the client?

Appendix 4: Study Topic Guide

1. Date of interview.....
2. Respondent number.....
- 3. Knowledge regarding wounds and wound healing**
4. What is a wound?
5. What are the different types of wounds that you know?
 - a. Vernacular name.....
 - b. English name.....
6. Is there any specific way in which you categorise wounds?
7. How do you make a diagnosis for each wound type?
8. Do you use plants for treatment of any of these wounds in people?
 - a. Yes
 - b. No
9. If yes, do you normally use plant based remedies only or do you use them in combination with other remedies?
10. How does each individual plant species contribute to wound healing?
11. Are there any prohibitions involved in using any of these plants for wound healing?
12. Is there any ritual that needs to be performed before the plant is administered?
13. About how many patients with wounds do you treat in
 - a. A day?
 - b. A month?
14. What is the average price charged for healing of each wound type
15. Who normally prepares the remedy?
16. Is it you who usually administers the prescription to the client?
17. Have you planted or preserved medicinal plants in your garden?

Appendix 5: Draft Questionnaire**Section A: Preparation and use of medicinal plants (For each plant mentioned, question 1-9 will be asked)**

1. Which plants do you use for the treatment of wounds?
 - a. Vernacular name.....
 - b. Botanical name.....
2. How do you prepare this plant for use or what do you tell the clients who have to prepare it at home? (Please provide details including amounts)
3. How is the plant remedy administered?
 - a. What is the dosage?
4. Is the remedy administered on its own or in combination with something else?
5. What type of plant is it?
 - a. Tree(T)
 - b. Climber (C)
 - c. Herb (Hb)
 - d. Shrub (S)
6. What part is harvested for use?

a. Leaf (L) <input type="checkbox"/>	e. Fruit (Fr) <input type="checkbox"/>
b. Root (R) <input type="checkbox"/>	f. Whole plant (W) <input type="checkbox"/>
c. Bark (B) <input type="checkbox"/>	g. Other.....
d. Flower (Fl) <input type="checkbox"/>	
7. What method is used for harvesting this part?
8. Where is the plant collected from?
 - a. Forest (F)
 - b. Farm (Fa)
 - c. Wetland (Wd)
 - d. Home garden (H)
 - e. Other.....
9. How easy is it to access the plant?

Difficult	<input type="checkbox"/>	Moderate	<input type="checkbox"/>	Easy	<input type="checkbox"/>
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Section B: Demographic characteristics

10. Location/Home

- a. District.....
- b. County.....
- c. Sub county.....
- d. Parish.....
- e. Village.....

11. Sex

- a. Male
- b. Female

12. Age.....

13. Education level

- a. No formal education
- b. Primary level
- c. Secondary level
- d. College
- e. University

14. Primary occupation

- a. Farmer
- b. Trader
- c. Housewife
- d. Teacher
- e. TMP.....
- f. Other (specify)

**Appendix 6: Participant consent form
Preparation and use of commonly administered medicinal plants for local wound
healing in South Western Uganda.**

The following information will be read out to the participants.

	Please confirm the statements by putting your initials or thumbprint in the box below
I have read and understood the participant information sheet	
I have had the opportunity to ask questions and discuss this study	
I have received satisfactory answers to all of my questions	
I have received enough information about the study	
I understand that I am free to withdraw from the study:- 1 At any time 2 Without having to give a reason for withdrawing	
I understand that any information I provide, including personal details, will be confidential, stored securely and only accessed by those carrying out the study.	
(When relevant) I understand that any information I give may be included in published documents but my identity will be protected by the use of pseudonyms	
I agree to take part in this study	
Participant Signature	Date
Name of Participant	
Researcher Signature	Date
Name of Researcher	

Thank you for agreeing to take part in this study.

Appendix 7: Participant Information Sheet**Preparation and use of commonly administered medicinal plants for local wound healing in South Western Uganda.**

We would like to invite you to take part in the above research study. Before you decide, you need to understand why this research is being done and what it would involve for you. Please take time to listen to the following information carefully.

What is the purpose of the study?

This study is to help us collect information about the preparation and use of commonly administered medicinal plants used for wound healing. The information gathered from the participants in this study will allow a better understanding of the local practice of medicinal plant use in wound healing in South Western Uganda. Some of the information collected will also be used towards a doctoral thesis for the chief investigator.

Who is doing the study?

Patience Muwanguzi who is a PhD student at the University of Leeds will be carrying out the interviews as part of her PhD studies.

Why have I been invited?

You have been invited because you are recognised by your community as a healthcare provider.

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

You will be invited to participate in an audio-recorded one to one interview with Patience Muwanguzi and a team comprised of a botanist, a physician and one other community member with whom you are familiar.

Once you decide to take part, we can arrange a convenient time for the interview to be conducted. It will involve a series of questions regarding your prescription of medicinal plants for wound healing.

Do I have to take part?

No - it is up to you to decide whether or not you wish to take part. I will describe the study and go through this information sheet, which I will then give you. I will then ask you to sign a

consent form if you agree to take part. You are free to withdraw at any time even during the interview without stating any reason.

What are the disadvantages of taking part?

You will have to make time for the interview to take place.

What are the advantages of taking part?

There are no advantages to you personally. You will be contributing to the research base on complementary practice in Uganda and will receive the regular consultation fee.

Will my taking part in the study be confidential?

Yes, unless you expressly wish to be named, all of your personal details will be removed from any transcribed data and you will be described only as a traditional healer. The information collected for the study will be securely destroyed once the study is completed and the results published; and any information from the study used in the doctoral thesis will be anonymised.

What will happen to the results of the study?

You will be invited to attend one of several meetings which will be held for the key stake holders to share this information

Who has reviewed the study?

This study has been approved by the University of Leeds; School of Healthcare Research Ethics Committee and the Uganda National Council for Science and Technology.

Consent Form

You will be given a copy of the signed consent form to keep.

If you agree to take part, would like more information or have any questions or concerns about the study please contact: Patience Muwanguzi: telephone: 0782861883 (Uganda number); +447556143874 (UK number)

Appendix 9: Ethical approval from SHREC (SHREC/RP/183)

School of Healthcare

Dr Janet Holt
0113 343 1296
hcsjh@leeds.ac.uk

Baines Wing
University of Leeds
Leeds LS2 9JT



UNIVERSITY OF LEEDS

20th May 2010

Ms Patience A Muwanguzi
School of Healthcare
Rm 3.35
Baines Wing
University of Leeds
LEEDS LS2 9JT

Dear Patience

Research Projects for Ethical Approval (SHREC/RP/183)

Thank you for making the necessary changes to your amended documents for approval.

This has been reviewed and I can confirm that the issues raised by the School of Healthcare Research Ethics Committee (SHREC) have been fully addressed and consequently ethical approval is granted.

The committee wishes you every success with your project.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Janet Holt'.

Dr Janet Holt
Chair
School of Healthcare Research Ethics Committee

Professor Dawn Freshwater
Head of School of Healthcare



Appendix 10: Approval of transfer of samples from Uganda to UK**Uganda National Council for Science and Technology***(Established by Act of Parliament of the Republic of Uganda)***Our Ref: HS 936****30 January 2012**

Ms. **Patience Amooti** Muwanguzi
 Mbarara University of Science and Technology
 P.O Box 1410
 MBARARA

Dear Ms. Muwanguzi,

RE: APPROVAL OF TRANSFER OF SAMPLES FROM UGANDA TO UNIVERSITY OF LEEDS, UK

We refer to your application application to Uganda National Council for Science and Technology requesting for permission to transfer samples obtained under the approved research project titled, **"UNDERSTANDING THE LOCAL PRACTICE OF WOUND MANAGEMENT USING MEDICINAL PLANTS IN SOUTH WESTERN UGANDA"**.

The UNCST on 30 January 2012 approved your application to transfer samples of leaves of the following plants through Entebbe International Airport to University of Leeds, UK.

- a. 1 kg of *Bidens pilosa*.
- b. 1kg of *Galinsoga parviflora*.
- c. 1kg of *Ageratum conyzoides*.

The approval is subject to the terms and conditions of the MTA between Mbarara University of Science and Technology, Faculty of Medicine and School of Healthcare, University of Leeds, UK. We also request that you submit to UNCST annual progress reports of studies done on the samples. The Commissioner Customs, Uganda Revenue Authority is duly informed by copy of this letter and is kindly requested to give you the necessary assistance to facilitate the transfer of the specimen within the terms of this agreement.

Yours sincerely,

Leah Nawegulo
 for: Executive Secretary
UGANDA NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

cc The Secretary, Office of the President
 cc The Commissioner Customs, Uganda Revenue Authority
 cc Prof. Andrea Nelson, University of Leeds, UK

LOCATION/CORRESPONDENCE

*Plot 6 Kimera Road, Ntinda
 P. O. Box 6884
 KAMPALA, UGANDA*

COMMUNICATION

TEL: (256) 414 705500
 FAX: (256) 414-234579
 EMAIL: info@uncst.go.ug
 WEBSITE: <http://www.uncst.go.ug>

Appendix 11: Approval to conduct research in South Western Uganda

**MBARARA UNIVERSITY OF SCIENCE AND TECHNOLOGY
INSTITUTIONAL ETHICAL REVIEW COMMITTEE**

P.O. BOX 1410, MBARARA,
TEL: 256 4854 21387,
Email: irc@must.ac.ug



UGANDA

Fax: 256 4854 20782

Your Ref:

Date: 15 July 2010

Our Ref: MUIRC 1/7

Ms Patience A. Muwanguzi
University of Leeds

Re: SUBMITTED RESEARCH PROTOCOL ON "UNDERSTANDING THE
LOCAL PRACTICE OF WOUND MANAGEMENT USING MEDICINAL
PLANTS IN SOUTH WESTERN UGANDA" NO. 28/06-08

Reference is made to the above study proposal which was submitted to the
Institutional Ethical Review Committee for consideration and approval.

I am glad to inform you that the committee at its sitting of 9th July, 2010 did
consider your study protocol and agreed to approve it for a period of one year
up to June 2011.

You can now proceed with the rest of the research activities as per your work
plan.

I wish you all the best.

Emmanuel Kyagaba
CHAIRMAN MUST-IRC



Cc Secretary –IRC

Appendix 12: Sample field notes from the fieldwork phase

Knock, knock.....Who's there; Gate keepers make all the difference.

Whoever said that “getting in is the first and most uncomfortable stage of fieldwork” (Wax, 1971) must have been thinking about me.

Before I came to Uganda, I had a very clear picture of what I was going to do and a list of about four people that I thought I needed to get on my side in order to ‘get-in’. The horror of gaining entry into the community for the pilot interviews is simply indescribable, to the point where am actually considering going into people’s gardens in the middle of the night and just picking random leaves. I have discovered that I am seeking for permission in all the wrong places and that my idea of entry through political access is wrong whereas what I need now is social access.

Gatekeepers are people who will allow the researcher gain access to a particular group or community; such individuals often hold pivotal positions in the hierarchy of the group or organisation one seeks to study; although they may not be high up in the hierarchical ranking, they are nonetheless in positions to hinder the researcher’s ability to gain access (Berg, 2007, Creswell, 1998).

I have learned that I need to talk to a few people ‘nicely’ and once they see my study and research team in a favourable light, then hopefully the people in the village will talk to me. It appears that the gate keepers include the richest man in one village, the reverend of the local Anglican Church, the headmaster of the nearby primary school, the local council chairman and one influential member of the women’s local savings and cooperative association. Whenever I go to recruit a potential participant and they refuse to talk to me, I now casually ‘name-drop’ a list of gate keepers whose approval I have obtained and that I find this always does the trick. I must state it clearly that I still follow the procedure outlined in the ethics section and always obtain consent for participation in the study. The participants are free to refuse to take part in the study or to withdraw from the study at anytime.

(Field notes excerpt 25/11/2010)

Another way to handle initial relationships is to locate guides and informants. Guides are indigenous persons found among the group and in the setting to be

studied(Berg, 2007). These persons must be convinced that the researchers are who they claim to be and that the study is worthwhile.

Because of the initial problems we experienced with gaining entry, it has now been decided to get some participants onto the research team and in some cases have changed our sampling method to a modified snow ball sampling method.

In this modified method, the participant actually takes us to the next potential participant and makes the introductions or the original guide introduces us to another guide because of the end of his sphere of influence like when we move to a new village. This is very risky because the next participant could as easily refuse to talk to us because of their dislike or resentment for the person who introduces us but thankfully nothing like that has happened and we have found that this also helps in creating rapport during the initial stages of the interview.

(Field notes excerpt 10/12/2010)

Keep a lid on it; Be flexible and remain calm

*Today was very disappointing; I can't believe that those women actually refused to talk to me. That is one of the reasons why Africa will develop slowly and why these men will continue to control us; we sisters ought to stick together. I had to sit through (name removed)'s interview today and not implode, after all the training we did and after he assured me that he was on board about the subject of the research, he just kept asking questions that were nowhere near anything that can be used for the purpose of this study. I suppose that is why we do pilot tests, hard to imagine this happening after driving a whole day only to render the data unusable. I will speak to him tomorrow and we can find our way around it, I fear that I still have some anger within me and may take it out on him if I approach him today **(Excerpt from my reflective journal 10/11/2010).***