Frailty in older people admitted to hospital in northern Tanzania: A longitudinal mixed methods study

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Abstract

Background

Hospitals in low- and middle-income countries are admitting larger numbers of older people with disability, multimorbidity and geriatric syndromes. Tanzania – the setting for this research – has experienced a dramatic increase in life expectancy in recent decades. Despite this, older people in Tanzania often spend their later years in ill health. Frailty is an age-related state of multiple health deficits and increased vulnerability. While frailty is known to be prevalent in the community in northern Tanzania, little is known about its impact in hospital settings in this context.

Aim

This research aimed to explore the extent, impact and experience of frailty amongst older people admitted to hospital in northern Tanzania.

Methods

This aim demanded a mixed methods approach. In the quantitative strand, consecutive people aged ≥60 years, admitted to four hospitals, were assessed for frailty using multiple instruments, with exploration of demographic and clinical characteristics. Outcomes, including mortality, were assessed at 12 months follow-up. Qualitative interviews with a purposive sample of service users, their caregivers and healthcare providers were conducted to explore the context of frailty, its outcomes and hospital care experiences.

Results

Regardless of the instrument used, frailty was prevalent and associated with a twofold increase in mortality. Themes – identified in the analysis of transcribed and translated qualitative interviews – highlighted the contributors to health in old age in Tanzania, the needs of hospitalised older people, caregiver roles during admission, and the impacts of resource limitations on the patient journey.

Discussion

This study was the first to assess frailty amongst hospitalised older people in Tanzania and demonstrates that frailty instruments can identify those with the greatest risk of adverse outcomes. Findings are critically discussed with reference to barriers and facilitators to

effective care, and the implications for healthcare services striving to align with the needs of older people.

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Abbreviations

ADLs	Activities of Daily Living
B-FIT2	Brief Frailty Instrument for Tanzania version 2
CES-D	Centre for Epidemiologic Studies Depression Scale
CFS	Clinical Frailty Scale
CGA	Comprehensive Geriatric Assessment
CHSA	Canadian Study of Health and Ageing
HDH	Hai District Hospital
HICs	High-income countries
HIV	Human Immunodeficiency Virus
IADLs	Instrumental Activities of Daily Living
ICOPE	Integrated Care for Older People
IDEA	Identification and Intervention for Dementia in Elderly Africans
JBI	Joanna Briggs Institute
KCMC	Kilimanjaro Christian Medical Centre
LMICs	Low- and middle-income countries
MLH	Machame Lutheran Hospital
MRRH	Mawenzi Regional Referral Hospital
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PROSPERO	International Prospective Register of Systematic Reviews
STROBE	Strengthening the Reporting of Observational studies in Epidemiology
TZS	Tanzanian Shillings
WHO	World Health Organization

Chapter 1. Introduction

1.1 Chapter introduction and report structure

In this chapter, the key concepts required to understand the context for this thesis are defined and introduced. Global populations are ageing and older people, particularly in low- and middle-income countries (LMICs), are facing enormous health challenges. Frailty is one such challenge and is discussed in reference to Tanzania and the Tanzanian hospital system, which provides the setting for this research. Chapter 2 reports the results of a systematic review of the existing literature relating to the prevalence and outcomes of frailty amongst older people admitted to hospital in LMICs. In conjunction with the present chapter, this provides the context and justification for the aims and objectives of this research, which are outlined in Chapter 3. Chapter 4 describes and justifies the mixed methods approach adopted to meet the aims and objectives, while Chapters 5 & 6 report and discuss the quantitative and qualitative results respectively. Finally, Chapter 7 summarises the key findings and discusses the implications for current practice and future research.

1.2 Ageing and the definitions of “older people”

Ageing is a biological process, characterised by fundamental changes occurring throughout the body at a molecular level, that impair the body’s ability to repair and maintain itself (Dziechciaż and Filip, 2014). Genetically determined cell senescence and acquired DNA damage are believed to be major contributing factors to the ageing process, the rate of which can very between individuals, and between different organ systems within the same individual (Bulterijs et al., 2015, Dziechciaż and Filip, 2014).

In the absence of an accepted test for biological age, the biomedical literature tends to define older people based on their chronological age (years since birth). Often these definitions are based on the statutory retirement age which presents obvious problems as this varies between nations, over time, and as a result of political, economic and social pressures (Dziechciaż and Filip, 2014, Orimo et al., 2006). To combat this variation, the World Health Organization (WHO) attempt to give a biological justification for their definition. They argue that 60 years of age is the turning point at which morbidity and mortality are more likely to result from impairments related to age and non-communicable disease, than from trauma or infection (World Health Organization, 2015c). This is still imperfect as it represents a global average and does not account for disparities in life-expectancy between nations (Kowal and Dowd, 2001). However, because this definition maximises comparability between this research and existing literature, throughout this thesis the term “older people” is used to refer to those aged 60 years and above.

1.3 Global ageing

The global population is ageing rapidly. For the first time in human history, most people can expect to live into their 60s (World Health Organization, 2016). It is projected that by 2050, there will be 2.1 billion people aged over 60 and that over two-thirds of them will be living in LMICs (United Nations, 2019). East and South-East Asia are projected to have the largest absolute rise in the number of people aged over 60 years, while North Africa, western Asia and sub-Saharan Africa are expected to see the greatest increase in older people as a share of their populations (World Health Organization, 2015c, United Nations, 2019).

The biggest drivers of these demographic changes are falling fertility rates and increasing life expectancy (World Health Organization, 2015c). Life expectancy at birth rose by more than 6 years between 2000 and 2019 (World Health Organization, 2019a). This rise has been contributed to by unprecedented socioeconomic development, reductions in deaths during childbirth, falling infant mortality, better management of communicable disease and a decline in the mortality of older people (World Health Organization, 2015c). As people are increasingly living to see adulthood and old age, the burden of disease is shifting. While the proportion of deaths from infectious diseases are in decline, deaths as a result of noncommunicable disease (such as cardiovascular disease, chronic respiratory conditions, cancer and diabetes) are increasing (World Health Organization, 2015a). These changes in the demographic and clinical characteristics of populations pose an unprecedented challenge for global health, and for the health and social care systems of individual nations.

1.4 The health of ageing populations

Life expectancy may be rising globally, but these extra years are not always passed in good health. Healthy Life Expectancy is a measure of years spent free from disability and without major limitations (Organisation for Economic Cooperation and Development, 2019). In 2019, life expectancy globally at age 60 was 21.1 years, while Healthy Life Expectancy was only 15.8 years (World Health Organization, 2019a). In old age, quality of life may be negatively impacted by physical factors such as multimorbidity, geriatric syndromes, functional decline and disability (World Health Organization, 2015c). Moreover, psychosocial factors such as lower socioeconomic status, small social support networks, low levels of societal participation and anxiety or depression can also exert a negative influence (Sowa et al., 2016, Inouye et al., 2007, Cooper et al., 2022). In addition, older people in LMICs still face high rates of communicable illnesses (such as HIV, tuberculosis, malaria and dengue) and thus face a *"double burden"* from noncommunicable and infectious disease (Boutayeb, 2006).

In addition to suffering from multiple medical conditions (referred to as multimorbidity), older people are also affected by common symptom clusters, or phenotypes, known as *"geriatric syndromes"* (Inouye et al., 2007). These may be defined as *"multifactorial health conditions that occur when the accumulated effects of impairments in multiple systems render [an older] person vulnerable to situational challenges"* (Tinneti et al., 1995). Traditionally the geriatric syndromes (or *"Geriatric Giants"* to use the popular term coined by Bernard Isaacs in 1965) have included incontinence, immobility, falls, delirium and pressure ulcers (Inouye et al., 2007). However, several others have been proposed including caregiver stress, elder abuse, polypharmacy, anorexia of ageing, sarcopenia and frailty (Morley, 2017, Cruz-Jentoft et al., 2010, Stevenson et al., 2019). Geriatric syndromes have often been overlooked in epidemiological research and their complexity poses a major challenge to healthcare systems, particularly those in which services are orientated towards the treatment of single-organ disease (World Health Organization, 2015c).

Multimorbidity and geriatric syndromes form part of a picture of functional decline, disability and dependency that too often affects older people. Between 1990 and 2013, the number of years lived with disability globally increased from 537.6 million to 764.8 million

(Global Burden of Disease Study, 2015). Functional decline is usually measured in terms of Activities of Daily Living (ADLs) – such as eating, bathing, dressing, mobilising and using the toilet. As populations age in poor health, increasing numbers of older people require assistance with one or more of these activities. The responsibility for providing this care falls on informal caregivers, pressured healthcare systems and – in countries where such service are available – institutional care (World Health Organization, 2015c).

Older people undoubtably have greater healthcare needs than younger adults. However, this greater need does not invariably translate into higher utilisation of healthcare systems. In fact, economic and transport barriers, as well as poor community provision of services in LMICs mean that utilisation of primary and secondary care services is often lower amongst older people (McIntyre, 2004). Even in high-income countries (HICs), where healthcare is accessed at greater rates by older people, the complex multisystem problems associated with increasing age can lead to disjointed and uncoordinated care (World Health Organization, 2015b).

1.5 Healthy ageing

Numerous terms and models have been used to describe a desirable state of health in older age and its determinants. Since around 2005, *"healthy ageing"* has become the dominant term in the literature, though others including *"active ageing"*, *"successful ageing"* and *"productive ageing"* are still in use *(Lin et al., 2021)*. The consensus definition of *"healthy ageing",* from the *2015 WHO World Report on Ageing and Health*, is as a *"process of developing and maintaining functional ability that enables well-being in older age"* (World Health Organization, 2015c). This gives rise to a model with the following key elements (World Health Organization, 2015c):

- ***"Intrinsic capacity"*** refers to an individual's physical and mental abilities, as determined by their genetics, biological health, psychological health and fixed personal characteristics.
- ***"Environments"*** are the extrinsic physical and social contexts of older people.
- ***"Functional ability"*** is the capability of a person to undertake activities they value, which shifts according to interactions and changes in their intrinsic capacity or environment.

- **“Resilience”** is the capability of a person to conserve their functional ability, despite changes to their intrinsic capacity and their environment.

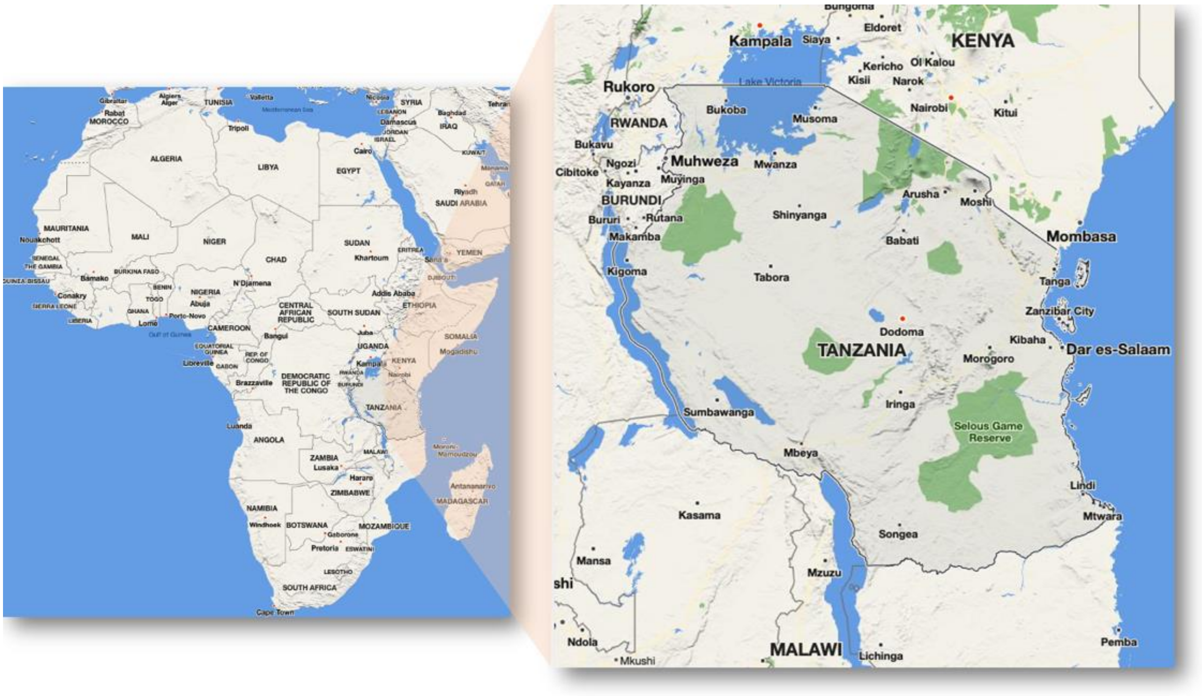
The United Nations (UN) have sought to make ageing populations an international health priority through the Sustainable Development Goals, one of which aims to *“ensure healthy lives and promote well-being for all at all ages”* (United Nations: Department of Economic and Social Affairs, 2015). Utilising healthy ageing as a framework, the United Nations and WHO have advocated for coordinated government efforts to improve ageing trajectories, declaring 2021-2030 the *Decade of Healthy Ageing (World Health Organization, 2020)*. Their baseline report outlines a policy framework advocating for coordinated government efforts to deliver universal healthcare, improve statistical reporting, tackle ageism and design integrated, person-centred health and social care services which are better aligned to the needs of older people (World Health Organization, 2020). The report argues that better management of physical and mental health (intrinsic capacity), and more age friendly environments, will lead to maintained functional ability in older age and healthier ageing trajectories (World Health Organization, 2020).

In addition to these global goals, regional policy frameworks have also sought to establish strategies to tackle the health challenges of ageing populations. Notable to this thesis is the African Union Policy Framework and Plan of Action on Ageing, originally published in 2010 with a revised draft in 2022 (African Union, 2022). One of the major vulnerabilities highlighted in this report is that existing African health systems are oriented towards the needs of younger people. Services must change if they are to manage the chronic and complex needs of older populations (African Union, 2022). Proposed policies stress the need for integrated health services which make the most of older people’s traditional intergenerational roles, retain norms of family involvement for long-term care, and establish an African base for ageing research and training (African Union, 2022). While ageing populations present a global challenge, both the WHO and African Union urge the need to incorporate older people’s perspectives and locally tailored approaches in the design of health services to support healthy ageing.

1.6 Tanzania

Tanzania is a large country in East Africa and the setting for this research. This brief background to the country’s history, healthcare system and selected cultural norms provides important context for understanding the work described in this thesis.

Figure 1. Map of Tanzania



Adapted from images from Microsoft Bing (2022).

1.6.1 Tanzania: A very brief history

Early communities in the region now known as Tanzania were largely coastal and from as early as the 11th century there is evidence of trade with and Middle East, with links developing with Europe in the 15th century. Zanzibar, an archipelago off the coast of mainland Tanzania, came to be governed by the Arabic Sultanate of Oman and was the base for East Africa’s international trade, an industry based largely on slavery, ivory and natural products. Entering the 19th century, the British, French and Germans expanded their influence in the region with establishment of German colonial rule over both the mainland and Zanzibar in the 1890s. Following the First World War, the majority of Tanganyika (the mainland), fell under British rule (Kimambo et al., 2017d, Kimambo et al., 2017c).

A unified African nationalist movement emerged to lead opposition to colonial rule in the 1920s and grew over subsequent decades to become the Tanganyika African National Union in 1954. Led by Julius Nyerere, after a largely peaceful struggle, this movement achieved independence on the mainland in 1961. Zanzibar remained under the rule of the Sultan of Zanzibar and an Arab minority until 1964, when African nationalists seized power in a violent uprising (Kimambo et al., 2017a). The newly independent Tanganyika and Zanzibar joined to form the United Republic of Tanzania on 26th April 1964.

In the initial years after independence, Nyerere presided over a single-party state with a Pan-African socialist ideology. This era was key to the development of modern Tanzania and the legacy of this ideology remains relevant in the present day. *Ujamaa*, often translated as "*familyhood*", was the name given to the political philosophy enacted by the newly independent Tanzania's first government. They enacted sweeping collectivist agricultural reforms with households organised into groups of ten, led by a *Balozi* (ten-cell leader), with the goal of self-reliance through collective effort (Kimambo et al., 2017b). Many people were relocated to *ujamaa* villages in the 1970s – sometimes through coercive means – ostensibly to improve living standards, as well as access to education, healthcare and essential services (Kimambo et al., 2017b). Though they achieved some success in promoting rural development, the policies were extremely socially disruptive and ultimately agricultural productivity was less than expected leading to food crises in the 1980s. After Nyerere stepped down in 1985, Tanzania eased state economic control and liberalised free trade with help from the International Monetary Fund and the World Bank. The country became a multi-party democracy in 1995 with a President and unicameral legislature (Oxford Business Group, 2022).

1.6.2 Tanzania in the present-day

The present-day Tanzania has a population of around 67 million people, made up of hundreds of native tribes and other ethnic groups which migrated during various phases in the country's history (World Bank, 2023). Over 100 languages are spoken, though Swahili was adopted as the national language following independence. Until recently, Tanzania was classified as a low-income country by the World Bank, but political stability and steady economic growth saw it re-classified as a lower-middle-income country in 2020 (The World

Bank, 2020a). The largest industry is agriculture and in 2020, 65% of the population lived in rural areas, though this proportion has been in chronic decline with the growth of the major cities (The World Bank, 2020b). Christianity is the most common religion, followed by Islam which is observed in greater rates in Zanzibar and coastal communities.

Although Tanzania is now politically a multi-party democracy, Chama Cha Mapinduzi – the party of Nyerere – has remained in power continuously since independence. Nyerere is still considered the father of the nation and his portrait, along with the portrait of current president Samia Hassan, is hung in most public spaces. Power remains concentrated in central government, with active suppression of opposition parties (including imprisonment of opposition leaders), accusations of interference in elections, and widespread government corruption (USAID, 2022). Though they do not operate as they were originally intended, the structures of the *ujamaa* era, including ten-cells/Balozi, still exist in many agricultural communities.

As is true in many African countries, there is a cultural norm of respect for older people in Tanzania (Oppong, 2006). This is evident from the moment of greeting an older person in Swahili when the polite "*shikamoo"* is used in preference to the less formal *"jambo" or "habari"*. Another linguistic example is the term used to refer to an older person, "*mzee"*, which denotes not only seniority in years but also has connotations of respect for wisdom, experience and authority. The current generation of older people were born in the era surrounding independence, lived through the *ujamaa* policies and experienced Tanzanian nation-building firsthand.

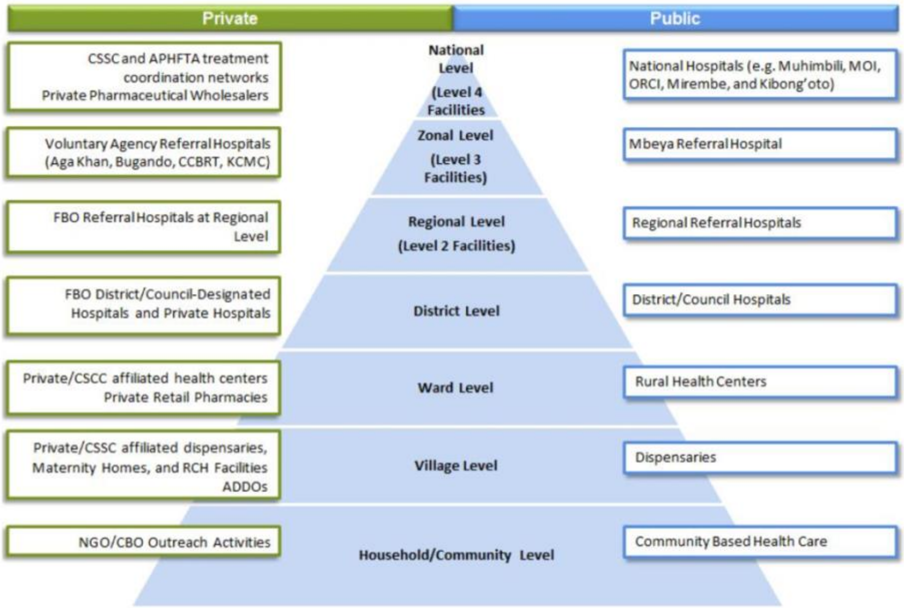
Despite this, life for many older Tanzanian's is filled with challenges. Older people are around twice as likely as younger Tanzanians to experience poverty and food deprivation (Mboghoina and Osberg, 2010). The current pensionable age is 60, but these funds are accessed by only 4-10% of the population (OECD, 2021, The National Security Fund, 2018). Without pensions, the majority of older Tanzanian's are dependent on others once they are unable to work. In a 2010 survey, two thirds were entirely reliant on their children for their income (Mboghoina and Osberg, 2010). Although there are limited home-based care initiatives in some areas, the vast majority of long-term care for older people is delivered by the extended family (Rutagumirwa et al., 2020, Mboghoina and Osberg, 2010).

1.6.3 Tanzanian healthcare

Between 2000 and 2020, life-expectancy at birth in Tanzania rose by 15 years (The World Bank, 2022). Now, females born in Tanzania can expect to live to 69 and males to 65 years (United Nations Department of Economic and Social Affiars Poulation Division, 2022). Moreover, for those who are currently aged 60, life-expectancy is 15.8 years for males and 17.5 years for females (The World Bank, 2020a). Despite this, the provision of specialist geriatric care in Tanzania, and more broadly in sub-Saharan Africa, has historically been extremely limited. A 2013 survey demonstrated only a handful of specialist geriatricians across the African continent, and at that time most African countries had no national undergraduate or postgraduate geriatric training schemes (Dotchin et al., 2013).

Tanzania's healthcare system is 73% public, with the remaining services being run by private or religious organisations (Wang and Rosemburg, 2018). Over one third of the total health budget is provided by international investors (International Trade Administration, 2021). As of July 2019, Tanzania spent $40.34 USD per capita on healthcare. This is around 3.83% of Global Domestic Product which is considerably lower than the average health spending for sub-Saharan Africa which is $79.43 USD and 4.95% of Global Domestic Product (World Health Organization, 2019b). Health services in Tanzania are organised in a pyramidal structure, with community level care providing the base and a series of more specialist referral centres as one travels up the pyramid (see Figure 2).

Figure 2. The pyramidal organisation of the Tanzanian healthcare system



Source: Health Sector Strategic Plan IV 2015.

Note: ADDOs = accredited drug dispensing outlets; APHFTA = association of private health facilities in Tanzania; CBO = community cased organizations; CCBRT = comprehensive community based rehabilitation in Tanzania; CSSC = Christian social services commission; FBO = faith-based organization; KCMC = Kilimanjaro Christian medical centre; MOI = Muhimbili orthopaedic institute; NGO = nongovernmental organization; ORCI = Ocean Road cancer institute.

Reproduced from the United Republic of Tanzania Ministry of Health and Social Welfare (2015).

The government has been attempting to expand healthcare coverage over several decades, a programme in keeping with the United Nations Sustainable Development Goal to *"achieve universal health coverage by 2030"* (United Nations, 2015). At the point of access, Tanzanian public healthcare facilities charge fixed user fees, or *"out-of-pocket"* payments. These cover part of the cost of care, while the rest is paid through numerous government funding streams (Wang and Rosemburg, 2018).

Health insurance, both private and public sector, is available but not widely utilised. In addition to private health insurance (utilised by less than one percent of the population), and a pension-linked health insurance programme for private sector workers (called the *National Social Security Fund*), there are two main government prepayment schemes (Wang and Rosemburg, 2018, Tungu et al., 2020, Binyaruka et al., 2023):

- *The Community Health Fund*, devised for rural areas and first introduced in 1996, is the oldest scheme. It is a voluntary community-based insurance fund, covering 19.8% of the population, in which members pay premiums matched by government contributions. The cost of contributions is around $13.00 USD per year, per six-member household. Members of the scheme gain funded access to basic public health services within the district or accredited private facilities.

- *The National Health Insurance Fund* was introduced in 2001 and covers 7.2% of the population. It is more commonly utilised in urban areas and membership is compulsory for civil servants who contribute by salary deduction with a top-up government contribution. Non-civil servants can also join voluntarily through paying premiums. Coverage costs between $23.79 and $36.23 USD per year and the coverage provided is much more comprehensive.

Despite these schemes, the majority of the population lack health insurance (International Trade Administration, 2021). Exemptions from user fees in public facilities exist for groups including children under 5 years, pregnant women, people with specific conditions (including HIV) and the poorest segments of the population. Since 1994, officially exemption was extended to include all people aged 60 years and above utilising government healthcare facilities (Ntahosanzwe and Rwegoshora, 2021). However, a lack of awareness, differing local procedures and no universal method for identifying poor households has meant that the implementation of these exemptions has been inconsistent (United Nations: Department of Economic and Social Affairs, 2015).

1.6.4 COVID-19 in Tanzania

An important consideration when starting this research in early 2022 was the challenge posed by the COVID-19 pandemic which had such a devastating impact on older people globally. Data collection took place in the wake of the omicron wave. Though rates of COVID-19 were low at the time of data collection, it is worth understanding Tanzania's pandemic experience as the backdrop for this research.

The nation's first confirmed case of COVID-19 was in March 2020 (Tarimo and Wu, 2020). Initially the government responded by implementing a number of the WHO's recommendations, though they stopped short of a lockdown for fear of the economic impact this would have on poorer communities (Mfinanga et al., 2021). In June 2020, the then President, John Magafuli, denied the ongoing presence of the virus in Tanzania (Buguzi, 2021). At this stage, publication of further COVID-19 data was prevented, speculative herbal remedies were promoted, anti-vaccination views were expressed by government officials and doctors felt unable to diagnose COVID-19 for fear of admonishment (Buguzi, 2021). After the death of the vice President of Zanzibar from COVID-19, and the death of Magafuli himself soon after, the new President Samia Hassan oversaw an expansion of testing and the start of the vaccination programme (Buguzi, 2021).

Due to the political circumstances in the early pandemic, very little has been published regarding the in-hospital experiences of COVID-19 in Tanzania in 2020 and 2021. As of December 2023, Tanzania had reported around 43,000 confirmed cases and 846 deaths from COVID-19, though this is likely a significant underestimate (World Health Organization, 2023). Vaccination rates initially lagged behind other African nations, but by December 2022 close to 100% of eligible adults had received their primary course (Mfinanga et al., 2023).

1.6.5 The Kilimanjaro Region

Located to the north of Tanzania on the border with Kenya, the Kilimanjaro Region is the setting for this research. The 2022 census reported that the population was 1.8 million, with the majority of those living rurally (Tanzanian National Bureau of Statistics, 2022). Despite this, in the long-term Kilimanjaro is seeing the same rural to urban migration trends that are being experienced across Tanzania. Driven by traditional sector unemployment and higher incomes in urban centres, the percentage of the population living in urban areas in the Kilimanjaro Region has risen from 7.5% to 24.2% since 1978 (Aikaeli et al., 2021).

Kilimanjaro is a region of many tribes, but the largest by far are the Chagga who have traditionally dwelt in agricultural communities around the mountain and use the Kichagga dialect. Other major groups include the Pare who also have roots in the agricultural areas around the mountain, and the Maasai whose origins are in semi-nomadic communities that make a living from the herding of livestock. Christianity (with Lutheran, Anglican, Pentecostal, Presbyterian and Catholic denominations) is the religion for most people in the region, with pockets of Islam and other traditional belief systems (Tanzanian National Bureau of Statistics, 2022). Most people in Kilimanjaro work in agricultural industries growing crops (the commonest being coffee, bananas, wheat and barley) or herding livestock, but the region is also a major centre in the Tanzanian tourist industry (Local Government Kilimanjaro Region, 2017).

The largest hospitals in the Kilimanjaro Region are located in municipal centres and along main highways which are tarmacked. However, most other roads are uneven and potholed dirt tracks which can be incredibly steep. The rains, which are so important to agriculture in the region, tend to fall from March to May and again from November to December. Although, with climate change these are increasingly variable. During the rainy season, the dirt roads become thick with mud and even four-wheel drive vehicles regularly struggle and become stuck.

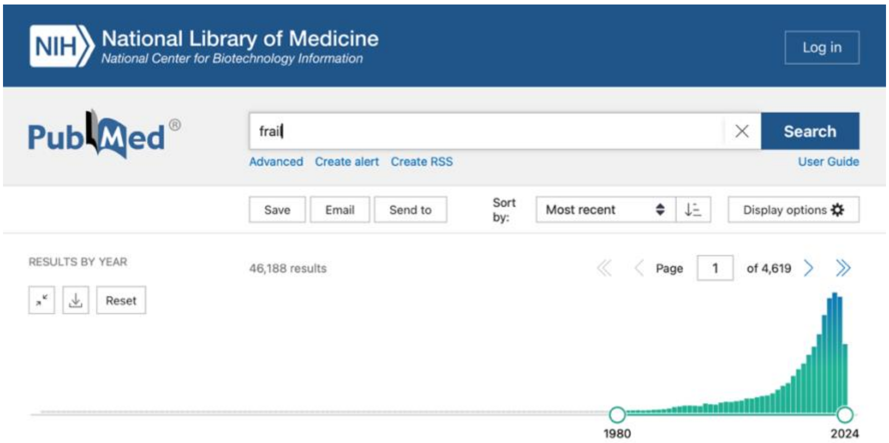
1.6.6 Tanzania: Summary

Albeit a very brief summary, this subsection has hopefully set the scene and provided the essential details for understanding the setting of this research. The next section considers frailty and its potential relevance to older people admitted to hospital in Tanzania.

1.7 Frailty

Frailty is the concept at the heart of this thesis. A quick PubMed search, with frail as a keyword, demonstrates the exponential rise in number of publications relating to frailty that has been taking place, especially since the early 2000s (see Figure 3).

Figure 3. PubMed results containing the keyword "frail" over time*



frail

Sort by: Most recent

46,188 results

Page 1 of 4,619

The number of publications by year on PubMed with "frail" as a keyword (National Center for Biotechnology Information (NCBI), 1869 - cited 02/07/24).*

1.7.1 Defining frailty

There remains no consensus definition of frailty, and the nuances of different models are discussed here. However, most researchers and geriatricians would agree on several core components which are here summarised:

> *Frailty is a term, usually applied to older people, which refers to a state of poor health and reduced resilience. This state is characterised by multiple health problems that may be related to age, but that are not inevitable consequences of ageing. If an older person living with frailty develops an acute illness, their underlying vulnerability means they are more likely to experience a poor outcome, or to die, than somebody of the same age who is non-frail. Resilience is so diminished that even minor health insults may have fatal consequences.*

1.7.2 Frailty as a phenotype

The Fried frailty phenotype is one of the most widely adopted definitions of frailty (Fried et al., 2001). The underlying hypothesis is that there is a syndrome, made up of several physical signs and symptoms, that is a precursor to disability and dependency. Fried characterised this as a *"cycle of frailty"*, in which age-related changes, disease and undernutrition produce sarcopenia with consequences for functional ability, which in turn feed the cycle leading to a *"downward spiral"* (Fried et al., 2001).

Based on the *"cycle of frailty"* hypothesis, Fried et al. (2001) identified five physical health criteria used to define frailty:

1) Unintentional weight loss of >10 lbs, or ≥ 5% body weight in one year.
2) Hand grip strength in the lowest 20% of cohort by sex and Body Mass Index (BMI).
3) Self-reported exhaustion identified by two questions from the Centre for Epidemiologic Studies Depression Scale (CES-D).
4) Time taken to walk 15 feet in the lowest 20% of cohort by sex and height.
5) Physical activity in the lowest quintile measured the Minnesota Leisure Time Physical Activity questionnaire.

A person was defined as frail if three or more of the criteria were present. Pre-frailty, which can be considered a state of vulnerability to frailty, was defined by the presence of one or two of the five items. Fried et al. (2001) applied these criteria retrospectively to a dataset of more than 5000 people, aged 65 years and over, enrolled in a longitudinal population-based study looking for risk factors for cardiovascular disease. These criteria produced a definition that differentiated frailty from the overlapping concepts of multimorbidity and disability, and independently predicted falls, reduced mobility, hospitalisation and death (Fried et al., 2001).

Since this work was published in 2001, the frailty phenotype has been applied extensively around the world, both in hospital and in community settings (Ofori-Asenso et al., 2019, O'Caoimh et al., 2021). As it focuses entirely on the five physical signs and symptoms listed above, this definition of frailty tends to produce lower prevalence estimates than other measures based on a more wide-ranging clinical evaluation (Cesari et al., 2013). Other limitations include variability in the way different studies apply the criteria and limited utility in people who are already disabled; both factors affect the phenotype’s ability to predict adverse outcomes (Cesari et al., 2013, Theou et al., 2015). Nonetheless, the phenotype remains the most widely used operational definition for frailty in epidemiological studies.

1.7.3 Frailty as deficit accumulation

As we age, the body is incrementally damaged across multiple organ systems. Rockwood and Mitnitski (2007) argued that rather than a phenotype, frailty should be considered a state of multiple physiological deficits, that individually are perhaps insufficient to lead to specific disease, but cumulatively result in a reduced ability to maintain homeostasis in response to a stressor (e.g. infection). In this conception of frailty, predisposing genetic and environmental factors, and precipitating cumulative molecular and cellular damage, produce reduced physiological reserve across multiple organ systems (Clegg et al., 2013). Combined with low physical activity and undernutrition, accumulated deficits produce the state of frailty, in which even minor external stressors can lead to greater disability and dependency (Clegg et al., 2013).

This model quantifies frailty by use of an index score which provides a count of *"deficits in health"* (Searle et al., 2008). Indices have been constructed ranging from 20-70 items, though 30-40 items tend to provide a balance between practicality and accuracy (Rockwood and Mitnitski, 2012, Rockwood et al., 2005). *Deficits* can be symptoms, signs, disabilities or diseases and to be included in an index they must fulfil five criteria (Searle et al., 2008):

1) They must relate to health status.
2) Their prevalence must increase with age.
3) They must not saturate too early (e.g. presbyopia affects nearly all people over 55).
4) They must cover a range of body systems.
5) If used longitudinally in the same group of people, the items must remain the same.

After the frailty phenotype, the frailty index is the most widely used method by researchers to assess frailty (O'Caoimh et al., 2021). Despite the fact that no two frailty indices are the same – they may contain different numbers of items, different deficits and give different weightings – their ability to predict adverse outcomes is maintained (Kojima et al., 2018). Their flexibility is a strength, as items can be weighted differently to improve accuracy of prediction, or for different cohorts and cultures (Rockwood and Mitnitski, 2007, Searle et al., 2008). Further advantages are that, unlike the frailty phenotype, an index grades older people on a continuum and it does not require specialist equipment (e.g. dynamometer) (Dent et al., 2016). On the other hand, frailty indices are time-consuming to construct, and because they often include items relating to disability and multimorbidity they are not as accurate at differentiating frailty from these other constructs (Cesari et al., 2013).

1.7.4 Frailty as a social construction

Regardless of which of the above instrumental definitions are used to define it, frailty demonstrates strong social dimensions. Female sex, low educational attainment, low socioeconomic status and inadequate housing are all factors which have previously been associated with increased risk of both frailty and mortality (Andrew et al., 2008, Cooper et al., 2022, Ouvrard et al., 2019, Andrew et al., 2012). Moreover, older people with smaller social networks, who feel lonely, or who don't engage in social activities are also at greater risk of developing frailty (Andrew et al., 2008, Cooper et al., 2022, Ouvrard et al., 2019, Andrew et al., 2012). These factors are often characterised as *"social vulnerability"*, or *"social frailty"* (Bunt et al., 2017, Hayajneh and Rababa, 2021).

On the one hand, it could be argued that understanding of the social dimensions of frailty has helped to broaden the purpose of geriatric medicine, encouraging clinicians to consider the wellbeing of older people more holistically. On the other hand, these same social determinants – distributed through a lifetime – are regarded by others as evidence that frailty represents the medicalisation of sociopolitical problems, or even the normal spectrum of ageing (Kaufman, 1994). Through this lens, frailty may be viewed as a social construction which has evolved to describe problems in a *"western"* cultural context (Kaufman, 1994). A good example of this is that *"vulnerability"*, central to the frailty concept, is often described in reference to risk of dependency and institutionalisation (Burghardt, 2013). If frailty is a *"western"* social construct, rather than a disease, how relevant is it in countries with different cultural norms in the care of older people? This question has previously been the subject of qualitative research in Tanzania and is examined further in the final section of this chapter.

1.7.5 The importance of frailty

One of the main reasons frailty has generated so much research interest in recent years is its ability to identify older people at the greatest risk of adverse health outcomes. Amongst older adults living in the community (mainly in studies based in the US and Europe), frailty predicts healthcare utilisation and is associated with higher healthcare costs (Hoogendijk et al., 2019). When they are admitted to hospital, older people with frailty experience greater functional decline, longer hospital stays and higher rates of mortality compared with their non-frail counterparts (Cunha et al., 2019). Similarly, during the pandemic, frailty was a key predictor of illness severity, length of hospital stay, Intensive Care Unit admission and mortality in older adults with COVID-19 (Pranata et al., 2021). It is this predictive power that has made frailty such a valued clinical tool.

Once older individuals at risk of adverse health outcomes have been identified, how can this information be used? One of the ways is to target treatments to at-risk individuals. With the correct intervention, the trajectory of frailty (and its precursor pre-frailty) can be modified.

The *"gold standard"* intervention is the Comprehensive Geriatric Assessment (CGA). This is expanded upon in the next section, but suffice to say CGA for community-dwelling adults with frailty can reduce the rates of unplanned hospital admission (Briggs et al., 2022). For those who are admitted to hospital, CGA on admission extends life, prolongs functional independence, and reduces the need for professional care (Ellis et al., 2017, Pilotto et al., 2017).

A controversial use of frailty status has been as a tool for triage and the rationing of services. This has been explored most extensively in decisions around admission to the Intensive Care Unit (ICU). It is true that frailty is capable of identifying older people who are less likely to survive Intensive Care Unit admission or who will experience greater functional impairment on discharge (Wilkinson, 2021). However, there are ethical concerns that rationing care on this basis alone would discriminate against older people and the disabled, as well as reinforce sociodemographic inequalities (Wilkinson, 2021, Lewis et al., 2020a). Frailty tools should therefore be used as an adjunct to clinical judgement and to aid shared decision-making with each older individual (Oliver, 2021).

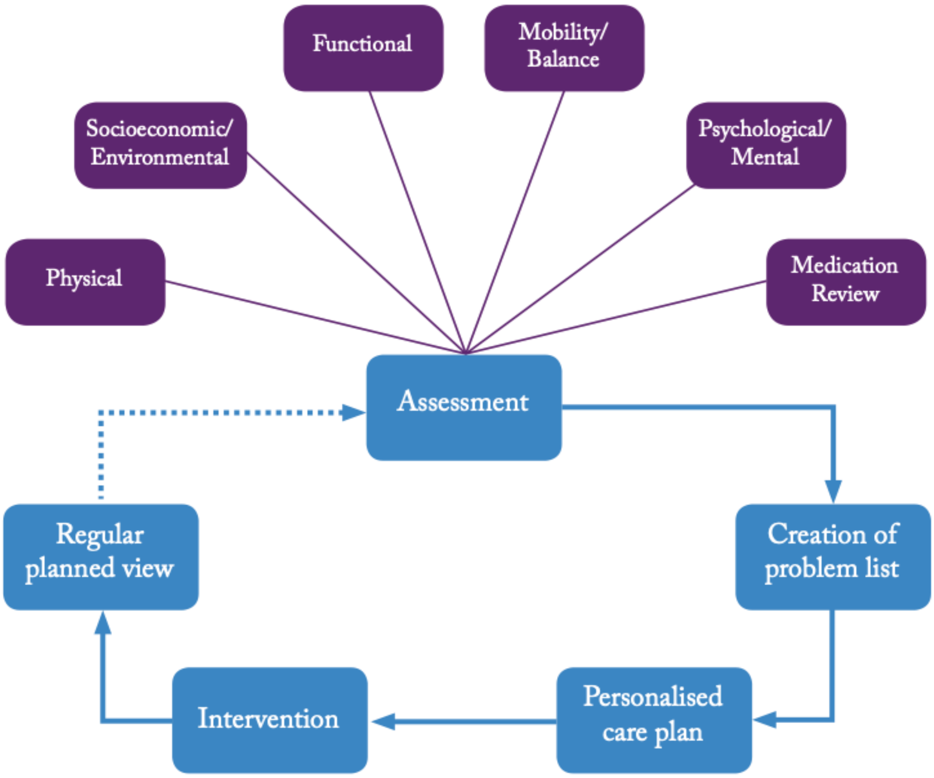
1.7.6 Assessment of frailty in clinical practice

Variations on Fried's phenotype and deficit accumulation indices are the most common methods used to identify frailty in the research setting (Dent et al., 2016). However, there are a myriad of other frailty assessment tools that have been developed and there is no consensus regarding which, if any, is the most appropriate for use in screening and assessment in clinical practice (Dent et al., 2016). In this section, two methods with relevance to the present study are discussed.

The first method is the CGA. This is a multidimensional clinical assessment that aims to put the patient's priorities at the centre of their care (see Figure 4) (British Geriatrics Society, 2015). The process is multidisciplinary, usually iterative and generates integrated management plans for older people. It is widely considered to be the *"gold standard"* for the clinical assessment of older people and the most effective intervention for frailty (Parker et al., 2017, British Geriatrics Society, 2015, Ellis et al., 2017). Broken down, CGA considerations for an older person living with frailty might include (Dent et al., 2019):

- Slowing the progression of physical features of frailty (e.g. weakness, slow gait) through reducing sedentary behaviour, encouraging exercise, improving nutrition, modifying their environment and specific interventions to improve strength and balance.
- Optimising the medical management of comorbidities and considering the impact of each of these and the benefits, risks and interactions of their treatments.
- Mitigating the effects of hearing loss and visual impairment.
- Doing all of the above with the individual's priorities at the centre.

Figure 4. The Comprehensive Geriatric Assessment

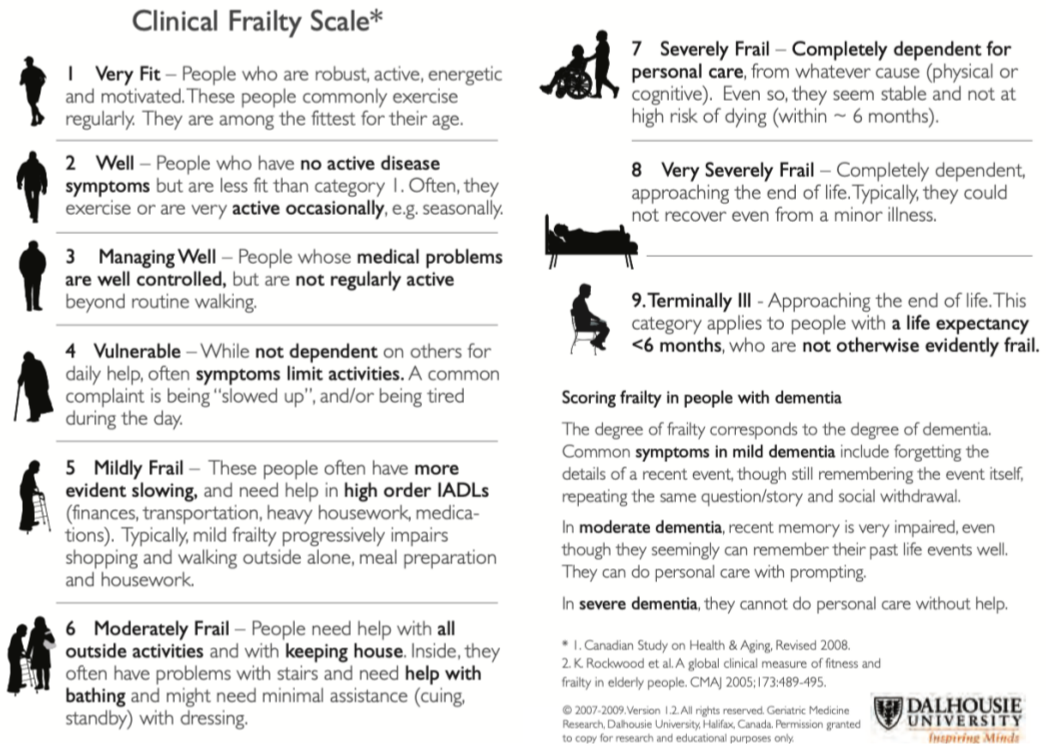


Reproduced from the British Geriatrics Society (2015).

Frailty indices derived from CGA are better than other measures at predicting adverse outcomes in both clinical and community settings (Dent et al., 2016). The major downside of CGA is the resource-intensive nature of the process. Furthermore, it traditionally involves physicians with specialist training in geriatrics, as well as a team of allied health providers with infrastructure to support this (Lewis et al., 2018c).

There are several tools that are used to screen for frailty, or to summarise clinical assessments. One example that is commonly used, and is referred to later in this research, is the Clinical Frailty Scale (CFS) (see Figure 5). Also developed by Rockwood et al. (2005), the CFS was originally a seven-point scale, used as a global judgement tool designed to summarise the results of a CGA. It was first applied to more than 2000 participants of the Canadian Study of Health and Ageing. In this cohort, the CFS was strongly correlated with a frailty index, and successfully predicted dependency and mortality at five years (Rockwood et al., 2005). Following further development, it was expanded to incorporate nine points ranging from *"Very Fit"* to *"Terminally Ill"* with visual accompaniments (Rockwood et al., 2005).

Figure 5. The Clinical Frailty Scale



Clinical Frailty Scale*

1 **Very Fit** – People who are robust, active, energetic and motivated. These people commonly exercise regularly. They are among the fittest for their age.

2 **Well** – People who have **no active disease symptoms** but are less fit than category 1. Often, they exercise or are very **active occasionally**, e.g. seasonally.

3 **Managing Well** – People whose **medical problems are well controlled,** but are **not regularly active** beyond routine walking.

4 **Vulnerable** – While **not dependent** on others for daily help, often **symptoms limit activities.** A common complaint is being "slowed up", and/or being tired during the day.

5 **Mildly Frail** – These people often have **more evident slowing,** and need help in **high order IADLs** (finances, transportation, heavy housework, medications). Typically, mild frailty progressively impairs shopping and walking outside alone, meal preparation and housework.

6 **Moderately Frail** – People need help with **all outside activities** and with **keeping house**. Inside, they often have problems with stairs and need **help with bathing** and might need minimal assistance (cuing, standby) with dressing.

7 **Severely Frail** – **Completely dependent for personal care**, from whatever cause (physical or cognitive). Even so, they seem stable and not at high risk of dying (within ~ 6 months).

8 **Very Severely Frail** – Completely dependent, approaching the end of life. Typically, they could not recover even from a minor illness.

9. **Terminally Ill** - Approaching the end of life. This category applies to people with **a life expectancy <6 months**, who are **not otherwise evidently frail.**

Scoring frailty in people with dementia

The degree of frailty corresponds to the degree of dementia. Common **symptoms in mild dementia** include forgetting the details of a recent event, though still remembering the event itself, repeating the same question/story and social withdrawal.

In **moderate dementia**, recent memory is very impaired, even though they seemingly can remember their past life events well. They can do personal care with prompting.

In **severe dementia**, they cannot do personal care without help.

* 1. Canadian Study on Health & Aging, Revised 2008.
2. K. Rockwood et al. A global clinical measure of fitness and frailty in elderly people. CMAJ 2005;173:489-495.

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Rockwood et al. (2005), modified in 2007. There is also a 2020 version which replaces "Well" with "Fit", and "Vulnerable" with "Living with very mild frailty".

The CFS has been extensively utilised as a screening tool, owing to its simplicity. It has had numerous translations and adaptations and has proved very popular with specialties outside of geriatrics (Church et al., 2020, Rodrigues et al., 2021, Chan et al., 2010). During the pandemic, the National Institute for Health and Care Excellence (2020) in the UK issued guidance recommending that discussions should be had over the appropriateness of referral to Intensive Care Units for older people with a CFS of five or more. The guideline in question was modified after concerns that it would be applied to younger people (in whom is not validated) and due to the ethical concerns around rationing care by frailty status already described (Wilkinson, 2021, Lewis et al., 2020a). Nonetheless, the CFS remains a useful tool which, when applied correctly, accurately identifies those at risk of adverse outcomes (Church et al., 2020).

1.8 Frailty on a global scale

Up to this point, the literature discussed in relation to frailty has overwhelmingly been from HICs. However, increasingly frailty is being applied to settings outside of the *“western”* biomedical contexts in which it evolved. Several systematic reviews have sought to estimate the global prevalence of frailty across different settings. This existing literature is summarised in Table 1.

Table 1. Summary of existing systematic reviews relating to global frailty

Authors (Year)	**Scope and summary of the systematic review**	**N included study cohorts (N participants)**	**N included studies from LMICs**	**Estimated prevalence of pre-frailty (%)**			**Estimated prevalence of frailty (%)**		
				Community	**Long-term care setting**	**Hospital inpatients**	**Community**	**Long-term care setting**	**Hospital inpatients**
Boucher et al. (2023)	Meta-analysis of the prevalence and outcomes of frailty *globally* following unplanned hospital admissions, demonstrating a dose-response relationship between frailty and mortality.	45 (39,041,266 admission events)	2 (0 from Africa)	-	-	-	-	-	40.0
Coelho-Junior et al. (2020)	Summarised studies reporting the prevalence of frailty amongst adults ≥60 years from *South America* using a weighted average.	118 (53,134)	118 (0 from Africa)	47.6	29.8	50.7	23.0	55.8	39.1
Collard et al. (2012)	Summarised studies *globally* reporting the prevalence of frailty amongst community-dwelling adults ≥65 years using a weighted average.	21 (61,500)	0	41.6	-	-	10.7	-	-
Cunha et al. (2019)	Meta-analysis demonstrating higher mortality and longer hospital stays *globally* amongst hospitalised adults with frailty aged ≥60 years. This table reports the ranges of prevalence from included studies.	19 (9,655)	2 (0 from Africa)	-	-	26.0 – 58.3	-	-	25.0 – 97.0
Dzando et al. (2024)	Summarised methods used to screen for frailty in sub-Saharan Africa, which included the frailty phenotype, frailty index, Clinical Frailty Scale, Tilberg Frailty Indicator, Study of Osteoporotic Fracture Frailty Scale, Short Physical Performance Battery and the B-FIT.	17	17 (All from sub-Saharan Africa, 15 community & 2 hospital samples: 1 inpatient	-	-	-	0.7 – 64.9	-	-

			and 1 outpatient)						
Doody et al. (2022)	Meta-analysis of the prevalence of frailty *globally* amongst hospitalised adults aged ≥65 years which found no evidence that prevalence was associated with national economic indicators.	96 (467,779)	5 (0 from Africa)	-	-	25.8	-	-	47.4
Gray et al. (2016)	Summarised the methods used to screen for frailty in *LMICs* which mostly included the phenotype and frailty indices; narratively reported the prevalence from included studies showing wide variation.	70	70 (4 from Africa, all community samples)	-	-	-	5.2 – 37.7	-	33.2 – 46.5
Nguyen et al. (2015)	Narratively summarised prevalence, definitions and risk factors for frailty amongst studies from *LMICs*. The prevalence for long-term care and hospital are each based on single studies (Khandelwal et al., 2012, Nóbrega et al., 2014).	14	14 (0 from Africa)	-	-	-	5.0 – 44.0	49.3	32.3
O'Caoimh et al. (2021)	Meta-analysis of the prevalence of frailty amongst community-dwelling adults aged ≥65 years from *global* population-based studies; they compared physical frailty and deficit accumulation methods, with the latter giving higher overall pooled-estimates (both presented in this table).	240 (1,731,107)	97 (5 from Africa, all community samples)	46.0 & 49.0	-	-	12.0 & 24.0	-	-
Ofori-Asenso et al. (2019)	Meta-analysis of the *global* incidence of frailty amongst community-dwelling adults aged ≥60 years, finding a higher incidence in LMICs than in HICs despite younger populations.	46 (120,805)	7 (0 from Africa)	-	-	-	-	-	-
Siriwardhana et al. (2018)	Meta-analysis of the prevalence of frailty amongst community-dwelling adults aged ≥65 years in	47 (75,133)	47 (1 from Africa	49.3	-	-	17.4	-	-

	LMICs. Authors tentatively suggest prevalence may be higher than in HICs.		[Tanzania], community sample)						
Veronese et al. (2021)	Meta-analysis of the *global* prevalence of frailty with a standardised measure, the multidimensional prognostic index, constructed to define frailty across studies to maximise comparability. The number of papers from LMICs was not stated but authors caution against generalising findings outside HICs.	57 (56,407)	Not stated	33.7	20.0	39.3	13.3	51.5	29.8

"N participants" is the number of individuals included in the meta-analysis or weighted average for frailty. LMICs, low- and middle-income countries; HICs, high-income countries.

The studies in Table 1 highlight the enormous heterogeneity in frailty research and the huge variability in prevalence. While this may be because of the different characteristics of different populations, it may also be due to the lack of consensus definition, and the fact that tools based on physical models of frailty tend to produce lower estimates of prevalence than those based on deficit accumulation (O'Caoimh et al., 2021).

The systematic reviews that have used meta-analysis (rather than narrative summaries or weighted averages) to estimate the global prevalence of frailty have put it at 12.0-24.0% amongst community-dwelling adults, 51.5% in those living in long-term care settings (e.g. residential and nursing homes), and at 29.8-47.4% amongst hospital inpatients (O'Caoimh et al., 2021, Veronese et al., 2021, Doody et al., 2022, Boucher et al., 2023). Compared with the prevalence of frailty, pooled estimates for pre-frailty indicated that it was generally lower in long-term care settings (20.0) and perhaps in hospital (25.8-39.3%), but higher amongst older people living in the community (33.7-49.0%) (Veronese et al., 2021, O'Caoimh et al., 2021, Doody et al., 2022). Given the characteristics of frailty outlined in this chapter, this is unsurprising: the greater the frailty, the more likely a person is to become institutionalised.

Systematic reviews which have focussed specifically on LMICs have found high rates of frailty (Coelho-Junior et al., 2020, Ofori-Asenso et al., 2019, Siriwardhana et al., 2018). However, there is a striking paucity of data when compared with the number of studies from HICs, particularly with regard to the prevalence of pre-frailty and frailty in hospital settings and their association with clinical outcomes.

1.9 Frailty in Tanzania

Returning the focus to Tanzania, previous work by Lewis et al. (2021) has investigated the cross-cultural relevance of frailty in qualitative interviews with older people in the Hai District of the Kilimanjaro Region. This qualitative investigation found a congruence between the phenotype model from the medical literature, and existing Tanzanian ideas around *"udhaifu wa wazee"* or *"weakness of the elderly"* (Lewis et al., 2021). However, there were a few key differences. First, amongst those interviewed, the physical changes associated with frailty were more likely to be seen as a natural part of the ageing process. Second, problems arising from frailty were more likely to be attributed to social determinants of healthy ageing, particularly scarcity of resources and undernutrition. Finally, fears for the future were less about loss of autonomy and more about material scarcity, and lacking the resources or care to support *"rest in old age"* (Lewis et al., 2021).

In addition to this qualitative investigation, Lewis et al. (2018a) also used a version of the phenotype to assess the prevalence of frailty amongst 235 people aged ≥60 years across five villages. In this cohort, 9.3% of older participants were living with frailty, a figure that increased to 19.1% when measured by CGA which considers the broader psychosocial context (Lewis et al., 2018c, Lewis et al., 2018a). This same cohort of older people was also used to externally validate a screening tool, known as the Brief-Frailty Instrument for Tanzania (B-FIT 2). This incorporates items relating to cognition, mobility, ADLs, nutrition, sensory impairment and social support and was designed to model a more Tanzanian conception of frailty, in a tool that could be utilised by non-experts in a low-resource setting (Gray et al., 2017, Lewis et al., 2020b).

Despite what appears to be a reasonably high prevalence of frailty in the community, no existing studies have assessed the prevalence of frailty amongst hospitalised older adults in Tanzania. Moreover, very little is known about the lived experiences of people with frailty and those caring for them in the Tanzanian hospital system.

1.10 Summary and key messages

The world's population is ageing and the increasing burden of complex health problems poses challenges to healthcare systems around the world. This is particularly acute in LMICs, such as Tanzania, where demographic changes are occurring at the fastest rate and where existing healthcare services are often orientated to the needs of younger populations. Frailty is an age-associated syndrome that is a strong predictor of poor clinical outcomes and high healthcare costs. Though there are many different ways of identifying frailty, underpinned by different conceptual models, it appears that all of these have their utility and are capable of accurately identifying those at risk of death, disability and dependency. Identifying frailty is important because these outcomes are preventable, through social and public health interventions to mitigate risk factors, and through specialist geriatric healthcare services. Frailty is prevalent amongst community-dwelling older people globally and in HICs this translates into an even greater prevalence amongst hospital inpatients. However, the extent, impact and experience of frailty amongst older hospital inpatients in LMICs, including Tanzania, remains uncharacterised. Understanding this is essential if we are to design future interventions and healthcare services capable of meeting the needs of older people.

Chapter 2. Systematic review: The prevalence of frailty amongst older hospitalised adults in low- and middle-income countries

2.1 Chapter introduction

This chapter presents a systematic review of the prevalence of frailty amongst older hospitalised adults in LMICs, structured according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyss (PRISMA) guidelines (Page et al., 2021). The methods are presented and explored, followed by the meta-analysis and narrative synthesis of the results along with a discussion of their implications. Conducting a rigorous systematic review cannot be achieved by a single researcher alone and where others contributed this is clearly stated in the text. This chapter provides part of the background for the work that followed and is thus a snapshot of the literature at the start of this PhD in 2022. The content of this review was updated in 2024 and published in Age and Ageing (Davidson et al., 2025).

2.2 Rationale for this review

The prevalence of frailty may be defined as the number of people with frailty (numerator), as a proportion of the total population that is assessed (denominator). As discussed in the previous chapter, there are several existing reviews relating to the prevalence of frailty. However, the vast majority of studies included in these reviews report the prevalence amongst community-dwelling adults (Collard et al., 2012, Nguyen et al., 2015, O'Caoimh et al., 2021, Ofori-Asenso et al., 2019, Siriwardhana et al., 2018, Gray et al., 2016). Those that do focus on hospital inpatients provide pooled estimates overwhelmingly based on data from HICs (Doody et al., 2022, Veronese et al., 2021, Cunha et al., 2019, Boucher et al., 2023). Establishing the prevalence of frailty amongst older hospital inpatients in LMICs is important for planning of services and the potential need for future provision of specialist geriatric care. A systematic review methodology was selected to summarise existing literature on this topic. This methodology seeks to provide a comprehensive summary of the literature in a transparent and replicable way, with in-built quality assessment, which minimises the risk of selection bias which can occur with traditional narrative reviews (Siddaway et al., 2019).

2.3 Aims and objectives

The aim of this review was to identify and summarise existing literature regarding the prevalence of frailty amongst older people admitted to hospital in LMICs with reference to the following objectives:

1) To conduct a systematic review of literature relating to the prevalence of frailty amongst people aged 60 years and over admitted to hospitals in LMICs.
2) To synthesise these data in meta-analyses to produce pooled estimates for the prevalence of frailty, and where possible pre-frailty, in this setting.
3) Where the frailty prevalence was reported in the context of a prospective cohort study, to summarise the all-cause mortality of older adults by frailty status.

2.4 Methods

This systematic review was registered on the International Prospective Register of Systematic Reviews (PROSPERO, reference: CRD42022340466) and conducted in accordance with PRISMA guidelines (Page et al., 2021). Ethical approval was not required as it only provided a secondary summary of existing data.

2.4.1 Eligibility criteria

To be considered eligible for inclusion, studies had to meet the following criteria:

1) *Cross-sectional or cohort design.* These are the standard methods adopted in epidemiology in order to establish the numerator and denominator required to assess disease prevalence (Munn et al., 2015).
2) *Report data from LMICs.* This was according to the World Bank's classification of countries by Gross National Income (GNI) per capita as of 1st July 2022 (World Bank, 2022). This defined low-income as less than $1,086 USD, lower-middle income as $1,086-4,255 and upper-middle income as $4,256-13,205 GDI per capita.
3) *Report data from adults aged 60 years and over.* As discussed in the first chapter, 60 years is considered by the World Health Organization to be the turning point at which morbidity and mortality are more likely to result from age-related impairments and non-communicable disease, than trauma or infection (World Health Organization, 2015c).

4) *Report data from hospital inpatients.* Hospital inpatients were defined as those admitted to medical and surgical ward environments and expected to stay in hospital overnight. Studies which assessed frailty amongst a subpopulation based on an index disease (e.g. acute coronary syndrome or COVID-19) were excluded on the basis that the prevalence of frailty in these groups might not necessarily reflect the prevalence in the general hospital inpatient population. To minimise the risk of selection bias, included studies had to at least attempt to assess all members (e.g. whole hospital, ward or department), or a random sample, of the target clinical population. Studies relating to community, primary care, outpatient, emergency department or short-stay settings were excluded.
5) *Report frailty prevalence using clearly defined and validated methods.* A 2016 systematic review summarised methods for frailty assessment in studies from LMICs (Gray et al., 2016), finding that a majority utilised tools based on Fried's frailty phenotype (Fried et al., 2001), and deficit accumulation indices (Jones et al., 2004, Searle et al., 2008). In addition to these, studies were also considered for inclusion if they used CGA (Jones et al., 2004), multidimensional clinical measures including the Edmonton Frail Scale (Rolfson et al., 2006), or global clinical assessment tools including the CFS (Rockwood et al., 2005).

Given the international scope of this review, it was deemed important to include studies which were not available in the English language. Professional translation was unavailable due to financial constraints. As a result Google Translate® was used to translate non-English-language studies; this is increasingly recognised as a viable and accurate tool for use in systematic reviews (Jackson et al., 2019).

2.4.2 Search strategy and information sources

In developing a search strategy, guidance was sought from librarians Jenny Richardson and Heather Anderson at the Northumbria Healthcare NHS Foundation Trust. Medline (OVID), Embase (OVID), CINAHL (EBSCO) and PsychInfo (ProQuest) were searched from their inception to the 29th of July 2022. Titles and abstracts were searched for the terms "frail", "frailty" or "frail elderly" as a keyword and/or subject heading or the truncated keyword "frail*". They were combined with every country listed as an LMIC by the World Bank as of

July 2022, also as a keyword and/or subject heading (World Bank, 2022)[1]. No additional filters or limits were used. In addition to this primary database search, the reference lists of previous systematic reviews and included studies were also manually reviewed, and relevant titles that were not captured in the initial literature search were included.

2.4.3 Selection process

Database search results were imported to Endnote 20 reference management software where duplicates were removed. Remaining records were then exported to Rayyan, an open access cloud-based programme in which records could be accessed and screened by multiple authors blinded to one another (Ouzzani et al., 2016). Further duplicates were removed at this stage. The titles and abstracts of all articles were then screened for eligibility for inclusion according to the set criteria. All records were screened by two people; the author (SD) screened all records. Meanwhile MRes students Luke Emmence, Emily Bickerstaff and George Rayers, as well as Psychiatry Registrar Doctor Elizabeth Parrott, provided the second screen. Disagreements were resolved by discussion and consensus.

Once the final list of eligible studies was agreed upon, full-text articles were sought through the Newcastle University library and the inter-library loan service. For conference abstracts, the corresponding authors of each record were contacted to ascertain whether their work was available in a full-text journal article and they were given 30 days to respond.

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[1] Afghanistan, Albania, Algeria, Angola, Argentina, Armenia, Azerbaijan, Bangladesh, Belarus, Belize, Benin, Bhutan, Bolivia, Bosnia, Botswana, Brazil, Bulgaria, Burkina Faso, Burundi, Cabo Verde, Cambodia, Cameroon, Central African Republic, Chad, China, Columbia, Comoros, Congo (Dem. Rep./ Rep.), Costa Rica, Côte d'Ivoire, Cuba, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Equatorial Guinea, Eritrea, Eswatini, Ethiopia, Fiji, Gabon, Gambia, Georgia, Ghana, Grenada, Guatemala, Guinea, Guinea-Bissau, Haiti, Herzegovina, Honduras, India, Indonesia, Iran, Iraq, Jamaica, Jordan, Kazakhstan, Kenya, Kiribati, Korea (Dem. Rep.), Kosovo, Kyrgyz Republic, Laos, Lebanon, Lesotho, Liberia, Madagascar, Malawi, Malaysia, Maldives, Mali, Marshall Islands, Mauritania, Mauritius, Mexico, Micronesia (Fed. Sts.), Moldova, Mongolia, Montenegro, Morocco, Mozambique, Myanmar, Namibia, Nepal, Nicaragua, Niger, Nigeria, North Macedonia, Pakistan, Palestine, Palau, Papua New Guinea, Paraguay, Peru, Philippines, Russia, Rwanda, Samoa, São Tomé, Senegal, Serbia, Sierra Leone, Solomon Islands, Somalia, South Africa, South Sudan, Sri Lanka, St. Lucia, St Vincent, Sudan, Suriname, Syria, Tajikistan, Tanzania, Thailand, Timor-Leste, Togo, Tonga, Tunisia, Turkey, Turkmenistan, Vanuatu, Venezuela, Vietnam, Yemen, Zambia and Zimbabwe.

2.4.4 Data items, risk of bias assessment and extraction process

A data extraction template was developed and trialled by the author (SD) in Excel to aid data collection and the risk of bias assessment.

The Joanna Briggs Institute (JBI) critical appraisal checklist for studies reporting prevalence data was used to guide the risk of bias assessment (Munn et al., 2015). This tool was selected because a 2020 systematic review concluded that the JBI checklist addressed the most important factors relating to methodological quality in prevalence studies, and was developed with greater rigour than other available quality assessment tools for this purpose (Migliavaca et al., 2020). The JBI checklist consists of nine questions with four tick-box responses: 1) “yes” if quality standards are met, 2) “no” if they are not, 3) “unclear”, or 4) “not applicable”. The final item is an overall appraisal based on the rater’s judgement in which the study may be included, excluded, or further information sought. Comments are then recorded justifying this global assessment of quality. It is worth noting that the terms “*methodological quality assessment”* and *“risk of bias assessment”* have previously been used interchangeably in the literature despite referring to different concepts (Furuya-Kanamori et al., 2021). In this systematic review, the JBI checklist was used both to assess the scientific rigour of each study (its methodological quality) and to consider the potential impact of methodological decisions on the frailty prevalence estimates produced (risk of bias).

All eligible full-text articles were examined by the author (SD), and Doctor Jim Lee (JL), a Specialist Foundation Doctor. Both independently extracted the data and conducted a methodological quality assessment, blinded to one another. The full list of data items and methodological quality assessment questions included in the Excel template are presented in Table 2. If a data item was not calculable from the article, or the information presented was unclear, this was recorded as *“unavailable”* and no assumptions or imputations were made. Where there was disagreement between the author (SD) and JL over whether or not to include a study, supervisors Professor Richard Walker (RW) and Doctor Catherine Dotchin (CD) were given the final say as to whether a study was included.

Table 2. Data items for extraction and methodological quality assessment

Data items	**Notes**
i. Authors	
ii. Year of publication	
iii. Country	
iv. World Bank income status	
v. Study design	E.g. cross-sectional or prospective cohort
vi. Sampling method	E.g. consecutive, random or convenience
vii. Hospital setting	E.g. small regional hospital or large referral centre
viii. Ward/ clinical population	E.g. hospital wide or geriatric ward
ix. Dates of data collection	
x. Age criteria for inclusion	
xi. Frailty assessment method	Noting cut-offs used to define “frail” versus “pre-frail” versus “robust”, or “frail” versus “non-frail” for studies lacking a pre-frail category
xii. Sample size	
xiii. Mean or median age	With standard deviation or interquartile range
xiv. Sex makeup of participants	Including number and percentage of total sample
xv. Frailty prevalence[1]	Including number and percentage of total sample
xvi. Length of follow-up	Only for studies also reporting all-cause mortality
xvii. Dropout rate over follow-up	Only for studies also reporting all-cause mortality
xviii. All-cause mortality by frailty status[1]	Including number and percentage of total in each frailty status category
Joanna Briggs Institute critical appraisal checklist for studies reporting prevalence data[2]	
1. Was the sample frame appropriate to address the target population?	“Yes”, “No”, “Unclear” or “Not applicable”
2. Were study participants sampled in an appropriate way?	“Yes”, “No”, “Unclear” or “Not applicable”
3. Was the sample size adequate?	“Yes”, “No”, “Unclear” or “Not applicable”
5. Was the data analysis conducted with sufficient coverage of the identified sample?	“Yes”, “No”, “Unclear” or “Not applicable”
6. Were valid methods used for the identification of the condition?	“Yes”, “No”, “Unclear” or “Not applicable”
7. Was the condition measured in a standard, reliable way for all participants?	“Yes”, “No”, “Unclear” or “Not applicable”
8. Was there appropriate statistical analysis?	“Yes”, “No”, “Unclear” or “Not applicable”
9. Was the response rate adequate, and if not, was the low response rate managed appropriately?	“Yes”, “No”, “Unclear” or “Not applicable”
Overall appraisal	“Include”, “Exclude” or “Seek further info”
Comments	Including reasons for exclusion

[1] While some studies report frailty status as “frail” versus “pre-frail” versus “robust”, others lack a pre-frail category. These typically amalgamate participants who are robust and pre-frail into one

category referred to as “non-frail”. During data extraction, frailty status of participants was recorded in whichever format the authors used. [2]*(Munn et al., 2015).*

Data items regarding country and World Bank income status were collected to establish where existing research on this topic was from and to highlight regions where there were gaps in existing knowledge. Furthermore, data items relating to hospital setting and clinical population were collected because existing literature suggests that frailty prevalence varies depending on clinical setting, for example it has previously been shown to be more prevalent in medical and geriatric environments than on surgical wards (Doody et al., 2022). This was also why the dates of data collection were of interest, as COVID-19 dramatically affected the clinical and demographic composition of hospital inpatients (Rennert-May et al., 2021). Age and sex were recorded as two of the most important risk factors for frailty in existing literature (Qin et al., 2023) and were therefore also useful when assessing the clinical heterogeneity amongst the populations across studies.

2.4.5 Synthesis of extracted data

All data items were presented in tabular form with a brief narrative analysis in the text. For frailty and pre-frailty, meta-analyses were performed to synthesise the data and give pooled estimates for prevalence. All-cause mortality data by frailty status were collected from included studies that were of prospective cohort design. Due to a small number of studies with considerable methodological heterogeneity these data were summarised narratively.

2.4.6 Meta-analysis of frailty and pre-frailty

Meta-analysis was chosen over narrative synthesis as it provides a robust way to summarise quantitative data, assess statistical heterogeneity between studies and can provide a more precise estimate of prevalence with greater statistical power than any single study alone (Siddaway et al., 2019). Studies were included in the meta-analysis if they were deemed to be of sufficient quality and methodological homogeneity. In practice, this was considered during the risk of bias assessment stage (guided by the JBI checklist) and subsequent discussions between the author (SD), JL, CD and RW. Not all studies reported prevalence of pre-frailty, instead they reported “frail” versus “non-frail” status. Thus, to allow all included studies to feed into the pooled estimate for the prevalence of frailty, in preparation for data synthesis “pre-frail” and “robust” categories were combined under the banner of “non-frail”. A second separate meta-analysis was performed to give a pooled estimate of pre-frailty and this analysis was restricted to studies which reported this value.

The meta-analysis was conducted using the MetaXL plugin for Excel version 16. Considerable variation in the true prevalence of frailty between studies was anticipated because of differences in the time and place that studies were conducted, as well as the sample size, local population demographics, socioeconomic circumstances and health systems. In anticipation of this methodological heterogeneity, a random-effects model was chosen over a fixed-effects model because this approach assumes that the true prevalence could vary between studies as a result of such methodological heterogeneity (Dettori et al., 2022).

In a standard meta-analysis, studies with the smallest variance are given the greatest weighting and vice versa. This usually means that studies with larger sample sizes are given greater weighting. However, for meta-analyses involving prevalence data, a transformation must be applied to avoid undue weight being given to studies where the prevalence is high or low, as these scenarios can produce an artificially low variance (Barendregt et al., 2013). However, there is disagreement in the literature regarding which is the best method of transformation for studies reporting single proportions. Probably the most popular method is the double arcsine transformation, however this can be misleading when data are back-transformed to help with interpretation, particularly in extreme scenarios where there are big differences in sample size or very low prevalence figures (Barendregt et al., 2013, Lin et al., 2022). Generalised linear modelling is an alternative, but similarly can create problems when sample sizes are small, or when prevalence is very high or very low (Schwarzer et al., 2019, Lin et al., 2022). Logit transformation is another method used less frequently than the other two because of a tendency to produce nonsensical Confidence Intervals that fall outside of the zero to one (0-100%) range (Barker et al., 2021). In practice, more often than not, all of these methods produce similar prevalence estimates (Lin et al., 2022). Therefore, taking a pragmatic approach, in this meta-analysis the double arcsine transformation was applied with a sensitivity analysis to assess the robustness of this method of synthesis. Pooled estimates of frailty and pre-frailty are presented with the 95% Confidence Intervals.

Results of meta-analyses were displayed in forest plots, with all studies ordered by prevalence.

2.4.7 Assessment of statistical heterogeneity

Statistical heterogeneity was assessed using Higgins I^2, the output of which is a number between zero and one and represents the percentage of the variance that is due to methodological differences between studies, as opposed to random sampling error (Higgins et al., 2003). A value of 0-25% is regarded as low, 50-74% as moderate and 75-100% as high statistical heterogeneity (Higgins et al., 2003). However, this statistic was developed for use in comparative data and it must be remembered that in the case of frailty prevalence, due to the vastly different contexts in which studies are conducted, high levels of statistical heterogeneity are to be expected (Barker et al., 2021).

2.4.8 Sensitivity analysis

To assess the robustness of this synthesis and whether any single study was having an outsized effect on the pooled prevalence estimate, a sensitivity analysis was conducted. This function in MetaXL repeated the primary analysis multiple times with the removal of one study each round. Changes in the pooled estimates of frailty and pre-frailty were observed giving an idea of which studies had the greatest influence on the pooled estimate and statistical heterogeneity.

2.4.9 Reporting of risk of bias

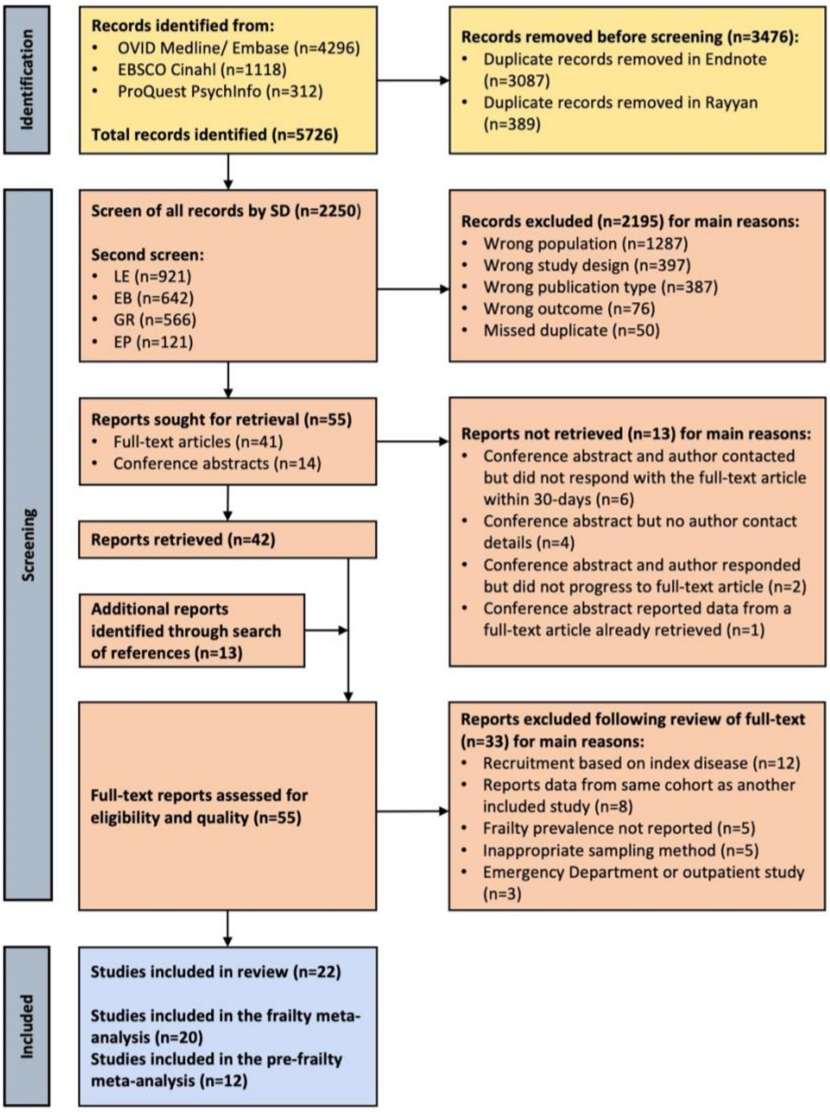
Though MetaXL does have a function that considers the risk of bias assessment in the weighting of studies in a meta-analysis, the JBI checklist is essentially qualitative and does not produce a numerical score so cannot be used in this way. Therefore, risk of bias from included studies was summarised narratively. Additionally, funnel plots, and all other statistical tests for publication bias, are not recommended for use in proportional meta-analyses (Barker et al., 2021). The reason for this is that they were developed for interventional and comparative studies and make the assumption that positive results are more likely to be published (Barker et al., 2021). This assumption is meaningless in the context of studies reporting frailty prevalence.

2.5 Results

2.5.1 Study selection

Searches identified 5726 records and 2250 remained after removal of duplicates. After title and abstract screening, 55 were identified as potentially eligible for inclusion, with a further 13 identified from references. After retrieval, full-text review and methodological quality assessment, 22 studies were included in the review and 20 in the meta-analysis for frailty. Figure 6 demonstrates the selection process for included studies and reasons for exclusion.

Figure 6. Flow diagram demonstrating the selection process of included studies with main reasons for exclusion detailed at each step



Of the 55 reports that appeared to meet inclusion criteria after title and abstract screening, 42 full-text articles were retrieved. As outlined in Figure 6, one abstract (Liang et al., 2019a) reported data from a full-text article that had already been retrieved (Zheng et al., 2020) and 12 could not be obtained for one of the following reasons:

1) Authors were contacted but did not respond with the full-text article within 30-days (Contreras and Barragan Berlanga, 2019, Hasmuk et al., 2020, Soric et al., 2017, Taniguchi et al., 2018, Catikkas et al., 2022, Zribi et al., 2019).
2) Author contact details could not be found (Chen et al., 2016, Jl et al., 2021, Popescu, 2020, Taniguchi et al., 2018).
3) Authors responded but the abstract did not progress to a full-text article (Avelino-Silva et al., 2018, Deffune et al., 2020).

After independent review and methodological quality assessment of the 55 retrieved full-text articles, the author (SD) and JL disagreed regarding the inclusion/ exclusion of two studies (Kizilarslanoglu et al., 2017, Lv et al., 2022b) which were then adjudicated by RW and CD. There were 34 reports which were excluded after full-text review. The main reasons for exclusion are listed below (where there was more than one reason for exclusion, only the main reason is reported):

1) The commonest rationale underlying exclusion was a focus on the prevalence of frailty among participants recruited on the basis on an index condition. Conditions included: cardiovascular disease (Aggarwal et al., 2020, Meng et al., 2021, Kang et al., 2015, Diaz-Toro et al., 2017, Nguyen et al., 2019b, Yalinkilic et al., 2020); COVID-19 (Aliberti and Avelino-Silva, 2021, Ma et al., 2020, Thiam et al., 2021); community-acquired pneumonia (Lv et al., 2022a, Luo et al., 2020); an multimorbidity (Lv et al., 2022b).
2) Several studies did not report frailty prevalence, but rather the cohort's average frailty scores and thus could not be included (An et al., 2015, de Fátima Santos Antunes et al., 2015, Essam Behiry et al., 2019, Gu et al., 2021, Roopsawang et al., 2020).
3) Sampling method was another reason for exclusion and in these cases it was either unclear (Bhurchandi et al., 2021), or based on convenience (Han et al., 2019, Díaz et al., 2020, Oliveira Crossetti et al., 2018, Storti et al., 2013).

4) Closer examination of three studies revealed there were in outpatient (Ajayi et al., 2021, Garcia-Delgado et al., 2020) and Emergency Department populations (Aprahamian et al., 2019) rather than hospital inpatients.
5) The remaining studies were excluded because they analysed data from other studies that had already been included (Chehrehgosha et al., 2021a, Nguyen et al., 2019a, Nguyen et al., 2020b, Li et al., 2021, Zheng et al., 2020, Zhang et al., 2021, Zhang et al., 2022, Xu et al., 2021).

2.5.2 Characteristics and extracted variables for included studies

The characteristics and prevalence data from the 22 included studies are displayed in Table 3. For studies which used multiple tools to assess frailty, the prevalence by each measure is reported in the rows below the initial study characteristics.

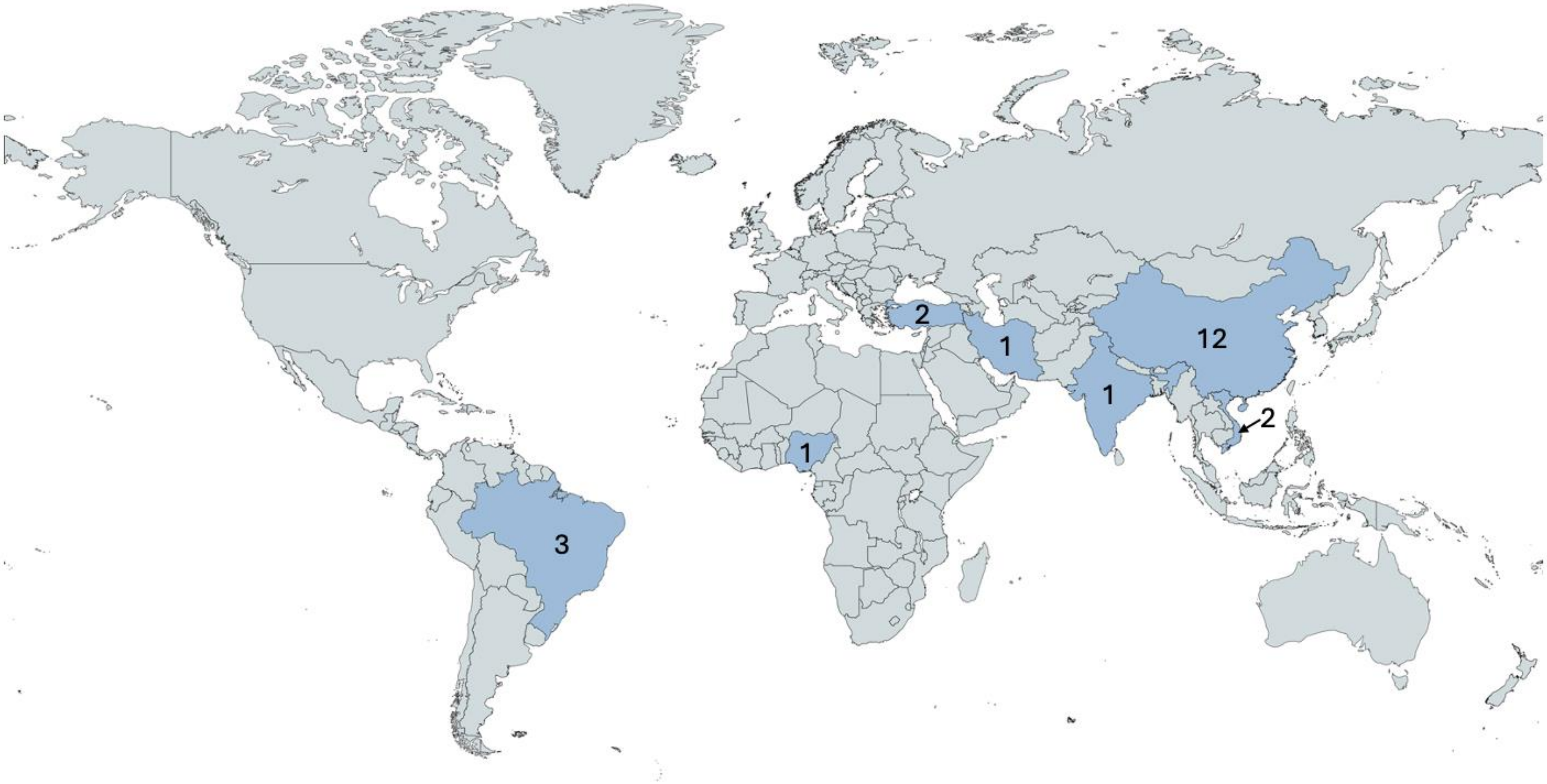
Table 3. Characteristics of included studies and extracted frailty and pre-frailty prevalence data

Authors (year)	Country	World Bank Income status	Setting	Clinical population	Study design	N	Female N (%)	Mean age of participants (years +/-SD)	Age range (years)	Frailty measure	Frailty and pre-frailty cut-offs	Non-frail/ robust prevalence N (%)	Pre-frailty prevalence N (%)	Frailty prevalence N (%)
Adebusoye et al. (2019a)	Nigeria	Lower-middle	University hospital in Ibadan	Internal medical wards	Prospective cohort	450	234 (52.0)	71.5 (8.0)	60-101	Canadian Study of Health and Ageing (CHSA) Clinical Frailty Scale	Frail if "mild", "moderate" or "severe" frailty; Pre-frail if "apparently vulnerable"	65 (14.4)	100 (22.2)	285 (63.3)
Chehrehgosha et al. (2021b)	Iran	Lower-middle	General hospital In Tehran	Geriatric, internal medical and coronary care wards	Prospective cohort	304	225 (74.0)	75.7 (6.3)	65-85	Frailty index	Frail if >3.0; Pre-frail if >0.21 to ≤0.30	167 (54.9)	102 (33.6)	35 (11.5)
dos Santos Tavares et al. (2015)	Brazil	Upper-middle	University hospital in Uberaba	Internal medical and surgical wards	Cross-sectional	255	99 (38.8)	68.7 (6.6)	≥60	Fried frailty phenotype	Frail if ≥3; Pre-frail if 2-3	52 (20.4)	136 (53.3)	67 (26.3)
Hao et al. (2019)	China	Upper-middle	University hospital in Chengdu	Geriatric ward	Prospective cohort	271	55 (20.3)	81.1 (6.6)	60-101	Frailty index	Frail if ≥0.25; No pre-frail category	138 (50.9)	-	133 (49.1)
Hong et al. (2019)	China	Upper-middle	University hospital in Hangzhou	Geriatric ward	Cross-sectional	380	193 (50.8)	83.1 (7.8)	≥65	Fried frailty phenotype	Frail if ≥3; Pre-frail if 1-2	140 (36.8)	81 (21.3)	159 (41.9)
Ji et al. (2022)	China	Upper-middle	Tertiary hospital in Shandong Province	Internal medical ward	Cross-sectional	667	326 (48.9)	Unavailable	60-90	Fried frailty phenotype	Frail if ≥3; Pre-frail if 1-2	160 (24.0)	386 (57.9)	121 (18.1)
Jiao et al. (2020)	China	Upper-middle	Six tertiary hospitals across China	All inpatient wards	Cross-sectional	9996	4218 (42.2)	72.5 (5.8)	65-97	FRAIL Scale	Frail if ≥3; Pre-frail if 1-2	8195 (82.0)	-	1801 (18.0)
Khandelwal et al. (2012)	India	Lower-middle	University hospital in Delhi	Internal medical wards	Cross-sectional	250	96 (38.4)	66.4 (6.3)	≥60	Fried frailty phenotype	Frail if ≥3; No pre-frail category	167 (66.8)	-	83 (33.2)
Kizilarslanoglu et al. (2017)	Turkey	Upper-middle	University hospital in Ankara	Intensive care unit	Prospective cohort	122	60 (49.2)	Median 71 (no IQR)	60-101	Frailty index	Frail if >0.4 Pre-frail if 0.25–0.40	59 (48.4)	37 (30.3)	26 (21.3)

Li et al. (2020)	China	Upper-middle	Tertiary hospital in Beijing	All inpatient wards	Cross-sectional	260	121 (46.5)	68.7 (7.1)	≥60	Fried frailty phenotype	Frail if ≥3; Pre-frail if 2-3	74 (28.4)	103 (39.6)	83 (31.9)
Liang et al. (2019b)	China	Upper-middle	Tertiary hospital Beijing	Cardiology, medical and surgical wards	Cross-sectional	1000	485 (48.5)	75.2 (6.7)	≥65	Multiple (see below)	-	-	-	-
As above	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	Clinical Frailty Scale	Frail if ≥5; No pre-frail category	638 (63.8)	-	362 (36.2)
As above	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	FRAIL Scale	Frail if ≥3; No pre-frail category	808 (80.8)	-	192 (19.2)
As above	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	Fried frailty phenotype	Frail if ≥3; No pre-frail category	677 (67.7)	-	323 (32.3)
As above	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	Edmonton Frail Scale	Frail if ≥8; No pre-frail category	748 (74.8)	-	252 (25.2)
As above	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	Frailty index	Frail if ≥0.25 No pre-frail category	649 (64.9)	-	351 (35.1)
Ling et al. (2019)	China	Upper-middle	Tertiary hospital in Wuhan	All inpatient wards	Cross-sectional	550	190 (34.5)	74.6 (7.3)	≥65	Fried frailty phenotype	Frail if ≥3; Pre-frail if 2-3	429 (78.0)	73 (13.3)	48 (8.7)
Nguyen et al. (2020a)	Vietnam	Lower-middle	General hospital in Ho Chi Minh	Geriatric ward	Prospective cohort	364	212 (58.2)	74.9 (9.4)	≥60	Clinical Frailty Scale	Frail if ≥5; Pre-frail if 3-4	4 (1.1)	160 (44.0)	200 (54.9)
Oliveira et al. (2013)	Brazil	Upper-middle	Tertiary hospital in São Paulo	Internal medical wards	Cross-sectional	99	50 (50.5)	74.5 (6.8)	≥65	Fried frailty phenotype	Frail if ≥3; Pre-frail if 2-3	4 (4.0)	49 (49.5)	46 (46.5)
Öztürk et al. (2017)	Turkey	Upper-middle	University hospital in Gaziantep	Internal medical wards	Cross-sectional	420	208 (49.5)	71.9 (6.3)	65-98	Fried frailty phenotype	Frail if ≥3; Pre-frail if 2-3	35 (8.3)	110 (26.2)	275 (65.5)
Pinheiro et al. (2021)	Brazil	Upper-middle	University hospital in Belo Horizonte	Admissions from Emergency Department	Prospective cohort	206	87 (42.2)	Median 71 (IQR 66 – 78)	≥60	Clinical Frailty Scale	Frail if ≥5; No pre-frail category	79 (38.3)	-	127 (61.7)
Vu et al. (2017)	Vietnam	Lower-middle	National Geriatric	Internal medical wards	Cross-sectional	461	262 (56.8)	76.2 (8.9)	≥60	Multiple	-	-	-	-

			Hospital in Hanoi											
As above	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	Fried frailty phenotype	Frail if ≥3; No pre-frail category	298 (64.6)	-	163 (35.4)
As above	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	Reported Edmonton Frail Scale	Frail if ≥8; No pre-frail category	314 (68.1)	-	147 (31.9)
Xu et al. (2020)	China	Upper-middle	University hospital in Hangzhou	Geriatric wards	Cross-sectional	656	275 (41.9)	83.3 (8.3)	65-100	Clinical Frailty Scale	Frail if ≥5; No pre-frail category	368 (56.1)	-	288 (43.9)
Yang and Chen (2018)	China	Upper-middle	Three general hospitals in Chongqing and Zunyi	Internal medical wads	Cross-sectional	1400	812 (58.0)	75.5 (9.3)	60-99	Fried frailty phenotype	Frail if ≥3; Pre-frail if 2-3	690 (49.3)	458 (32.7)	252 (18.0)
Yin et al. (2018)	China	Upper-middle	Tertiary hospital and three general hospitals in Shanghai	Inpatients on all wards admitted >7 days	Cross-sectional	587	131 (22.3)	79.8 (9.3)	65-99	FRAIL Scale	Frail if ≥3; Pre-frail if 2-3	146 (21.9)	245 (41.7)	196 (33.4)
Yu et al. (2022)	China	Upper-middle	Tertiary hospital in Xi'an	All inpatient wards	Cross-sectional	1170	534 (45.6)	71.5 (8.5)	60-98	Multiple (see below)	-	-	-	-
As above	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	FRAIL Scale	Frail if ≥3; No pre-frail category	524 (44.8)	-	646 (55.2)
As above	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	*As above*	Tilburg Frailty Indicator	Frail if ≥5; No pre-frail category	262 (22.4)	-	908 (77.6)
Zou et al. (2018)	China	Upper-middle	General hospital in Chengdu	Geriatric wards	Cross-sectional	411	146 (35.5)	75.9 (8.1)	60-97	FRAIL Scale	Frail if ≥3; Pre-frail if 2-3	73 (17.8)	116 (28.2)	222 (54.0)

Figure 7. World map demonstrating number of included studies by country. Created using MapChart.net (2024).



2.5.3 Geographical distribution and income status of included studies

As is displayed in Figure 7, reports of the prevalence of frailty amongst hospital inpatients in LMICs were generally sparse, the notable exception being in China which accounted for more than half of included studies (n=12) (Hao et al., 2019, Hong et al., 2019, Ji et al., 2022, Jiao et al., 2020, Li et al., 2020, Liang et al., 2019b, Ling et al., 2019, Xu et al., 2020, Yang and Chen, 2018, Yin et al., 2018, Yu et al., 2022, Zou et al., 2018). Only one study from sub-Saharan Africa – and indeed the whole African continent – met the criteria for inclusion (Adebusoye et al., 2019a). All included studies were from Middle-Income Countries, with only a minority of those coming from Lower-Middle-Income settings (n=5) (Adebusoye et al., 2019a, Chehrehgosha et al., 2021b, Khandelwal et al., 2012, Nguyen et al., 2020a, Vu et al., 2017).

2.5.4 Clinical environments of included studies

Though there were four studies which included participants from general hospital settings (Chehrehgosha et al., 2021b, Nguyen et al., 2020a, Yang and Chen, 2018, Yin et al., 2018), the vast majority surveyed inpatient populations admitted to university hospitals and tertiary referral centres. These were invariably in urban settings though their catchment areas likely also encompassed rural populations.

Study populations were drawn from a wide range of clinical environments. Five studies assessed the prevalence of frailty across all inpatient wards (Jiao et al., 2020, Li et al., 2020, Ling et al., 2019, Yin et al., 2018, Yu et al., 2022). The remaining studies focussed on one or more specific environments, with internal medical wards being the most commonly surveyed (n=10) (Adebusoye et al., 2019a, Chehrehgosha et al., 2021b, dos Santos Tavares et al., 2015, Ji et al., 2022, Khandelwal et al., 2012, Liang et al., 2019b, Oliveira et al., 2013, Öztürk et al., 2017, Vu et al., 2017, Yang and Chen, 2018), followed by geriatrics (n=6) (Chehrehgosha et al., 2021b, Hao et al., 2019, Hong et al., 2019, Nguyen et al., 2020a, Xu et al., 2020, Zou et al., 2018), cardiology (n=2) (Chehrehgosha et al., 2021b, Liang et al., 2019b), general surgery (n=2) and intensive care (n=1) (Kizilarslanoglu et al., 2017). Pinheiro et al. (2021) recruited participants in the Emergency Department, though only included those who were admitted for at least one night.

2.5.5 Participant demographic characteristics

There were notable disparities in the basic demographic characteristics of included participants between studies. The proportion of females ranged from just 20.3% in one study from China (Hao et al., 2019) to 74.0% in a study from Iran (Chehrehgosha et al., 2021b).

With regards to age, nine studies used 65 years and over, rather than 60 year and over, as the age criterion for inclusion (Chehrehgosha et al., 2021b, Hong et al., 2019, Jiao et al., 2020, Liang et al., 2019b, Ling et al., 2019, Oliveira et al., 2013, Öztürk et al., 2017, Xu et al., 2020, Yin et al., 2018). The study with the youngest population was Khandelwal et al. (2012) from Delhi, India, where the mean age of participants was 66.4 (±6.3) years. By contrast, Xu et al. (2020) found a mean age of 83.3 (±8.3) amongst inpatients in a hospital in Hangzhou on the east coast of China, a 16.9 year difference. In 12 studies, the mean or median age of participants was 65-74 years and in nine it was 75-84 years. One did not report the mean age of the sample as a whole (Ji et al., 2022).

2.5.7 Frailty measures

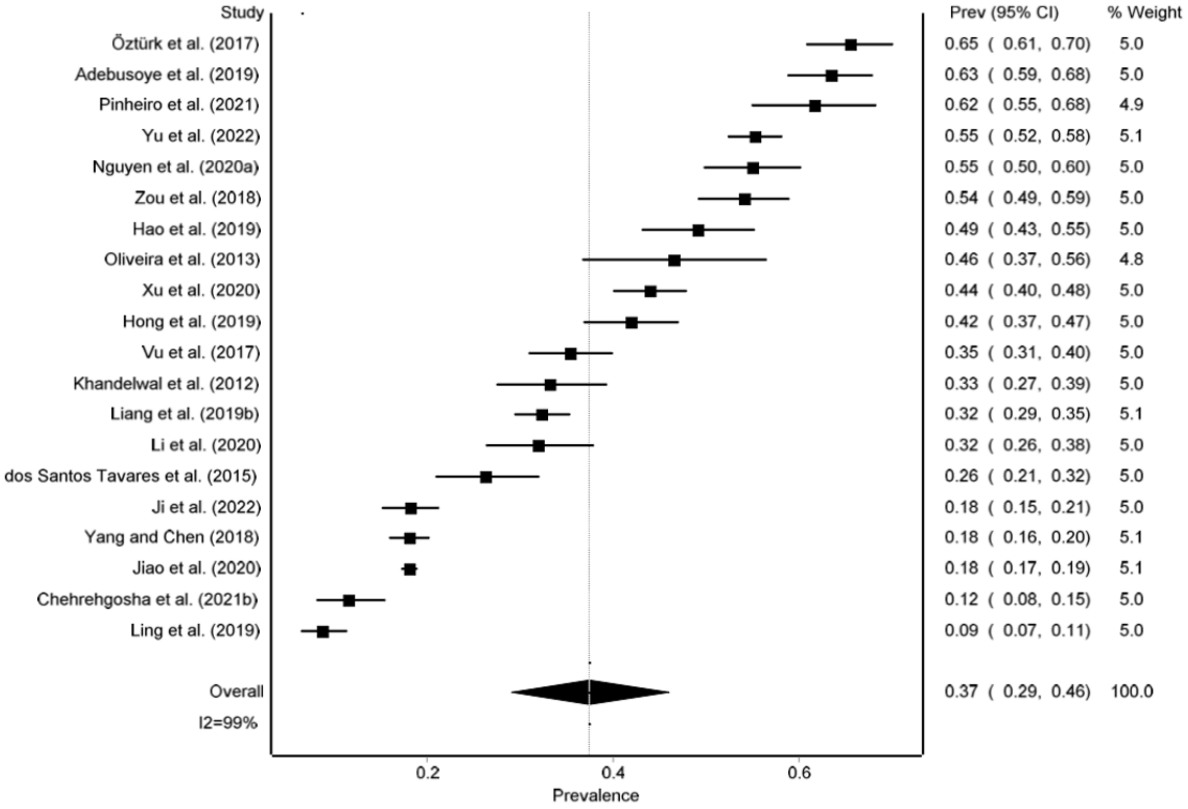
A range of tools were used in the assessment of frailty. The Fried frailty phenotype was the most commonly used instrument (n=11) (dos Santos Tavares et al., 2015, Hong et al., 2019, Ji et al., 2022, Khandelwal et al., 2012, Li et al., 2020, Liang et al., 2019b, Ling et al., 2019, Oliveira et al., 2013, Öztürk et al., 2017, Vu et al., 2017, Yang and Chen, 2018), followed by the FRAIL Scale which is based upon the same domains (n=5) (Jiao et al., 2020, Liang et al., 2019b, Yin et al., 2018, Yu et al., 2022, Zou et al., 2018). A number of studies utilised tools with origins in a deficit accumulation model of frailty including the frailty index (n=4) (Chehrehgosha et al., 2021b, Hao et al., 2019, Kizilarslanoglu et al., 2017, Liang et al., 2019b), CFS (n=4) (Liang et al., 2019b, Nguyen et al., 2020a, Pinheiro et al., 2021, Xu et al., 2020), and its older version the Canadian Study of Health and Ageing CFS (n=1) (Adebusoye et al., 2019a). Other measures used included the Edmonton Frail Scale (Liang et al., 2019b), its updated version the Reported Edmonton Frail Scale (Vu et al., 2017), and the Tilburg Frailty Indicator (Yu et al., 2022).

There were three studies which utilised more than one tool to measure the prevalence of frailty (Liang et al., 2019b, Vu et al., 2017, Yu et al., 2022). For the purposes of the meta-analysis, in these cases only the measure that allowed the greatest comparison with other included studies was used. The Fried frailty phenotype was used from Liang et al. (2019b) and Vu et al. (2017), while the FRAIL Scale was used from Yu et al. (2022).

2.5.8 Meta-analysis of the prevalence of frailty

A total of 20 studies, comprising data from 19,570 older adults admitted to hospital, demonstrated a pooled estimate of the prevalence of frailty of 37.3% (95% CI 29.0 – 46.0%). The summary estimate for each study and a visual depiction of the pooled estimate can be found in the forest plot in Figure 8. Estimates of frailty ranged widely between studies from 8.7% to 65.5%. This was reflected in the I^2 test which at 99.2% indicated high levels of statistical heterogeneity. Sensitivity analysis (through repetition of the primary analysis with the removal of each study individually) did not indicate that any one study was exerting an outsized influence on the pooled estimate or statistical heterogeneity. The results of this sensitivity analysis can be found in Table 4.

Figure 8. Forest plot depicting the prevalence of frailty and pooled prevalence estimate with studies ordered by ascending prevalence



95% CI, 95% Confidence Interval. Prevalence figures are reported as a proportion of the total sample.

Table 4. Sensitivity analysis for the meta-analysis of frailty prevalence

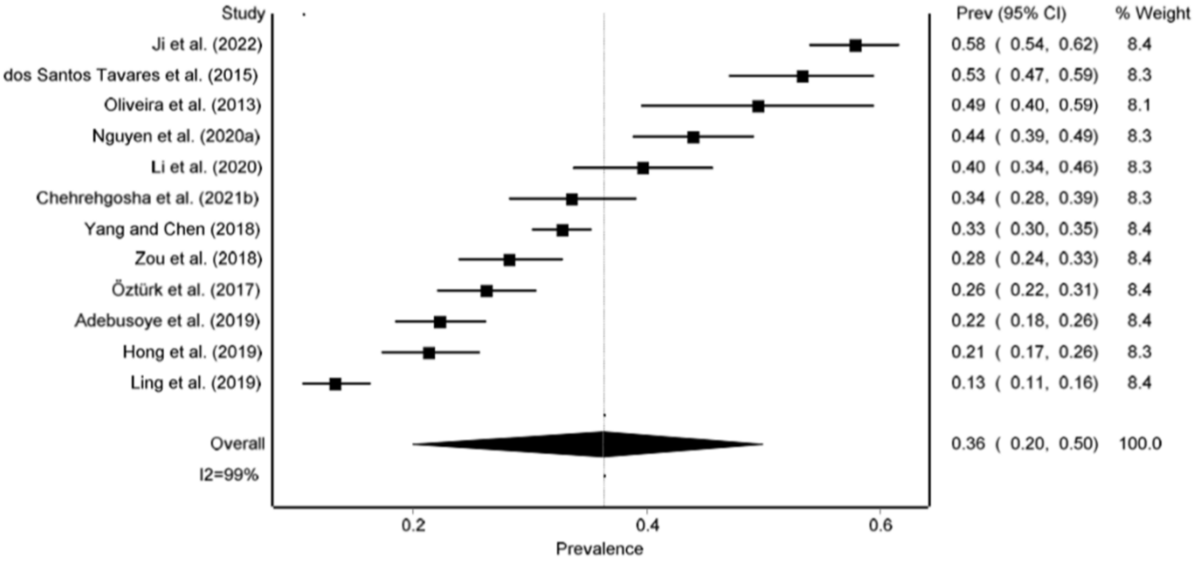
Excluded study	**Pooled estimate of frailty prevalence (%)**	**95% Confidence Interval (%)**	**Higgins I^2**
Öztürk et al. (2017)	35.9	27.8 – 44.3	99.1
Adebusoye et al. (2019a)	36.0	27.9 – 44.5	99.1
Pinheiro et al. (2021)	36.1	27.8 – 44.9	99.2
Yu et al. (2022)	36.4	28.4 – 44.8	99.0
Nguyen et al. (2020a)	36.4	28.1 – 45.2	99.1
Zou et al. (2018)	36.5	28.1 – 45.3	99.1
Hao et al. (2019)	36.7	28.3 – 45.6	99.2
Oliveira et al. (2013)	36.9	28.4 – 45.8	99.2
Xu et al. (2020)	37.0	28.4 – 46.0	99.2
Hong et al. (2019)	37.1	28.5 – 46.2	99.2
Vu et al. (2017)	37.4	28.8 – 46.5	99.2
Khandelwal et al. (2012)	37.6	28.9 – 46.6	99.2
Liang et al. (2019b)	37.6	28.7 – 46.9	99.2
Li et al. (2020)	37.6	29.0 – 46.7	99.2
dos Santos Tavares et al. (2015)	37.9	29.3 – 47.0	99.2
Ji et al. (2022)	38.5	29.7 – 47.7	99.2
Yang and Chen (2018)	38.5	29.5 – 47.9	99.2
Jiao et al. (2020)	38.5	29.9 – 47.4	98.7
Chehrehgosha et al. (2021b)	38.9	30.3 – 47.9	99.2
Ling et al. (2019)	39.2	30.6 – 48.1	99.1

Each row represents the results of the meta-analysis if that study were excluded.

2.5.9 Meta-analysis of the prevalence of pre-frailty

The 12 studies included in the meta-analysis of the prevalence of pre-frailty comprised 5560 older adults admitted to hospital. This gave rise to a pooled estimate of the prevalence of pre-frailty of 36.3% (95% CI 19.9 – 49.9%). Again, statistical heterogeneity was high, indicated by an the I^2 of 99.3%. On sensitivity analysis, removal of each study one-by-one resulted in less than 4% variation the overall pooled estimate and no major change in the I^2 statistic. This analysis can be found in Table 5.

Figure 9. Forest plot depicting the prevalence of pre-frailty and pooled prevalence estimate with studies ordered by ascending prevalence



CI, Confidence Interval. Prevalence figures are reported as a proportion of the total sample.

Table 5. Sensitivity analysis for the meta-analysis of pre-frailty prevalence

Excluded study	Pooled estimate of pre-frailty prevalence (%)	95% Confidence Interval (%)	Higgins I^2
Ji et al. (2022)	34.2	16.5 – 49.5	99.3
dos Santos Tavares et al. (2015)	34.7	17.5 – 49.2	99.3
Oliveira et al. (2013)	34.8	18.3 – 49.2	99.2
Nguyen et al. (2020a)	35.1	20.0 – 48.1	99.1
Li et al. (2020)	36.0	18.4 – 50.6	99.3
Chehrehgosha et al. (2021b)	36.3	19.2 – 50.9	99.2
Yang and Chen (2018)	36.5	18.7 – 51.6	99.1
Zou et al. (2018)	37.1	19.3 – 51.8	99.3
Öztürk et al. (2017)	37.2	20.2 – 51.2	99.2
Adebusoye et al. (2019a)	37.7	20.0 – 52.2	99.2
Hong et al. (2019)	37.9	19.8 – 52.7	99.3
Ling et al. (2019)	38.3	23.7 – 50.2	98.9

Each row represents the results of the meta-analysis if that study were excluded.

2.5.10 All-cause mortality and frailty status

The majority of included studies were cross-sectional by design so did not report follow-up outcomes. However, there were eight prospective cohort studies of that did follow-up patients and report outcomes by frailty status. Two of these did not report mortality, only rates of readmission (Chehrehgosha et al., 2021b, Nguyen et al., 2020a). With only six studies and due to a high degree of methodological heterogeneity (especially in the duration of follow-up), meta-analysis was not possible. It was not possible to calculate standardised mortality rates because all studies reported outcomes at different durations of follow-up and only two reported median survival time. The extracted variables are summarised in Table 6.

Table 6. All-cause mortality by frailty status in included prospective cohort studies

Author (year)	**Participants followed-up N (%)**[1]	**Follow-up duration**	**All-cause mortality N (%)**[2]		
			Non-frail/ robust	**Pre-frail**	**Frail**
Adebusoye et al. (2019a)	450 (100.0)	In-hospital mortality	11 (16.9)	16 (16.0)	72 (25.3)
dos Santos Tavares et al. (2015)	247 (96.9)	In-hospital mortality	0 (0.0)	5 (3.7)	3 (4.5)
Hao et al. (2019)	271 (86.6)	36 months	20 (14.5)	-	38 (28.6)
Khandelwal et al. (2012)	250 (100%)	In-hospital mortality	0 (0.0)	-	5 (6.0)
Kizilarslanoglu et al. (2017)	122 (100%)	6 months	27 (45.8)	23 (62.2)	19 (73.1)
Pinheiro et al. (2021)	204 (99%)	6 months	9 (11.4)	-	52 (40.9)

[1]Percentage is equivalent to the follow-up rate, the proportion of the original cohort for whom follow-up data were available. [2]The percentage of participants who died as a proportion of the total in that group (e.g. number of frail participants who died/ number of frail participants x 100).

Although the rates could not be calculated, the absolute number of deaths from any cause was higher in the frail (range 4.5 – 73.1%) than in non-frail/ robust (range 0.0 – 45.8%) and pre-frail groups (3.7 – 62.2%). The differences between frail and non-frail groups were more pronounced in the studies with longer follow-up durations than in those that only looked at in-hospital mortality. Kizilarslanoglu et al. (2017) found the highest mortality overall which is unsurprising given that their study was based in an Intensive Care Unit and likely represents a generally more unwell population. Median survival time from admission to death in this particular study was 23 days amongst older people with frailty compared with 31 days and 140 days in the pre-frail and non-frail groups respectively (Kizilarslanoglu et al., 2017).

Adebusoye et al. (2019a) also reported the overall median survival time from admission to hospital for their cohort of older adults (36 days) but did not give a breakdown by frailty status.

2.5.11 Risk of bias in included studies

Two articles met inclusion criteria for this systematic review, but were excluded from the meta-analysis for the prevalence of frailty due to methodological heterogeneity and concerns they were not clear enough comparators for the other included studies:

1) The study by Kizilarslanoglu et al. (2017) was excluded from the meta-analysis on the basis it used an unusually high cut-off (>0.4 rather than the more usual >0.25) to define frailty in the index. Furthermore, this was the only study that looked solely at patients in ICU. All patients on specialty wards are in some senses *"selected"* from the general inpatient population based on their clinical characteristics and thus is it expected that rates of frailty will vary from ward-to-ward. Though older people admitted to the Intensive Care Unit were not excluded from this review per se, without any other comparable studies there was a concern that this Kizilarslanoglu et al. (2017) may represent an outlier.
2) The study by Yin et al. (2018) did meet the inclusion criteria for this systematic review but only recruited older people with a hospital stay of greater than seven days. There was concern that this may have led to an overestimation of the prevalence of frailty compared with the general inpatient population and thus it was excluded from the meta-analysis.

For the remaining studies which were included in the meta-analysis of the prevalence of frailty and pre-frailty, the risk of bias assessment highlighted several factors which could potentially impact prevalence estimates in individual studies.

Six studies were highly inclusive in their recruitment, only excluding older people who were haemodynamically unstable, had reduced conscious level, refused to participate or were completely unable to communicate and lacked an informant (Adebusoye et al., 2019a, Hao et al., 2019, Jiao et al., 2020, Kizilarslanoglu et al., 2017, Pinheiro et al., 2021, Yang and Chen, 2018). On the other hand, several of the remaining studies had a risk of selection bias due to restrictive inclusion criteria. Most of the exclusions were for practical reasons around consent or ability to complete assessments; however they may have led to an underestimation of the prevalence of frailty. Such exclusion criteria included:

- Terminal illnesses (Chehrehgosha et al., 2021b, dos Santos Tavares et al., 2015, Hong et al., 2019, Nguyen et al., 2020a, Oliveira et al., 2013, Pinheiro et al., 2021, Vu et al., 2017), in some cases excluding older people with cancer specifically (Nguyen et al., 2020a, Yu et al., 2022, Hong et al., 2019).
- Cognitive impairment, either acute, or as a result of an established diagnosis of dementia was also a common criterion for exclusion (dos Santos Tavares et al., 2015, Hong et al., 2019, Ji et al., 2022, Li et al., 2020, Liang et al., 2019b, Öztürk et al., 2017, Xu et al., 2020, Yin et al., 2018, Zou et al., 2018). Reasons for this were concerns around consent, inability to answer questions and inability to follow instructions required for assessments. Other studies circumvented the first and second of these issues by using proxies/ informants.
- Mobility problems were another common reason for exclusion, either because the older person was acutely unwell and bedridden (Ling et al., 2019, Öztürk et al., 2017, Yin et al., 2018, Yu et al., 2022), or because they had longstanding mobility problems due to stroke (dos Santos Tavares et al., 2015, Hong et al., 2019, Khandelwal et al., 2012, Li et al., 2020), Parkinson's Disease (dos Santos Tavares et al., 2015, Khandelwal et al., 2012, Li et al., 2020, Öztürk et al., 2017), other neurological disease (Oliveira et al., 2013, Öztürk et al., 2017), amputation (Oliveira et al., 2013, Xu et al., 2020) or other causes of disability (dos Santos Tavares et al., 2015, Hong et al., 2019, Oliveira et al., 2013).
- Sensory impairments, either of hearing or of vision, were also a common reason for exclusion (dos Santos Tavares et al., 2015, Hong et al., 2019, Ji et al., 2022, Liang et al., 2019b, Vu et al., 2017, Zou et al., 2018).

As has been discussed elsewhere in this thesis, older people with frailty were particularly vulnerable to COVID-19 and were more likely to suffer from severe illness requiring admission. Studies that did not exclude older people with COVID-19 in the early phase of the pandemic, or at least did not report the proportion with the disease, risk overestimating the frailty burden. Three studies had data-collection periods which coincided with phases of the pandemic prior to vaccine rollouts. Ji et al. (2022) recruited participants from June 2020 to January 2021, and Yu et al. (2022) from March 2020 to February 2021 though neither paper makes any reference to COVID-19. Pinheiro et al. (2021) collected data from December 2019 to May 2020, then again from November 2020 to January 2021, with an interruption due to the pandemic. However, they excluded patients on the respiratory support unit which included all of those with COVID-19 (Pinheiro et al., 2021).

Coverage bias is a common feature of cross-sectional studies using consecutive sampling. This occurs when people who are admitted for shorter periods are missed because they are well and discharged, are transferred for specialist care, or because they die early in their admission. In this context, this could result in prevalence figures which do not include the most robust and the frailest individuals. To some extent, this is unavoidable, and it is therefore best practice to report the number of participants included as a proportion of total admissions. This figure was provided only in a minority of the included articles (dos Santos Tavares et al., 2015, Liang et al., 2019b, Pinheiro et al., 2021, Vu et al., 2017, Xu et al., 2020, Yang and Chen, 2018).

2.6 Discussion

This systematic review identified 22 eligible studies which have examined the prevalence of frailty and pre-frailty amongst hospital inpatients aged 60 years and over in LMICs. Pooled estimates of the prevalence of frailty and pre-frailty were 37.3% and 36.3% respectively, and amongst the handful of studies that reported outcomes, all-cause mortality tended to be higher in the frail groups. This review has also highlighted the relative paucity of data, as included studies were all conducted in middle-income countries, and more than half were from China.

There are a number of existing reviews that have sought to estimate frailty prevalence amongst hospital inpatients. Perhaps the most comprehensive was performed by Doody et al. (2022), whose meta-analysis included 460,000 geriatric inpatients. This produced pooled estimates for the prevalence of frailty and pre-frailty of 47.4% (95% CI 43.7–51.1%), and 25.8% (95% CI 22.0–29.6%) respectively (Doody et al., 2022). In both Doody et al.'s review and the present investigation, over 70% of older inpatients were on the spectrum of frailty.

However, they found that a greater proportion of these were frail rather than pre-frail. There are a few major differences between the studies included in that review and the present investigation which may go some way towards explaining this difference. First, most studies in the present review which reported prefrailty used the phenotype (n=8/12), or FRAIL scale (n=2/12), both measures which tend to produce lower prevalence estimates than other tools. If more studies had utilised multidimensional or global assessment tools, it is quite likely the estimates of prefrailty prevalence would have been higher. Second, the participants in the 96 studies included in Doody et al.'s review – 91 of which were from HICs – were considerably older that those in the present review, thus potentially skewing more towards the frail end of the spectrum.

High heterogeneity was present in this investigation and is a common theme amongst other meta-analyses on this topic (Doody et al., 2022, Boucher et al., 2023). Given the array of tools for frailty assessment, and the vastly different contexts in which they have been applied, this is hardly surprising. Heterogeneity can even be considerable between studies which utilise the same tool to assess frailty prevalence, depending on how that tool is operationalised. For example, the frailty phenotype is often modified, affecting both prevalence estimates and its ability to predict adverse outcomes (Theou et al., 2015). The lack of a consensus definition for frailty certainly poses a major challenge when synthesising evidence and is sometimes decried as a weakness of the construct. However, this diversity in the understanding of frailty may also prove to be a major advantage when applying it to new settings, allowing for its adaptation for different sociocultural contexts.

In clinical practice, one of the strengths of frailty as a construct has been its ability to predict who is at greatest risk of adverse outcomes. In this systematic review of older inpatients in LMICs, the absolute number of deaths was higher amongst those with frailty, than those without, in the studies that reported this outcome. However, only six studies reported mortality. There are two other existing reviews that have looked at outcomes in relation to frailty status amongst inpatients, with both finding that it is associated with greater all-cause mortality (Boucher et al., 2023, Cunha et al., 2019). In these two studies, the relative risk of dying was two to three times higher for frail individuals than for their non-frail counterparts, and up to eight times higher during hospital admission (Boucher et al., 2023, Cunha et al., 2019). However, once again these data overwhelmingly reflect the experiences in high-income settings and the present review highlights how little is known about outcomes amongst older inpatients in LMICs.

There are a number of limitations to this systematic review and meta-analysis. Firstly there were several limitations to the search and inclusion criteria. LMICs were searched by name based on their World Bank classification as of July 2022 and this raises the possibility that studies which has changed status may have been missed. The eligibility criteria were restricted to whole ward populations, thus excluding many articles where participants were recruited on the basis of a specific disease. Though this was done out of concern that the prevalence of frailty differs in different conditions, cumulatively these data may have been informative. Similarly, the focus on observational studies may also have led to missing experimental research in which frailty prevalence was assessed pre-intervention.

Furthermore, during the screening process a number of potentially eligible articles could not be obtained and thus potentially informative data were not included. For the full-texts that were obtained, Google Translate software was used to convert three in to English to assess eligibility, risk of bias and to extract data (Ling et al., 2019, Yalinkilic et al., 2020, Diaz-Toro et al., 2017). This was done in the interests of inclusivity but introduces a greater risk of error than there would be with the gold standard of professional translation which was not performed due to resource limitations.

The small number of included studies were highly heterogeneous and the Confidence Intervals for the pooled prevalence of frailty and pre-frailty were broad. There was huge disparity in sample sizes between studies with the largest being almost 10,000 (Jiao et al., 2020) and the smallest consisting of just 99 individuals (Oliveira et al., 2013). While the inverse variance method of meta-analysis would have heavily weighted in favour of this largest study, the double arcsine transformation produced nearly equal weightings.

Due to the low number of included studies, it was not possible to conduct further subgroup analyses that may have provided further useful information, for example examining the relationships between frailty prevalence and age, sex, method of assessment, specialty ward and whether patients were admitted on an unplanned or elective basis. The aim of this review was to summarise existing literature regarding the prevalence of frailty amongst older people admitted to hospital in LMICs. However, due to the paucity of literature, the pooled estimates of frailty and pre-frailty prevalence reflect only the experiences of middle-income settings and China in particular.

2.7 Summary

This chapter has reported the systematic review and meta-analysis of the prevalence of frailty amongst older hospitalised adults in LMICs. While the pooled estimates produced suggest that frailty and pre-frailty are prevalent, this estimate is based on literature that is concentrated in China, and to a lesser extent Brazil. This review highlights the paucity of studies from sub-Saharan Africa, and the lack of outcomes data. With this in mind, the next section outlines the research question, aims and objectives guiding this thesis.

Chapter 3. Research questions and study aims

3.1 Overall research question

The overarching question this mixed methods PhD research sought to answer was: *"What is the extent of frailty amongst older adults admitted to hospital in northern Tanzania, and what are the experiences and implications of admission in this context?"*

Arising from this were several sub-questions, some of which were best answered using quantitative methods, others with qualitative approaches, and some through the synthesis of data of both kinds.

3.2 Quantitative research questions

What is the prevalence of frailty amongst older adults in this setting?

What are the demographic and clinical characteristics of older adults with frailty?

What are the outcomes for older adults with frailty in this setting?

The aim of this portion of the study was therefore to establish the prevalence, demographic characteristics, clinical characteristics and outcomes of older people with frailty admitted to hospital in northern Tanzania.

3.3 Qualitative research questions

How is the journey of hospital admission experienced by older people with frailty and those caring for them?

What are the needs of older people in hospital in this context, and to what extent are they being met?

What elements of hospital care for older people work well, and what could be improved?

The associated aims were 1) To explore the context of clinical outcomes with reference to the experiences and needs of hospitalised older people with frailty, from the perspectives of both service users and service providers; and 2) To identify barriers and facilitators to effective care.

3.4 Mixed research questions

These final sub-questions were best answered by the triangulation and synthesis of both quantitative and qualitative data. Their practical focus reflects both the author's clinical background, and the priorities of local clinical leaders consulted throughout this research.

Can, and should, frailty screening and assessment be used in this setting?

What might interventions to improve care look like, now within current resource constraints, and in the future?

The associated aim was to synthesise quantitative and qualitative strands, and to share findings with local Tanzanian stakeholders, in order to identify potential areas for intervention and future research needs.

Chapter 4. Methodology and methods

4.1 Chapter introduction

In this chapter, the methodology and methods adopted to answer the research question are described. This begins with a discussion of the theoretical principles that guided this research including the philosophical standpoint of critical realism, the use of systems thinking and a mixed methods approach. This is followed by a description and justification of the specific techniques and tools used to collect, analyse and interpret the quantitative and qualitative data.

4.2 Philosophical standpoints

As researchers, our assumptions about the nature of reality (ontology), and how knowledge is acquired (epistemology), are fundamental to our study designs and interpretations of the data. Failing to explicitly recognise and acknowledge our philosophical positions, or applying pragmatism uncritically, can lead to incoherence and threaten the validity of the resulting arguments (Lipscomb, 2008). What follows is a brief exploration of reasoning behind the adoption of a mixed methods approach and the ontological and epistemological standpoints that have guided this research.

4.3 Rationale for mixed methods

Mixed methods research is an approach that seeks to answer questions through the collection and synthesis of both quantitative and qualitative data (Allison and Joanna, 2017). It was adopted early within the social sciences, particularly anthropology, and has become increasingly popular in the health sciences since the 1990s (O'Cathain, 2009). The integration of qualitative and quantitative techniques is intended to draw upon the strengths of both methods whilst mitigating the weaknesses of the other, in order to provide a more comprehensive understanding of a research topic (Shorten and Smith, 2017).

As is outlined in the introduction of this thesis, frailty is a complex entity encompassing elements related to ageing, multimorbidity, disability, dependency and social vulnerability. Linda Fried and Kenneth Rockwood, who are from the United States and Canada respectively, are credited with popularising the frailty construct (Fried et al., 2001, Rockwood et al., 2005). Its application and evolution over the last 20 years has mostly occurred in healthcare systems in *"western"* countries. This PhD research considers frailty in a completely different cultural, socioeconomic and healthcare landscape to that in which it originated. To understand the *extent and experience* of frailty amongst older people admitted to hospital in northern Tanzania – a context in which frailty has not previously been applied – this study demanded a mixed methods approach.

Therefore, this PhD research incorporated both quantitative and qualitative elements. Quantitative assessment of the prevalence, characteristics and outcomes of frailty provided a way to understand the scale of the problem, to draw comparisons with existing literature and reflect on the use of frailty tools in this setting. Meanwhile complementary qualitative data collection regarding the experience of frailty gave the opportunity to triangulate this with the understandings and theories of local stakeholders, and to contextualise clinical outcomes through the experiences of participants (Timans et al., 2019, Shorten and Smith, 2017). Crucially for considering frailty in a new setting, the use of mixed methods also allowed for the emergence and exploration of unanticipated phenomena (Schrauf, 2017).

4.4 Critical realism

In conducting mixed methods research, one must also be mindful of its potential challenges. The process of synthesising and integrating quantitative and qualitative data can be particularly complex, requiring careful attention during study design to ensure proportionate weighting and ontological compatibility (Shorten and Smith, 2017, Lipscomb, 2008, Johnson and Onwuegbuzie, 2004). In considering how best to address these challenges in relation to this research, critical realism provided the most suitable framework. To understand why, it is important to outline the philosophical criticisms of mixed methods and the ways in which they have been addressed.

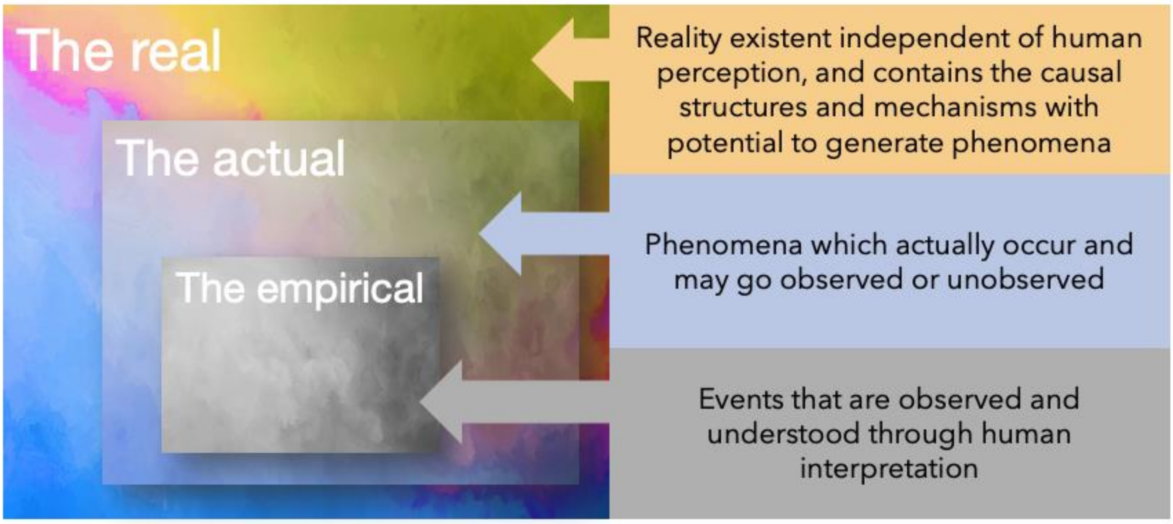
At one extreme, quantitative research may be underpinned by *positivism*. This philosophical standpoint emphasises an external objective reality. This leads to the conclusion that phenomena are best investigated through hypothetico-deductive cycles of value-neutral, and empirical data collection, with the aim of establishing causality and universal laws

(Sukamolson, 2007). At the other extreme, *interpretivism* holds that there are multiple realities which are socially constructed by individuals, and thus observations can only be understood qualitatively through interpretation within this subjective context (Alharahsheh and Pius, 2020). It has been argued by some that quantitative and qualitative approaches are therefore fundamentally incompatible (Howe, 1988, Lipscomb, 2008).

Nonetheless, mixed methods research has gained wide acceptance as a valid method of enquiry. To effectively sidestep ontological and epistemological concerns, mixed methods researchers have frequently adopted a pragmatic approach. Sometimes known as *Peircean pragmatism* (after Charles Sander Peirce who first proposed a version of it in the late 1800s), this proposes a third way between positivism and interpretivism by emphasising the importance of the reality of the natural world *and* of human experience (Peirce, 1905). This allows researchers to focus on whatever produces a desired outcome, whilst setting aside concepts that do not make a practical difference and selecting the methodologies which hold the best chance of answering their question (Allmark and Machaczek, 2018). However, this approach can feel unsatisfactory as it does little to address the challenges of integrating different types of data, and can lead to the selection of incommensurate methods (Lipscomb, 2008, Teddlie and Tashakkori, 2010).

Therefore, in this thesis, a critical realist approach was adopted. Critical realism, takes the view that reality is arranged in three levels (see Figure 10) (Bhaskar, 1979). Unlike the interpretivism, critical realism incorporates *"the real"*, a reality that is external to human perception (ontological realism) (Mukumbang, 2023). However, unlike positivism, this approach also holds that knowledge is a human product, mediated through theories and interpretations (epistemological relativism) (Fletcher, 2017, Lipscomb, 2008). While the causal structures and mechanisms of reality result in a variety of phenomena, termed *"the actual"*, our knowledge of these is restricted to the proportion that we can observe and interpret, known as *"the empirical"* (Lipscomb, 2008, Fletcher, 2017). This stratified ontology is particularly applicable to cross-cultural research because it acknowledges an independent reality but also values a multiplicity of contributions in the interpretation of observed events.

Figure 10. The ontological levels of critical realism



Adapted from (Fletcher, 2017, Mukumbang, 2023).

Methodological pluralism is fundamental to a critical realist approach (Lipscomb, 2008). In its stratified ontology, it is recognised that underlying causal mechanisms may produce different phenomena depending on the physical, social and environmental conditions and that these can be interpreted in different ways depending on the observer (Mukumbang, 2023). This supports the incorporation of multiple perspectives, methods and analytical techniques (Connelly, 2001). Hence, critical realism provides a highly suitable approach for mixed methods research and for the exploration of phenomena in different cultural settings, whilst overcoming many of the drawbacks of a pragmatic paradigm.

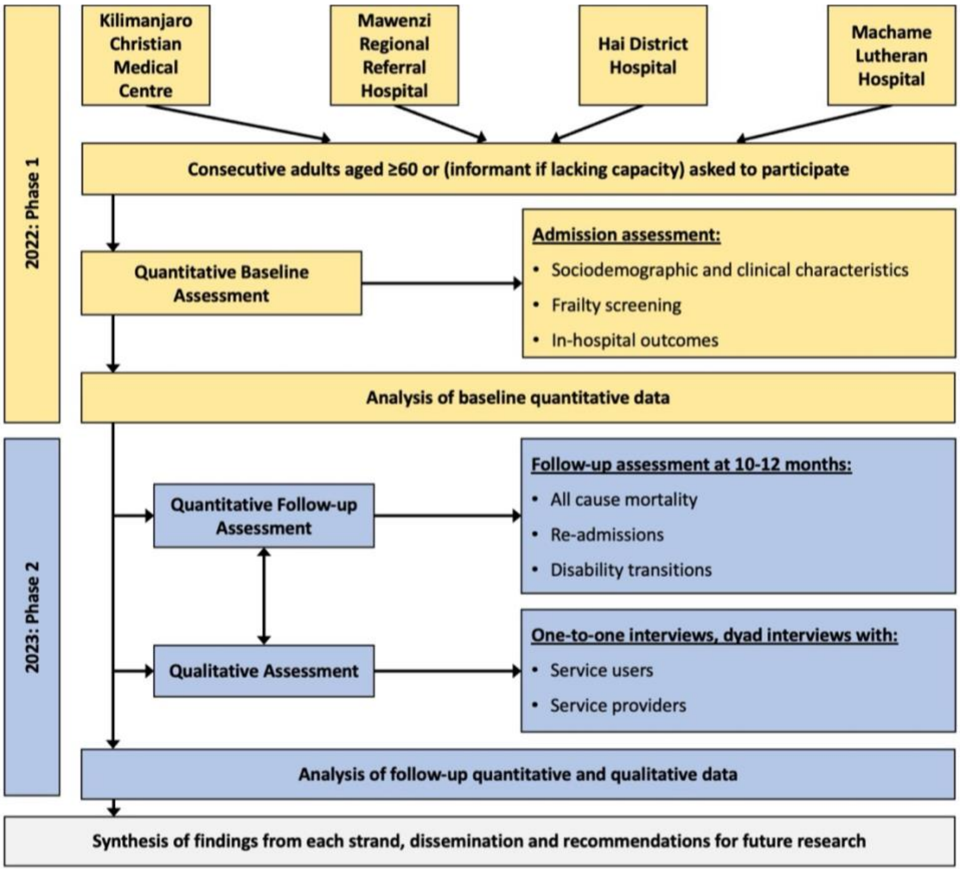
4.5 Systems-based approaches in healthcare research

In thinking about how to practically apply critical realism in the design of this study, systems-based thinking proved a valuable framework. The acute hospital admission of an older person is a complex system; that is to say it is composed of multiple interconnected elements, interacting in dynamic ways, to produce emergent outcomes that cannot be understood by examining components in isolation (Clarkson et al., 2017). Like critical realism, systems-based thinking emphasises the complexity of reality and the need to understand the interactions between underlying structures that shape the outcomes that are observed. This approach also encourages the use of mixed methods in this pursuit. *Engineering Better Care* (Clarkson et al., 2017) was a report produced in a collaboration between the Royal College of Physicians and the Royal Academy of Engineering in the UK. This report, and subsequent toolkit, outline practical approaches to understanding complex systems in healthcare (Clarkson et al., 2018). These tools were particularly valuable during the development of the qualitative strand of this study and their application is discussed further in Section 4.9.

4.6 Study design overview

In the design of mixed methods research, careful consideration must be given to the integration of quantitative and qualitative elements. This can occur at the level of the study design, methods and in the interpretation and reporting (Fetters et al., 2013). To establish the extent and experience of frailty amongst older people admitted to hospital in Tanzania, this study used an explanatory sequential design which is displayed in Figure 11 (Shorten and Smith, 2017). In the first phase, quantitate data were collected from a cross-section of older people recruited from four hospital sites: Kilimanjaro Christian Medical Centre (KCMC), Mawenzi Regional Referral Hospital (MRRH), Hai District Hospital (HDH) and Machame Lutheran Hospital (MLH). After the analysis of these data, participants were followed up to establish their longer-term quantitative outcomes and a purposive sample were recruited for semi-structured interviews, to explore the context of quantitative findings and give voice to the experiences of participants.

Figure 11. Overview of the mixed methods explanatory sequential (QUAN-qual) design



In addition to integration at the level of design, quantitative and qualitative data were also linked through the methods. This was achieved through *connecting,* which refers to shared sampling, and *building,* in which one dataset informs the collection of the other (Fetters et al., 2013). Service users interviewed for the qualitative strand were participants in the quantitative study, and service providers were healthcare professionals from participating wards. The quantitative analysis, which took place between the two phases, informed both the characteristics of interest for purposive sampling and the development of topic guides for the interviews. In the reporting and interpretation of the data, a *narrative contiguous* approach was used in which qualitative and quantitative results were presented and discussed in different chapters, with the overall key findings summarised together in the final chapter.

4.7 Research team recruitment, training and roles

This was a complex and ambitious study, involving collaboration between international institutions, and the recruitment of participants spread over a large geographical area. Given the multi-centre nature of the baseline quantitative data collection, and the simultaneous collection of quantitative and qualitative data during follow-up, it was often necessary to be in more than one place at a time. These factors necessitated the building of relationships with local clinical leaders and ward teams at participating hospitals, as well as the involvement of other researchers beyond author (SD). Tanzanian research colleagues played an important role, providing local expertise, language translation and acting as cultural brokers to ensure research tools and interactions were appropriate within the local context. In addition, intercalating medical students on the MRes programme at Newcastle University were engaged to support data collection and assist with the daily running of the study. While these individuals contributed meaningfully to the acquisition of data and ensured the smooth running of the project, author (SD) coordinated and led at every stage, and was independently responsible for all other aspects of the study, including the conceptualisation of research questions, development of data collection tools, data analysis, interpretation, synthesis and discussion of the work contained in this PhD thesis.

Tanzanian research colleagues were recruited by the author (SD), on the recommendations of Doctor Jane Rogathi, a Senior Lecturer at Kilimanjaro Christian Medical University College with whom UK supervisors had a longstanding research relationship. All Tanzanian research colleagues had previous experience of research collaborations between KCMC, the Hai District, Northumbria Healthcare NHS Foundation Trust and Newcastle University. MRes students were involved in the collection of data during baseline quantitative assessments in 2022 (Emily Bickerstaff, Luke Emmence, Sara May Motraghi-Nobes and George Rayers) and in 2023 during quantitative follow-up and qualitative interviews (James Hardy, Amie Murray and Theo Randall).

Training for all researchers was provided by the author (SD). This involved structured teaching sessions to give a grounding in frailty, the overall study design and the specific instruments that were to be used at each stage. Standard operating procedures for the completion of the various questionnaires and anthropometric measurements were taught, and both index and follow-up assessments were rehearsed with one another and volunteers. The standardised instructions for each questionnaire and anthropometric measurement were incorporated into the data collection tool, completed on an Android tablet, in an attempt to standardise measurements and ensure all participants received the same instructions. During practice, researchers became familiar with the data collection tools and became efficient in their use. It was also an opportunity to smooth out any problems with translations and the order and flow of assessments.

For the baseline cross-sectional study, a member of the clinical team on the wards at each site (namely Mary Chuwa, Fortunatus Kisheo and Elibariki Kisaruni) reported the number of new admissions each day to allow efficient allocation of the research teams' time. Two research teams travelled between sites to recruit participants and collect data. Having two teams allowed simultaneous data collection at multiple hospitals which were geographically distant. The first team covered KCMC and MLH, while the other covered MRRH and HDH. Two teams, rather than four, were used because of limitations in equipment, vehicles and research team members. Due to differences in the numbers of admissions between sites, the larger urban hospitals (KCMC and MRRH) were visited five days per week. Rural hospital sites (HDH, MLH), where there were fewer admissions, were visited roughly three times per week, with some flexibility built-in to account for fluctuations in the number of admissions.

For baseline assessment, each of the two teams consisted of a Tanzanian researcher (Godrule Lyimo, or Joseph Kilasara) who conducted the consent process and questionnaires with participants in Swahili. They were accompanied by one to two of the MRes students who provided transport and equipment, completed anthropometric measurements and uploaded data at the end of each day. Author SD liaised daily with each hospital, allocated where time would be spent, and alternated between teams to provide some overall consistency and quality control.

During follow-up, quantitative telephone interviews and questionnaires were conducted in Swahili by Godrule Lyimo and Joseph Kilasara based on a standardised data collection tool on an Android tablet. The training process for this new tool, and for the new MRes students, was the same as for the previous year. Author SD, and MRes students, managed the follow-up process by determining which participants should be called and when, and recording whether a participant had completed follow-up, or was lost to follow-up.

During the quantitative follow-up phone calls, SD and MRes students also identified service users with characteristics of interest during their baseline assessments to recruit to the qualitative study. Service providers for qualitative interviews were recruited by the same members of the clinical teams on participating wards in each hospital who had reported admission numbers (Mary Chuwa, Fortunatus Kisheo and Elibariki Kisaruni). Godrule Lyimo, Joseph Kilasara and Wema Msangi interviewed participants based on preset topic guides created by the author (SD). Author SD, or one of the MRes students, was present at each interview, driving to participant's homes, participating occasionally through intermittent translation and managing the recordings. Interviews and the translation process are described in more detail in section 4.9.

4.8 Quantitative methods

A multicentre cross-sectional design, with a follow-up phase, was chosen for the quantitative strand of this mixed methods research. This was selected so that the prevalence of frailty could be assessed and related sociodemographic and clinical characteristics could be explored. After this, participants could be followed up to assess clinical outcomes by frailty status. A multi-centre approach was taken to increase generalisability of findings by reflecting a range of hospitals, both large and small, private and public, urban and rural. Older people were then consecutively recruited from these hospital sites. Data from this stage of the study, and thus some of the content from this methods section, has been published in Davidson et al. (2024a) and has appeared in conference presentations (Davidson et al., 2023b, Davidson et al., 2023a, Davidson et al., 2023c, Davidson et al., 2024d, Moore et al., 2024).

4.8.1 Setting

Participants were recruited from four hospital sites selected to reflect the range of healthcare settings and resources available in Tanzania (see Figure 12). These were:

1. *Kilimanjaro Christian Medical Centre (KCMC)*, a large Zonal Level University hospital on the outskirts of the town of Moshi (population approximately 220,000 people), owned by a private non-profit organisation called the Good Samaritan Foundation and supported by Lutheran and Catholic denominations. It benefits from significant

international input and investment. The two participating male and female medical wards had a total capacity of 75 beds.

2. *Mawenzi Regional Referral Hospital (MRRH)*, a large government-run Regional Level hospital in the urban centre of Moshi. Participating male and female medical wards comprised a total of 49 beds.
3. *Hai District Hospital (HDH)*, a small urban government-run District Level facility in the small, but rapidly growing, town of Boma Ng'ombe (population approximately 13,000). Participating male and female general wards totalled 60 beds.
4. *Machame Lutheran Hospital (MLH)*, a small District Level rural facility in the foothills of Kilimanjaro, owned and operated by the Evangelical Lutheran Church of Tanzania. Male and female general wards participating in this study had 49 beds in total.

Figure 12. Location and photographs of participating hospital sites

Participating hospital sites: 1. *Kilimanjaro Christian Medical Centre (one of several courtyards with surrounding wards); 2. Mawenzi regional Referral Hospital (main concourse and laboratory); 3. Hai District Hospital (female ward); 4. Machame Lutheran Hospital (central courtyard with surrounding wards).*

4.8.2 Participants and recruitment

All consecutive adults aged ≥60 years, admitted to selected medical and general wards at the four hospital sites, over a period of six months, were invited to participate. Those with capacity were included if they agreed to participate, while those lacking capacity were still eligible for inclusion if an informant assented on their behalf. An informant was defined as a person aged ≥18 years, who knew the patient well, and was not acting in a paid or professional capacity. People were excluded if they were less than 60 years of age, refused to participate, or lacked capacity *and* an informant. It was the aim that all participants be seen and assessed within the first 72 hours of admission. For individuals who met inclusion criteria but did not participate, the main reason for non-participation was recorded. Furthermore, limited non-identifiable data (age and sex) were also recorded about older people who were eligible but not included to ensure those enrolled in the study were representative of the broader eligible population.

A power calculation was performed using the following standard formula for the estimation of required sample size in prevalence studies (Daniel and Cross, 2018):

$$n = \frac{Z^2 \, P \, (1 - P)}{d^2}$$

Variables in the equation were the 37% pooled estimate for the prevalence of frailty from the systematic review in this thesis (P), a desired precision of ± 5% (d) and a Confidence Interval of 95% (for which Z=1.96). This led to a target sample size of 359 individuals. Based on prior admission figures from a study which screened for delirium across all wards in KCMC, it was estimated there may be up to 1200 admissions of people aged 60 years and over across the four hospital sites over a six month period (Lewis et al., 2016).

4.8.3 Data collection: baseline assessment

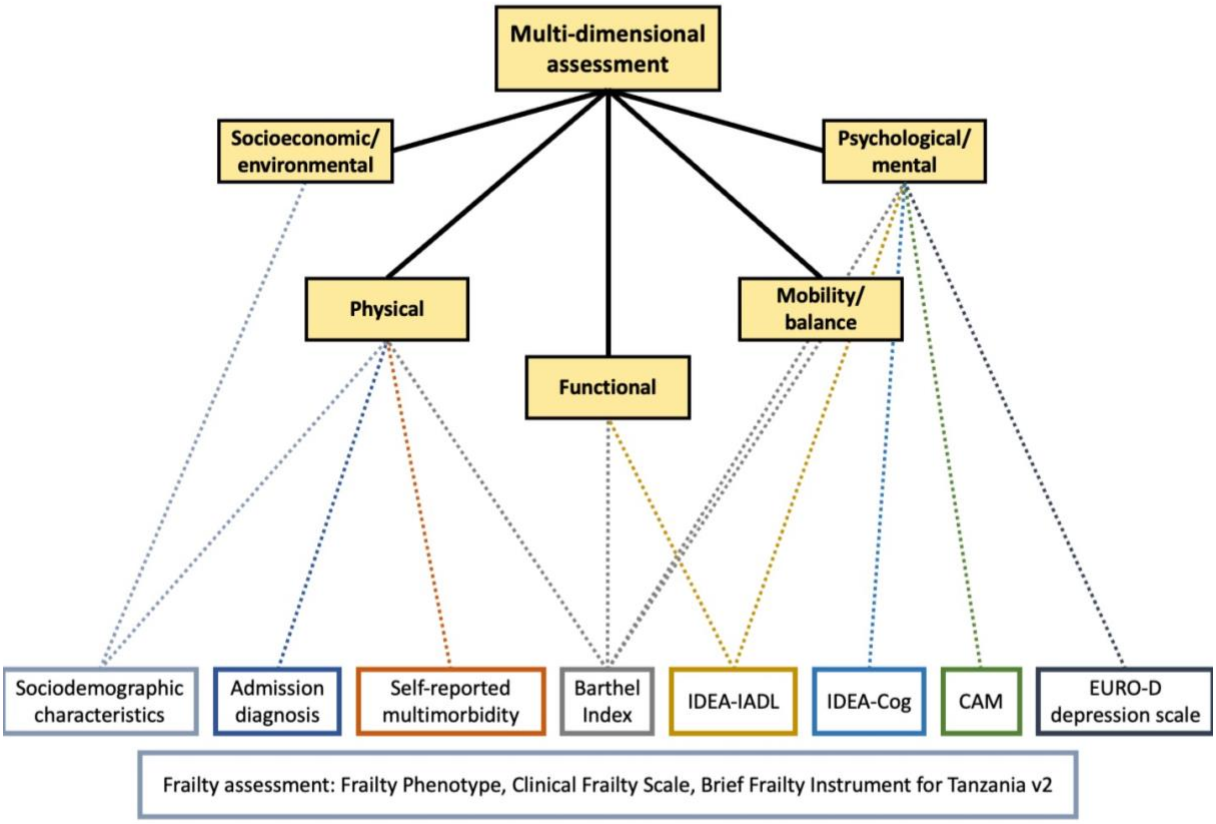
Data were collected on handheld Android tablets using Kobo Toolbox (Kobo Inc, Cambridge, MA, USA). This open-source software has been widely used by global health researchers and humanitarian organisations. It was used to build a standardised proforma, with questions and answers in a consistent format which could be switched between English and Swahili.

Compulsory fields, drop-down menus and restrictions on what could be entered were used to minimise the risk of variability and input errors.

Participants were assessed using a standardised proforma based around the domains of the Comprehensive Geriatric Assessment (CGA). This included the collection of sociodemographic and clinical characteristics pertinent to Tanzania and to frailty. The components of this multi-dimensional assessment, and how they relate to elements of the CGA, are summarised in Figure 13. Existing Swahili translations were already available for all questionnaires used. However, other elements of the Kobo Toolbox proforma were translated specifically for this project.

Recruitment was timed for the six-month period from March to August 2022. This was primarily due to the availability of research team members during this time. In Tanzania, the seasonal rains are heaviest between March and June, September and November. The rest of the year is relatively dry and temperatures peak in February. Clinical leaders at participating hospitals anecdotally reported periods of lower hospital attendances during harvests (important periods economically, varying throughout the year depending on crop) and rainy seasons (due to access problems). Many communicable diseases from malaria, to respiratory and gastrointestinal infections are also climate-sensitive and may affect admission rates through the year (Bishop-Williams et al., 2018). Although little has been published in the literature regarding seasonal trends in hospital attendance in Tanzania, in the similar climate of neighbouring Uganda admission rates tend to be higher during the dry season (Bishop-Williams et al., 2018).

Figure 13. Components of the baseline multi-dimensional assessment



Dotted lines indicate which component of the multi-dimensional assessment corresponded to each domain of the Comprehensive Geriatric Assessment. Frailty measures are not linked to specific domains because they span all of them to varying degrees. IDEA-Cog; Identification and Intervention for Dementia in Elderly Africans Cognitive screen. IDEA-IADL; Identification and Intervention for Dementia in Elderly Africans Instrumental Activities of Daily Living scale. CAM, Confusion Assessment Method.

Frailty was assessed using three different instruments. A variety were selected to maximise comparability with existing literature and to compare and contrast different frailty constructs in this setting. The three selected were:

1. *The Frailty phenotype*, a measure of physical frailty, was chosen because variations of Fried's original are the most widely used in studies of prevalence worldwide (Doody et al., 2022, Fried et al., 2001). A version of the FP has previously been successfully used in the community in the Hai District, an area served by the hospitals in the present investigation (Lewis et al., 2018a). The details of the operational criteria used for the phenotype can be found in Table 7. As in Fried's original, it was intended that number of items for which frailty criteria were fulfilled would determine frailty classification with 0-1 as *"Robust"*, 2 as *"Pre-frail"*, and 3-5 as *"Frail"*.

2. *The Clinical Frailty Scale (CFS),* a judgement-based visual instrument, was chosen because of its extensive use around the globe, particularly in hospital settings, and its previous use in the community in Tanzania (Church et al., 2020, Rockwood et al., 2005, Lewis et al., 2019). It was of particular interest because of its successful application in acute settings. The 2007-2009 version of the phenotype, (depicted in Figure 5) was used because this version had an existing Swahili translation and had been applied in the community study in Tanzania. For the purposes of analysis, participants were dichotomised so that those scoring 0-4 were categorised as *"Non-frail"* and 5-9 as *"Frail"* in a manner that is common in the comparable literature (Pinheiro et al., 2021, Nguyen et al., 2020a, Xu et al., 2020, Liang et al., 2019b). Note that this method of dichotomisation does include *"Terminally ill"* within the *"Frail"* category to maximise comparability with other tools which do not have an equivalent. Though it may be argued that one can be terminally ill without being frail, individuals with a CFS score of 9 typically exhibit profound functional decline and physiological vulnerability that can be a challenge to differentiate from frailty as it is conceptualised in both clinical practice and research.
3. *The Brief Frailty Instrument for Tanzania version 2 (B-FIT2)* is a tool developed specifically for screening older adults in the community in Tanzania (Gray et al., 2017, Lewis et al., 2020b). It was derived from a 40-item frailty index based on data from 1,198 adults from the Hai District Surveillance Site. The original B-FIT consisted of the Barthel Index and the IDEA-Cog scales and was correlated with mortality and dependency over a three-year follow-up period ($r=0.502$, $p<0.001$) (Gray et al., 2017). During external validation in a separate frailty-weighted sample of 235 community-dwelling older adults, the diagnostic accuracy of the B-FIT (compared with CGA) was improved by the addition of three further items. These were calf circumference, distance vision and a question about community activities. The optimal cut-off score (≥8/20) gave the tool 86.2% sensitivity and 88.8% specificity (Lewis et al., 2020b). The items and scoring of the B-FIT2 are summarised in Table 8.

Although researchers were not formally blinded to participant frailty status according to each scale, when conducting assessments, care was taken to try and keep the measurements independent. The CFS was conducted by researchers at the end of the multidimensional assessment based on their global impression and inevitably this was influenced by other components of the multi-dimensional assessment. However, the quintiles used to define the frailty criteria for hand grip strength and gait speed items of the phenotype were set later at the analysis stage, so phenotypic frailty status was unknown. Furthermore, the components of the B-FIT2 were dispersed, with the overall scores only being calculated during analysis to limit any effect on the CFS.

Table 7. Frailty phenotype methods and criteria, reproduced from Davidson et al. (2024a)

Phenotype item	**Description and frailty criteria**
Weak hand grip strength	Hand grip-strength (HGS) was assessed with the participant sat with their arm in 90 degrees of flexion by use of a JAMAR hydraulic hand dynamometer (Model J000105, Lafayette Instruments, Lafayette, IN, USA). The highest reading from a total of three measurements on each side was recorded. The lowest quintile (≤9 kg for males, ≤4kg for females) was used to define frailty.
Slow walking speed	The time taken for participants to walk 4.5m, at their usual pace and with their usual walking aids, was recorded. The slowest quintile (≥22 seconds) was classified as frail for this item.
Self-reported exhaustion	Participants were read verbatim Swahili translations of the statements “I felt everything I did was an effort” and “I could not get going” from the CES-D (Orme et al., 1986). They were asked to give one of a range of prescribed responses considering a usual week, rather than the last week, to avoid the confounding acute illness effect. This frailty criterion was met if participants answered either “a moderate amount of the time” or “most of the time” to either statement.
Weight loss	A verbatim Swahili translation of the question *“Have you lost weight during the last 3 months?”* from the Mini-Nutritional Assessment Short-Form (MNA-SF) was read to participants (Rubenstein et al., 2001). This frailty criterion was met if they answered: *“Weight loss greater than 3kg”,* or *“Weight loss between 1 and 3kg”*.
Low physical activity	Participants were asked a translation of the question “*On how many days do you do moderate physical activities like gardening, cleaning, bicycling at a regular pace, swimming or other fitness activities?”* from the International Physical Activity Questionnaire (Craig et al., 2003). As with the CES-D, participants were asked to consider a usual week, rather than the last week. This frailty criterion was met if participants answered *“0”*.

Table 8. Components and scoring of the B-FIT2

B-FIT2 component description	Categories	Scoring
Modified Barthel Index: This measure of ADLs is described in more detail below.	19-20 Mild/ no disability	0
	15-18 Moderate disability	3
	0-14 Severe disability	9
IDEA-Cog: This cognitive test is described in more detail below.	8-12 No impairment	0
	5-7 Possible impairment	1
	0-4 Probable impairment	2
Calf circumference: Maximum circumference measured with a tape measure to nearest 0.1cm over bare skin with the participant standing where possible (Kaiser et al., 2009).	≥31cm	0
	31cm	3
Community activities: Question from the WHO Disability Assessment Schedule *"In the past 30 days, how much of a problem did you have in joining in community activities (for example, festivities, religious or other activities) in the same way as anyone else can?" (Ustün et al., 2010).*	No, mild or moderate problems	0
	Severe or extreme problems	5
Distance vision: Question from the WHO Disability Assessment Schedule *"In the last 30 days, how much difficulty did you have in seeing and recognizing a person you know across the road (i.e. from a distance of about 20 meters)?" (Ustün et al., 2010).*	No difficulties	0
	Difficulties	1

Brief Frailty Instrument for Tanzania v2 weightings reproduced from (Lewis et al., 2020b); IDEA-Cog, Identification and Intervention for Dementia in Elderly Africans Cognitive screen.

Several clinical variables were assessed to build a picture of the characteristics of the older people being admitted. These included the diagnoses documented by the admitting physician, and whether these were communicable, or non-communicable, diseases. It also included COVID-19 status as index assessment took place in 2022 in the wake of the omicron wave, though by this stage lateral flow and polymerase chain reaction testing were widely available and rates of vaccination had improved since the early pandemic. Finally, participants were asked *"What medical diagnoses/conditions did you have before coming to hospital?"* from a list of 16 categories from the Study of Global AGEing and Adult Health

Questionnaire (diabetes, hypertension, cataracts, stroke, heart disease, chronic respiratory, tuberculosis, arthritis, stomach bowel or liver problems, dementia, depression, epilepsy, chronic renal failure, cancer, HIV or other diagnoses) (Kowal et al., 2012). Self-reported multimorbidity was defined as the presence of two or more conditions from this list. While multimorbidity was primarily self-reported, triangulation was undertaken using the notes of the admitting physician and participant's medication lists. Using this information, conditions that participants did not recall, but were present in the medical notes, could be added to improve accuracy.

To assess participants functional status, two questionnaires were used. The first was the Modified Barthel Index, a scale in which participants, or their informants, rated their level of independence for 10 Activities of Daily Living (including mobility, dressing, bathing etc.) (Collin et al., 1988). Scores range from 0-20, with lower scores indicating greater dependency. This tool has an existing Swahili translation which has previously been used in Tanzania (Lewis et al., 2018a). In this version, the item *"Is the older person able to walk upstairs?"* was adapted to include *"or a steep hill?"*, as most people in Tanzania do not have stairs in their homes. To aid aspects of the analysis, ADL disability was defined as scoring a zero for one or more items.

The second questionnaire used to measure functional status was the Identification and Intervention for Dementia in Elderly Africans Instrumental Activities of Daily Living scale (IDEA-IADL). This was developed locally through focus groups, with older people living in the community, to assess culturally specific aspects of social functioning that may be impacted by impaired cognition. Examples of these IADLs include settling conflicts, teaching traditions and supervising children (Collingwood et al., 2014). Each of the 11 items is scored from 0-3 with responses ranging from "*Cannot do this"* to *"Can do this with no difficulty"*. Total scores range from 0-33 with lower scores indicating greater difficulties. For both the Barthel and the IDEA-IADL, participants and their informants were asked to rate their usual function 30-days prior to admission to try and establish a baseline, rather than the effects of the acute illness. To aid aspects of the analysis, IADL disability was defined as having a zero for one or more items on the IDEA-IADL.

Cognition was measured using the Identification and Intervention for Dementia in Elderly Africans Cognitive screen (IDEA-Cog) (Gray et al., 2014). This scale was developed in the community in Tanzania, before external validation in inpatients and outpatients in Nigeria and Tanzania (Paddick et al., 2015, Paddick et al., 2018). It requires participants to remember ten words (delayed recall), describe a bridge (abstract reasoning), name animals (verbal fluency), name the village leader (long-term memory) and provide the day of the week (orientation). An additional item involving the arrangement of matchsticks (praxis) was in the original scale, but this was omitted from the B-FIT2 and in the present study. This was because of concerns about the practicalities of performing this in the hospital environment and the potential to disadvantage posed to older people with visual impairment (Gray et al., 2017, Lewis et al., 2020b). The IDEA-Cog was conducted near the beginning of the multi-dimensional assessment to ensure participant's attention and limit the effects of fatigue.

Though the IDEA-Cog demonstrates no educational bias, in previous studies it has not differentiated well between delirium and dementia (Paddick et al., 2018). Thus, the Confusion Assessment Method (CAM) was also conducted. This well-established tool is based on the diagnostic criteria for delirium from the Diagnostic and Statistical Manual of Mental Disorders, and has previously demonstrated good sensitivity and specificity for the detection of delirium in hospitals in Tanzania (Inouye et al., 1990, Paddick et al., 2018).

The assessment of depression in Tanzania, in the acute hospital setting, represents a challenging prospect. Though bespoke tools are being developed, these have not yet been externally validated (Howarth-Maddison et al., 2022). To try and capture at least some elements of potential depressive symptoms, the EURO-D was used (Prince et al., 1999). Although this was originally developed in Europe, it has been applied in a variety of LMICs including previously in the community in Tanzania (Guerra et al., 2015, Lewis et al., 2022, Lewis et al., 2018a). The scale comprises 12 questions based upon the Diagnostic and Statistical Manual of Mental Disorders criteria for depression. Examples include *"Have you been sad recently?"*, and *"How is your concentration?"*. Each item is marked as present or absent, with a score of four or more indicating clinically significant symptoms (Guerra et al., 2015).

4.8.4 Data collection: follow-up

Follow-up was planned for all participants approximately 12-months after their index admission. The primary outcome was all-cause mortality. Secondary outcomes included length of stay and number of re-admissions to hospital during the follow-up period. It was hypothesised, based on existing literature from other settings, that older adults with frailty would have higher rates of mortality, longer hospital stays and greater rates of readmission (Cunha et al., 2019).

Existing literature demonstrates strong evidence that acute hospital admission is a risk factor for functional decline and for disability, particularly in older people with frailty (Cunha et al., 2019, Gill et al., 2010). However, frailty and disability are also dynamic processes and while many older adults experience a decline in function following admission, others experience improvement (Gill et al., 2010, Amblàs-Novellas et al., 2022). Therefore, during follow-up assessment the Modified Barthel Index and IDEA-IADL were repeated to explore disability transitions amongst participants with and without frailty.

A nexus of factors including resource limitations, the challenging geography of the Kilimanjaro Region and concerns regarding the community transition of COVID-19, meant that in-person follow-up assessments were not feasible. As a result, follow-up assessments were conducted over the telephone with the older person, or their informants. During a community study in the Hai District in 2016, 73.6% of older people who participated owned a mobile phone (which, at the time, was greater than the 63.0% national average) (Macha and Massawe, 2023, Cooper et al., 2022). By 2023 and the start of data collection for this study, it was estimated that 93.0% of the adult population nationally had access to a mobile phone (Macha and Massawe, 2023). Mobile phones are increasingly being used for clinical applications in Tanzania, and have been used as a feasible and acceptable form of follow-up in similar research in this setting (Mmbali and Chillo, 2017, Cooper et al., 2022). Unfortunately, it was not possible to repeat frailty assessments over the phone, so frailty transitions could not be examined. Participants and their informants were called a maximum of three times, on different days, with care taken to change the times of day to maximise chances of success. If they did not answer or respond after three attempts, they were not included.

4.8.5 Statistical analysis

Data were exported from Kobo ToolBox to Microsoft Excel. After cleaning, analysis was conducted in IBM SPSS Statistics version 28.0 (IBM, New York, NY, USA). Descriptive statistics were presented as *"mean (±standard deviation [SD])"*, or *"median (±interquartile range [IQR])"* for non-parametric variables. No imputations were made for missing data. Two-tailed p-values were reported to quantify the strength of evidence against the null hypothesis. No fixed threshold (e.g. $p<0.05$) was applied to define statistical significance. Instead, p-values were interpreted as continuous measures of the strength of evidence, with smaller values indicating stronger support against the null hypothesis (Sterne and Davey Smith, 2001).

Univariate analyses were conducted to compare the age and sex distributions of included participants with those who were eligible but not included, to assess the representativeness of the sample. For age these two groups were compared using the independent samples t-test, and for sex distribution the Chi-squared test was used.

The prevalence of frailty was calculated as a percentage of the total number of participants, with 95% Confidence Intervals derived from bootstrapping based on 1000 samples to control for clustering by hospital site. The degree of agreement between the three frailty instruments was displayed visually in proportional Venn diagrams, which were also used to assess overlap with disability and multimorbidity. Agreement was assessed statistically using the Kappa statistic (Cohen's for comparing two tools and Fleiss' for comparing all three). This gives an output between zero and one which can be labelled from *"poor"* to *"very good"* with higher numbers indicating greater agreement (Altman, 1990). Linear regression was also used to further explore the relationship between scores on the different scales.

Binary logistic regression was used to investigate the sociodemographic and clinical predictors of frailty status. In existing literature from sub-Saharan Africa and LMICs, factors associated with frailty have included increasing age, female sex, increasing disability, being unmarried, low levels of schooling, multimorbidity, depression and delirium (Siriwardhana et al., 2018, Adebusoye et al., 2019b, Kasa et al., 2024a, Lewis et al., 2018a, Payne et al., 2017).

Therefore, these variables were selected for the regression models for each frailty instrument. These were chosen a priori to avoid selection bias and overfitting of the model. Both crude and adjusted odds rations were presented in tabular form with the 95% Confidence Intervals.

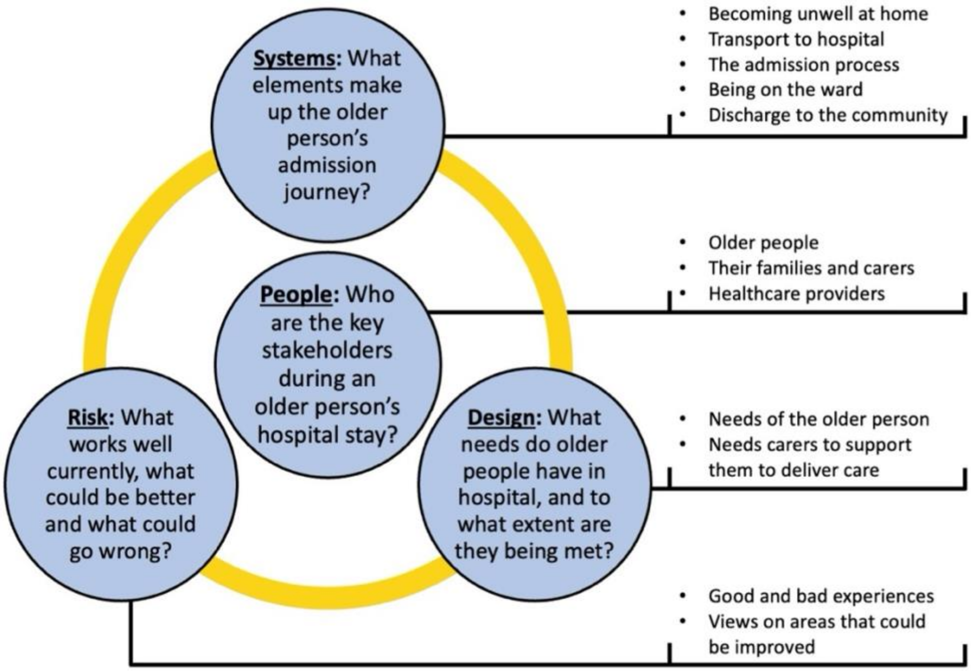
All-cause mortality data are presented as a proportion of the full baseline population, with a range reflecting the minimum and maximum possible mortality estimates assuming all participants lost to follow-up were deceased, or alive, respectively. To determine the effect of frailty status on the probability of survival, multivariable Cox Proportional Hazards models were applied, with output displayed visually in Kaplan-Meier curves. For each frailty instrument, adjusted and unadjusted models were presented with the Hazard Ratios and 95% Confidence Intervals. Cox regression models were adjusted for age, sex and educational status, as these variables are all known to be associated with mortality in Tanzania (Narh-Bana et al., 2012). Two methods were used to allow statistical comparison of different frailty instruments ability to accurately predict mortality. First, Harrell's C statistic was used as a measure of concordance between frailty and mortality, and the absence of concordance between frailty and survival. Values range from 0.5 to 1.0, with higher values indicating greater discriminatory power (Schneider et al., 2022). Second, Receiver Operator Characteristics (ROC) were calculated giving the Area Under the Curve as an additional measure of accuracy, and ROC coordinates were examined to understand how variations in the cut-off scores used might affect the sensitivity and specificity of each tool when predicting mortality.

Regarding secondary outcomes, the length of index hospital stay (days from admission to discharge or death) of participants with and without frailty, was compared using the Mann-Whitney U test. It was originally intended that Cox regression models be applied to readmission data, but events were too infrequent to allow meaningful statistical analysis. For disability transitions, a repeated measures ANOVA was conducted to examine changes in Barthel Index and IDEA-IADL over time, with comparison between participants with and without frailty. This analysis was adjusted for age, and baseline scores to account for ceiling effects. the difference in Barthel Index and IDEA-IADL scores for each respondent were calculated by subtracting baseline scores from those at follow-up. Differences were then time-adjusted by dividing by the number days to follow-up and groups were compared using the independent samples t-test. Transitions between states of dependency were displayed visually in Sankey diagrams.

4.9 Qualitative methods

Within this study's explanatory sequential design, qualitative elements were incorporated to provide context to quantitative findings, and to give voice to the experiences, attitudes and needs of hospitalised older people with frailty and those caring for them. It was also an objective to identify barriers and facilitators to effective care. These objectives have elements that are *exploratory* (involving the description of phenomena) and *explanatory* (involving attempts to identify the likely underlying causal mechanisms) (Fryer, 2022). A model from the *Engineering Better Care Toolkit* was used to break down these objectives further and inform the development of qualitative methods. This systems-based approach considers four perspectives: 1) People; 2) Systems; 3) Design; and 4) Risk (Clarkson et al., 2018) (see Figure 14).

Figure 14. A systems-based approach to understanding the hospital admissions of older people with frailty



This systems-based model was used as a thinking tool to help break down objectives and translate them into qualitative methods. Adapted from the Engineering Better Care Toolkit, (Clarkson et al., 2018)

This model was used as a guide when considering participant selection, sampling methods and topic-guide development. What follows is a detailed description of these qualitative methods, elements of which have previously been presented elsewhere (Davidson et al., 2024b, Davidson et al., 2024c).

4.9.1 Participant recruitment

Participants were recruited using a purposive sampling strategy, a technique which involves the deliberate selection of individuals based on their characteristics and the judgement of the researcher (Malterud et al., 2016). This method was chosen over alternative approaches because it complemented the quantitative strand, allowing the selection of participants based on characteristics of interest which were identified from quantitative analyses. This purposive sampling was guided by the principle of maximal variation, which seeks to capture the full spectrum of diversity in participant experiences, and explore commonalities and differences within the data (Patton, 1990). Along with the guide outlined in Figure 14, it was with this in mind that the following groups of participants were recruited for the qualitative strand:

1. *Service users:* Older people, aged 60 year and over, admitted to hospital during the quantitative phase were recruited at the time of follow-up phone calls. Though those with frailty were preferred, participants from across the frailty spectrum were considered based on other factors. Namely, these were the use of health insurance, or exemption, which were relatively rare in the quantitative strand and highlighted as characteristics of interest for a maximal variation sample. Interviews were arranged if the older person verbally consented to participate, though formal consent forms were completed in person.
2. *Service users:* The caregivers of the older people with frailty were eligible if they were aged 18 years and over and were directly involved in the older person's day-to-day care (i.e. living in the same household). They were excluded if they were working in a paid capacity.
3. *Service providers:* Hospital employees, over the age of 18 years, were recruited from across the four participating sites. To be eligible they had to work in clinical roles and have direct experience of caring for older patients for a period of 6-months or more.

> Service providers with different job roles (e.g. doctors, nurses, healthcare assistants etc.) were sought to maximise variation. Contacts working on participating wards at each hospital site recommended service providers who were eligible to participate and expressed willingness.

Saturation is the point at which new data no longer produces new themes and is the most commonly used method to determine sample size in qualitative research (Vasileiou et al., 2018). However, saturation is often poorly defined and is not necessarily compatible with all research designs (Malterud et al., 2016). In the present study, the objectives were not to exhaustively describe all aspects of a phenomena – an expectation not aligned with exploratory research – but rather to offer a range of new insights. Therefore, sample size was determined instead by the principle of information power. This approach focuses on quality and depth rather than the exhaustion of all available patterns (Malterud et al., 2016). Analysis began while data were being collected and there was continuous assessment of the strength of the dialogue, the richness of the narratives and the relevance of this material to the aims (Malterud et al., 2016). The decision to stop recruitment was based on discussions of these factors between the lead researcher (SD) and the supervisory team.

When applied, the principles of information power determined that a smaller number of service providers were needed compared with service users. This was because in the analyses that were taking place during data collection, service providers' narratives were less varied, with more focused dialogue and greater specificity for the study aims. By contrast, the information power was lower for service users, who were demographically more diverse, with less prior knowledge of the hospital system, and were considered in a broader context (including both pre- and post-admission).

4.9.2 Semi-structured interviews

Data were collected using semi-structured interviews. The advantages of using this format for this research were that conversations remained efficient and focussed around areas relevant to aims and objectives, whilst still allowing the exploration of tangents not anticipated by the researcher at the outset (Kallio et al., 2016). This was particularly important in this context due to the author's *"outsider"* status.

Service users were generally interviewed as a dyad, with the older person and caregiver interviewed simultaneously, at a time and location of their preference. In practice, all opted to be interviewed in their own homes to negate the need for them to travel. Tanzanian research colleagues Godrule Lyimo, Joseph Kilasara and Wema Msangi all had prior experience of qualitative interviews, as well as experience of working with foreign research staff. Consequently, they were able to draw upon these experiences not just to translate language, but meaning, context and traditions in both directions. This is sometimes referred to as bicultural competency (Hennink, 2008). They conducted the interviews in Swahili based around flexible topic guides which are discussed in the next section.

From arrival, care was taken to observe cultural norms and protocols. This began with dress, which was generally formal and modest. Initially, research team members introduced themselves in Swahili and used age-appropriate greetings. Examples of this include the use of the respectful "*shikamoo",* as opposed to the less formal *"habari"* to show greater deference when greeting an older interviewee, and the use of the terms *"Mzee"* to refer to a respected older male, or *"Bibi"* for an older female. Sometimes greetings involved meeting all members of the household, or neighbours, including the *Balozi*/ ten cell/ household leader. An important consideration when visiting participants at home was the etiquette of gift-giving, and within the ethics application, provision was made for a token gift, with a value of up to 3,000 Tanzanian Shillings (approximately one Pound Sterling). This was usually a bag of rice. After formal greetings, researchers took the lead from participants as to whether they would like to be interviewed inside, or outside. Once written informed consent was obtained, interviews were conducted based around the topic guides and audio-recorded on an encrypted Dictaphone (Phillips PocketMemo DPM8000).

Service providers were interviewed in rooms within the hospitals that they worked in. One-to-one interviews were conducted, rather than alternative approaches such as focus group discussions. This was because of concerns that cultural norms of respect for authority, and hierarchical work environments, may inhibit a participant's responses. In other respects, consent processes for service providers were conducted in a similar manner to service users. Rather than gifts, service providers were offered a range of refreshments of the same value.

The interviews themselves differed in that they each began with a case vignette. Vignettes come in a variety of different forms, but often include short stories about individuals which are designed to make the topic more relatable for interviewees and encourage them to share their attitudes and beliefs (Barter and Renold, 1999). In this study, an account of a fictional patient with frailty (based on data from the quantitative baseline assessment) was constructed to illustrate the patients of interest.

4.9.3 Topic guide development

A topic guide is a series of questions around which semi-structured interviews are conducted, with room for deviation and the exploration of unanticipated areas (Kallio et al., 2016). The quality of the topic guide has a knock-on impact on the quality of interviews and the credibility of analyses (Kallio et al., 2016). For this study, two topic guides were created: one for service users and one for service providers. The process of their development considered the overall aims and objectives of the study, the systems-based framework for thinking about these objectives (see Figure 14) and questions that had arisen from the analysis of data from the quantitative strand.

Good topic guides give clearly worded questions, which avoid leading the interviewee and provide space for new topics to arise (Kallio et al., 2016). The guides created were therefore structured around a series of open questions, with follow-up prompts to encourage interviewees to expand on aspects relevant to the study objectives. For service users, interviews began with broad questions about their backgrounds to establish rapport, before moving on to topics related health in old age and finally focussing more narrowly on hospital experiences. The vignette created for service providers described the case of *Amina Mushi,* an older patient with a background of frailty admitted acutely. This fictional character was created from the modal demographic and clinical characteristics of participants from the quantitative strand (e.g. age 75 years, female, child main caregiver, admitted acutely with non-communicable disease etc.).

Initial topic guides were drafted by the author (SD), after reflexive discussion of the quantitative findings with supervisors and Tanzanian research colleagues. English versions of the topic guides were revised based on feedback from supervisors. They were then translated into Swahili by Lucy Mariki, before review by Tanzanian research colleagues Joseph Kilasara, Godrule Lyimo and Wema Msangi. In discussions between these researchers and the author (SD), the meaning of translated questions was interrogated, often with backtranslation, to ensure all were well-formulated and relevant to the study's objectives. This process also provided an opportunity for feedback and discussion about cultural considerations, and areas that the author may have missed as an outsider from the UK. This is best illustrated through an example. Close to the end of the interview, the guide contained the question: "*What will you do if you become ill again in future?"*. This was intended to elicit responses about expectations for future health, attitudes regarding a potential return to hospital, or lead to discussions about death and dying. Follow-up questions included "*What are your wishes for the end of life?"*. However, when reviewing the translated text, Tanzanian research colleagues raised concerns about this line of questioning, in particular the follow-up questions regarding death and dying. As is the case in many cultures around the world, death and dying are not subjects that are discussed openly in many African societies (Ekore and Lanre-Abass, 2016). In the Kilimanjaro Region, the majority of the population identify as Christian, but elements of traditional systems of spirituality are enmeshed with understandings of the afterlife (Clack, 2005). Death remains a taboo topic and there remains a prevalent superstition that discussion of ill health and death can cause these events to occur. After discussion of these concerns with supervisors, a broader initial question of *"How do you feel about the future?"* was adopted with follow-up questions about future ill health, and death, asked in an impersonal way, for instance: "*How do people where you are from usually think about the end of life?".* After translation, Tanzanian research colleagues deemed this more acceptable, though all interviewers were still encouraged to use their discretion and not follow this line of enquiry if they felt it was inappropriate.

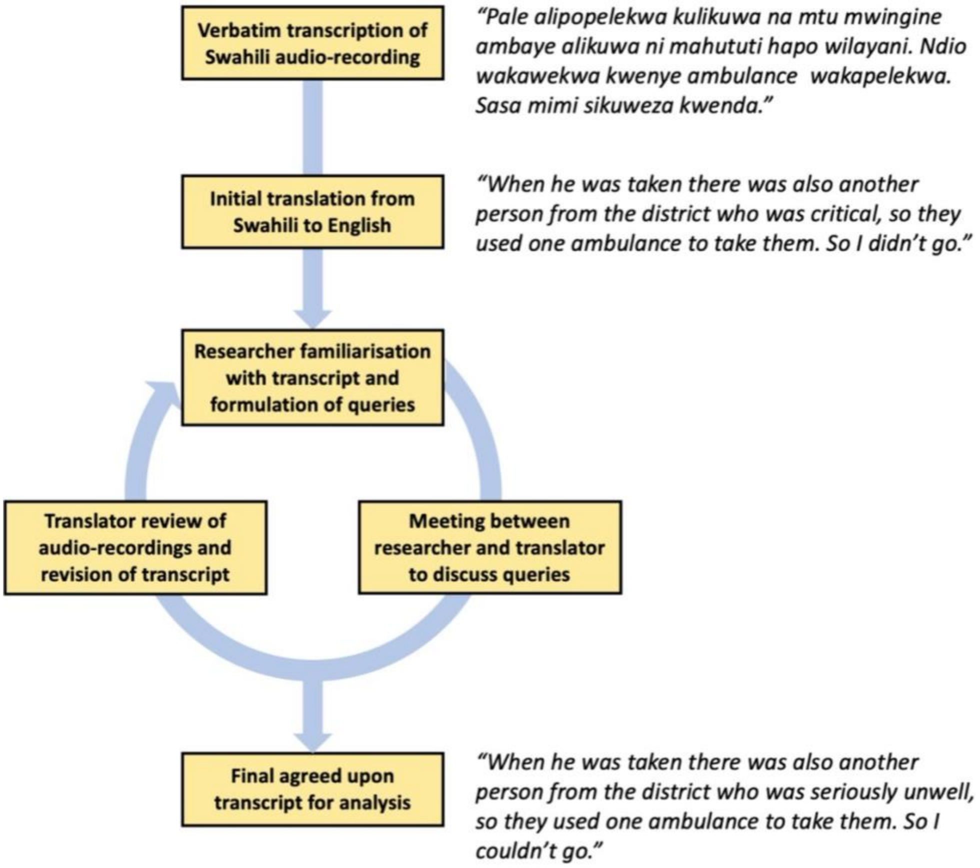
The resulting topic guides were then field-tested in initial interviews. Further cycles of revisions were made based on feedback from Tanzanian research colleagues, and review of the data. An example of a change that was made was the reduction in the number of follow-up questions, as interviewers found that there were too many and it was hard to scan for those that may be appropriate.

4.9.4 Translation

One of the greatest challenges in cross-cultural qualitative research is the process of translation, in which there is a risk of the original meaning of participant's responses being lost (van Nes et al., 2010). Far from being a technical or neutral process, translation is a series of subjective judgements influenced by the views, perspectives and background of the translator (Yunus et al., 2022). Metaphor, humour and specific cultural references are all aspects of language that are notoriously challenging to translate (Yunus et al., 2022). To preserve the validity of the data, and credibility of the qualitative research process, careful consideration must be given to minimising the gap between the intended meanings of language used by participants, and the language of the final analysed transcripts (van Nes et al., 2010).

The most commonly used method to tackle this challenge is back-translation, in which the translated texts are converted back into their original language. However, the validity of this method has been questioned, as it is often implemented uncritically, with translation regarded as a technical process that can be outsourced (Ozolins et al., 2020). Instead, numerous reviews now recommend the inclusion of translation experts within the research team, and the use of a transparent and reflective process (Ozolins et al., 2020, van Nes et al., 2010, Hennink, 2008). As a result, in this study a process of consultation was adopted. Translation was an iterative process, based on back-and-forth discussions between researchers and translators. This served to familiarise researchers with the data, and formed the first stage of its interpretation (Yunus et al., 2022). This process is described in more detail below and is summarised in Figure 15.

Figure 15. The consultation process of translation



"Pale alipopelekwa kulikuwa na mtu mwingine ambaye alikuwa ni mahututi hapo wilayani. Ndio wakawekwa kwenye ambulance wakapelekwa. Sasa mimi sikuweza kwenda."

"When he was taken there was also another person from the district who was critical, so they used one ambulance to take them. So I didn't go."

"When he was taken there was also another person from the district who was seriously unwell, so they used one ambulance to take them. So I couldn't go."

Yellow boxes demonstrate the stages of the translation process, while quotations (taken from an interview with participant H0017 and their caregiver), demonstrate the evolution of the transcript.

After each interview, professionally accredited translators Wema Msangi and Lucy Mariki transcribed interviews verbatim from Swahili into English. These initial translations were then examined and areas of ambiguity were highlighted areas for discussion. The author (SD) then led meetings in which each transcript was discussed by the whole team (including translators, Tanzanian research colleagues and MRes students), with the emphasis always being on the preservation of the original meaning of the interviewee. This often involved the translators going back and listening to portions of the audio-recordings again. This process was repeated until a final transcript was agreed.

To give an example of how this worked, consider the quotation in Figure 15. After researchers had familiarised themselves with the transcript, there were two queries brought to the team discussion. The first was the term "*mahututi*", which generally translates as *"critical"* or *"serious",* but is only used in the context of someone who is unwell. Of the potential English options, the team felt *"seriously unwell"* captured the essence of *"mahututi"* better. This was because *"critically unwell"*, in English, is more medicalised and would be an odd term for a lay person to use. The second phrase highlighted was *"Sasa mimi sikuweza kwenda"*, initially translated as "So I didn't go". This was a question of tone: said in a matter-of-fact way, this would be an appropriate translation. However, with a tone of bitterness, or resentment, this would not quite capture the meaning. After the translator reviewed the recordings, it was judged that "*So I couldn't go"* better captured the tone of resentment. In this way, each final transcript was an integration of inputs from interviewee, translators and researchers (Lewis et al., 2021, Björk Brämberg and Dahlberg, 2012).

4.9.5 Reflexive thematic analysis

Thematic analysis is a step-by-step process by which meaningful patterns in the data, that are relevant to the research question, can be identified (Braun and Clarke, 2006). These *"themes"* can then be described and summarised. Philosophically, it is not tied to any particular tradition, is generally considered to be epistemically and ontologically flexible, and compatible with critical realism (Wiltshire and Ronkainen, 2021). This study used a reflexive thematic approach for the analysis of qualitative data (Byrne, 2022, Braun and Clarke, 2019). This subtype of thematic analysis encourages the consideration of the subjectivity of the researcher (Olmos-Vega et al., 2023). Reflexivity is a process in which the researcher acknowledges that they are an active participant in data production, and critically examines the extent to which they impact this process and resulting analysis (Braun and Clarke, 2019). In the context of this thesis, there have already been many methodological decisions which were influenced by the views of the researcher. A prime example of this is the subjective judgements that were made during the iterative translation process which influenced the production of the final transcripts. This serves to demonstrate the importance of the critical examination of one's own perspectives and biases when making such methodological decisions, especially in cross-cultural research (Braun and Clarke, 2019).

Due to the layer of interpretation already applied by the act of translation, qualitative data were coded semantically based on participant's explicit statements, rather than attempting to identify deeper levels of meaning (Byrne, 2022). Coding was inductive, again reflecting what was explicitly said, and not any pre-determined theory or framework (Byrne, 2022).

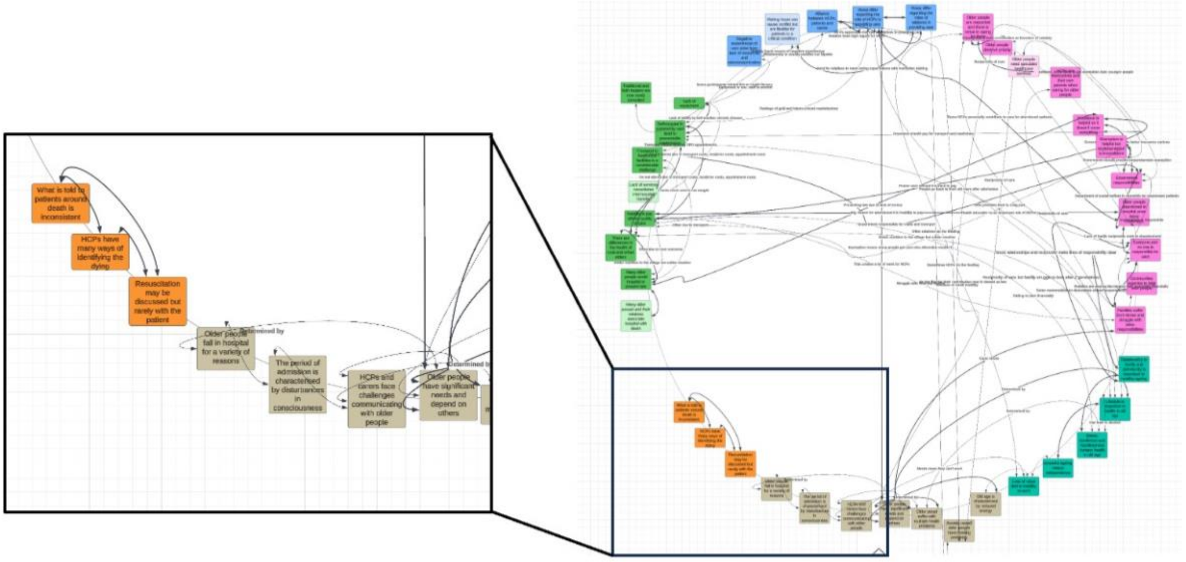
Reflexivity was practically embedded through the use of reflexive fieldnotes which were kept by members of the research team (Olmos-Vega et al., 2023). The process of reflexivity has previously been likened to an eternal hall of mirrors: it is likely that there is no such thing as *“enough” (Olmos-Vega et al., 2023, Lynch, 2000)*. For the purposes of this thesis, the reflexive account focuses on the positionality and impact of the author (SD) (section 4.10). Although it is represented in this chapter by a discrete account, reflexivity was a continuous process embedded throughout this research, with frequent discussions amongst the research team and supervisors. The influence of these critical reflections can be seen in many of the discursive elements of this thesis.

The process of reflexive thematic analysis comprises six stages (Braun and Clarke, 2006, Byrne, 2022):

1) Familiarisation with the data
2) Generating initial codes
3) Generating themes
4) Reviewing potential themes
5) Defining and naming themes
6) Producing the report

In practice, familiarisation with the data occurred during the translation process described above. NVivo 14 was used to aid in the generation of codes and themes. Each transcript was worked through systematically and all statements relevant to the objectives of this research were given a brief descriptive label, or code. Codes evolved throughout this process through *standardisation* and *consolidation*. In *standardisation*, statements within each code were examined to ensure they all described the same phenomenon, while in *consolidation* codes were compared and contrasted with one another to ensure they described different phenomena (Fryer, 2022). Once all transcripts had been coded, a conceptual map was used to help visualise links between codes and to help coalesce those that were strongly interlinked into potential themes (see Figure 16). Codes and potential themes were reviewed, discussed and revised in regular meetings with supervisors until the final themes could be named and defined. These results are described in Chapter 6.

Figure 16. A conceptual map used to help consider links between codes and to form potential themes



This conceptual map was not intended to make sense to anyone other than the author and the boxes do not include the final code names. However, it is included to demonstrate the methods used when thinking about the connections between codes when developing initial themes. Codes were arranged in the boxes around the perimeter, and ideas linking them were then added as directional arrows. Codes were iteratively rearranged, with connections added and removed, until they began to form clusters which were more strongly connected to one another than to other groups of codes. These groups (here colour coded) formed the potential themes.

In the process of defining and naming themes, conceptual models were produced. These were abstract visual representations of each theme, designed to provide a visual overview of the key concepts and relationships that could get lost in the more granular description of the data. Like all models of this kind, they are simplifications of real-world complexity. However, they are a valuable tool for summarising the key ideas and for beginning to form theories about the underlying mechanisms influencing the phenomena that are observed (Fryer, 2022).

4.10 Reflexive account

There are many aspects of my personal background, identity and professional development which have impacted this research. It is a challenging to consider every possibility, however in this section I will attempt to give an overview of my personal influence as lead researcher on the production of the data and its interpretation (Fletcher, 2017, Olmos-Vega et al., 2023).

I applied for this PhD, and for the job of Teaching and Research Fellow at Northumbria Healthcare NHS Foundation Trust, in 2021. By this stage, I had been practicing medicine for just under six years and was planning to pursue a mixed clinical/ academic career in internal medicine. I was drawn to this area of research because of a growing clinical interest in geriatrics, as well as a somewhat naïve excitement at the opportunity to travel and work in Tanzania, a country which I had never previously visited. I had just spent 18 months working in Aotearoa, New Zealand, in a service which implemented a Māori health model, an experience that ignited an interest in differing cultural understandings of health. At this stage, my research experience was entirely quantitative and was underpinned by a (largely unexamined) positivist philosophy. Furthermore, my experience of frailty was entirely clinical, and I considered it within the biopsychosocial medical framework in which I was educated. I had not yet considered frailty's evolution in social, or cultural, terms.

This was the academic context in which this PhD began. During the first four months I was based in the UK. I spent the time learning about Tanzania, learning Swahili, reviewing the literature, preparing ethics renewal applications and developing the quantitative baseline data collection materials. Though most of the measures used were well established, and had previously been used in Tanzania, it is fair to say that the index assessment collection tool was made from the perspective of an *"outsider"*. Having not yet been in a hospital in Tanzania, I leaned heavily on the experience and advice of my UK-based supervisors. Although I was also in frequent contact with research colleagues in Tanzania, we had not yet met in-person and it was a struggle to build effective working relationships remotely. Thus, much of the planning for the quantitative baseline assessment was implicitly shaped by my own medical education, evolving understanding of frailty and experiences of working in geriatric medicine in the UK.

During the follow-up and qualitative stages, the influence of these factors was diluted by practical experience of conducting research in Tanzania, and through the formation of relationships with local clinicians and research colleagues. My preconceptions of the Tanzanian hospital system, and the daily challenges faced by service users and service providers in this context, were modified by this experience. In some respects, I found contrasting the workings of UK and Tanzanian wards to be a useful tool. For example, in Tanzania I was struck by how often family members were present during the admission of an older person, and the extent to which they were involved in their care. This later formed a line of questioning when I was developing topic guides for the qualitative interviews. In this way, my previous knowledge and new experiences came together to help shape the qualitative research agenda and the interpretation of these data.

Having previously worked in Aotearoa, New Zealand, a country with a history of British colonisation, I anticipated some challenging power dynamics when I embarked upon this research. In Tanzania, I was often treated with a degree of respect and deference that felt unearned for an early career researcher. I was a white, male, British doctor in a former British colony, and this gave me outsized credibility and influence. Although most of my Tanzanian research colleagues were at similar stages in their careers to me, in most cases our relationships fell into an employee-employer dynamic. To flatten this hierarchy, and incorporate perspectives other than my own, at several stages in this research I invited questions, feedback and suggestions on data collection tools and topic guides. However, I think these attempts were at best only partially successful. It did lead to several minor changes (e.g. the refinement of topic guide questions related to death and dying), but overall, I was still left with the impression that my Tanzanian colleagues felt compelled to agree with me and were reluctant to express dissenting views.

In meetings with hospital leaders, and when presenting at local research meetings, I faced much greater scrutiny. KCMC and MRRH are engaged in a lot of international research collaborations and I picked up on a sense of frustration at the lack of translation and tangible benefits from these collaborations. Understandably, my meetings with clinical leaders focussed on how this research could be applied practically to improve outcomes for patients. This was rooted in their deep understanding of the local context, and a pragmatic interest in real-world benefits. Although these meetings were more balanced interactions, they also made me acutely aware of my outsider status and challenged me to remain focussed on the practical and immediate implications of the work. They also led me to ask uncomfortable questions of myself, including whether I was deserving of the privilege of conducting research in this setting, and whether my grant would not have been better used in the hands of a local researcher? Born of this discomfort, throughout this research I often asked myself *"What could be done now within current resource constraints?"*.

My relationship with the service users was shaped by several factors that likely influenced how they responded during interviews. Most were living in poverty, in rural agricultural communities and had limited educational opportunities. This contrasted starkly with my own position as a wealthy outsider. I was also much younger that the older people interviewed, some of whom were old enough to have lived under British colonial rule. These factors were ameliorated slightly by the fact that I had met many of them during their index hospital admissions, that we took care to respect cultural protocols and used Swahili where possible. Nonetheless, this outsider status, and affiliation with the institution of KCMC, may have meant that older people and their caregivers were more hesitant to express critical opinions. This dynamic likely extended to service providers as well, who may have been reluctant to speak negatively about hospital care in the presence of a foreign researcher. Amongst both service users and service providers, religious faith was the norm. This was another way in which we contrasted. Although my family come from an Irish Catholic background, I am not religious. This difference in faith may have influenced how I interpreted their responses and in the analysis of interviews, and I tried to remain mindful that I may be overlooking important spiritual elements that shaped participant's views.

In writing this passage I did not initially consider my gender at all. This in itself was interesting, as being male is something that I am often very conscious of in my day-to-day clinical practice. In a Tanzanian context, I was so conscious of the cultural, linguistic and economic distances between myself and participants that being male felt comparatively insignificant. As a result, I failed to consider how the experience of frailty and of hospitalisation for older people in Tanzania may be different for males and females. I was rarely conscious of my gender during interviews, and yet, given the gendered dynamics of caregiving roles, and many other power structures in Tanzania it is likely that my being male did influence my interactions, particularly with female participants. An older female speaking with a younger male may have been more reluctant to share information regarding topics like incontinence, menopause, family violence, or caregiving burdens. Gendered power dynamics may have influenced the degree to which female participants felt able to speak critically about care experiences, caregiving relationships or broader issues. As a result of my omission, this research may have neglected gender differences in the experiences of frailty and hospitalisation.

In this section I have considered some of the major ways in which my own personal, academic and social identity may have influenced this research. The next section discusses some similar themes in reference to ethical considerations, and the challenges of global health research partnerships.

4.11 Ethical considerations

Formal ethical approval for this research was granted by relevant institutions in the UK and in Tanzania. This section does not replicate these ethics applications but provides a brief overview of some of the main issues that were considered. Formal ethical approval was originally sought by the supervisory team in 2019 and annual applications for renewal were submitted by the author (SD). The reference numbers for these were:

- Newcastle University Faculty of Medical Sciences Research Ethics Committee: Registration No. 1836/17436/2019.
- Kilimanjaro Christian Medical University College Research Ethics Committee: Registration No. 2543.
- National Institute for Medical Research of Tanzania: Project No. NIMR/HQ/R.8a/Vol. IX/377.

4.11.1 Capacity and consent

Older people, particularly those with frailty or acute illness, may suffer from impairments of cognition and of consciousness. Excluding them from participation in research on this basis risks compromising real-world generalisability, and ultimately discriminating against this important and vulnerable section of the hospital inpatient population. In accordance with best practice frameworks for the inclusion of people with cognitive impairment in research, the older people admitted to hospital in this study were presumed to have capacity, and supported to make their own decision as to whether or not to participate (Thorogood et al., 2018, Novek and Wilkinson, 2019, Murphy et al., 2015b). All researchers were trained in the assessment of capacity outlined in the UK Mental Capacity Act (United Kingdom Government, 2005) and Tanzanian Mental Health Act (United Republic of Tanzania Government, 2008). In this four-step test, capacity was dependent on the older person's ability to *understand*, *retain*, *weigh-up* and *communicate* their decisions in relation to the study. Written information regarding the study was provided and read aloud in Swahili by Tanzanian researchers. Participants provided written informed consent by way of a signature, or thumbprint for those who were unable to write. Informants were able to assent on the behalf of older people lacking capacity so that those with dementia or transient impairments of consciousness were not systematically excluded. Consent was viewed as time and decision specific, and as a continuous process with the option for withdrawal at any time (United Kingdom Government, 2005). Participation was voluntary, with no incentives offered.

4.11.2 Confidentiality and privacy

Preserving the confidentiality and privacy of participants, many of whom lived in small communities, was a high priority. To ensure their identities were protected, anonymisation occurred at source and every participant was given a unique alphanumeric key. A password-protected document linking names to the relevant key was kept separately. All quantitative and qualitative data were kept on password-protected and encrypted digital devices or stored on a secure server. Data presented in this research, including quotes from qualitative interviews, were anonymised as far as possible by the removal of identifying information such as names and places. This was a particularly important consideration during qualitative interviews with service providers to allow them to express themselves freely without fear of discrimination from their employer.

4.11.3 Global health research partnerships

This study took place in the context of a research partnership of more than 20 years between Northumbria Healthcare NHS Foundation Trust, KCMC and the Hai District. Despite this longstanding and productive collaboration, academic global health is a constantly evolving field which requires dynamic reappraisal of its ethical complexities. Operating at their best, global health research partnerships are peer-to-peer collaborations for sharing expertise and addressing health problems which transcend national boundaries (Murphy et al., 2015a). However, at their worst they can perpetuate semi-colonial approaches, in which outsider's maintain control over research funding and agendas, while local experts are marginalised (Bhakuni and Abimbola, 2021). Such approaches do little to help address inequities between the Global North and Global South (Larkan et al., 2016). This section briefly outlines some of the major ethical considerations that were encountered when planning and conducting this research, with reference to proposed standards for *"good"* global health research collaborations (Emilie, 2022, Murphy et al., 2015a, Parker and Kingori, 2016).

Power imbalances were central to nearly all ethical issues encountered in the context of this international research. That is power imbalances between the UK and Tanzanian institutions, UK and Tanzanian researchers, and between researchers and participants. At the level of the institutions, one of the reasons that organisations in LMICs (like KCMC) partner with foreign universities is that existing structures (such as research funders and medical journals) tend to reflect the agendas of the dominant group, in this case *"western"* medical researchers. As a result, researchers in LMICs can be marginalised by perceptions that their institutions are illegitimate, or uncredible, without this patronage (Bhakuni and Abimbola, 2021, Emilie, 2022). In the case of this research, the agenda was conceived and negotiated with clinical leadership at all of the participating hospitals and at the Hai District level. However, after the broad brushstrokes of the project were agreed upon, most of the smaller and more detailed methodological decisions were made by the author and UK supervisory team. Similarly, ethics renewals and grant applications were reviewed and revised by members of all participating institutions but were drafted and submitted by the author and UK supervisory team. Funding for the research was entirely provided by British institutions and overall budgets were managed by the author and UK supervisory team.

Aside from the clinical leaders who negotiated the overall agenda, Tanzanian research colleagues contributed to this study in the refinement of questionnaires, the review of topic guides, the collection of quantitative and qualitative data and in the discussions around translation. These contributions were valuable opportunities to incorporate the perspectives and interpretations of local experts. However, the opportunities to have any major influence on the research methods at this stage were more limited, as it was bound by protocols that had already been through the process of ethical approval. Fundamentally, the relationships between UK and local researchers were transactional, as Tanzanian research colleagues were paid salaries set and negotiated by other local members of the research team. As described in the reflexive account above, the limited opportunities for more major contribution, and an employee-employer relationship, created an inescapable hierarchy within these interactions.

In the context of global health research, testimonial injustice refers to the marginalisation of the knowledge and experiences of local people, based on prejudicial assumptions about their credibility (Bhakuni and Abimbola, 2021, Fricker, 2007). In this research, a mixed methods approach was adopted explicitly to allow qualitative exploration of the knowledge and experiences of the older people, their caregivers and local healthcare providers. This was intentionally included to counterbalance tendencies to overlook, or dismiss, local perspectives. On the other hand, interviews were structured around a topic guide drafted by the author, thus potentially limiting participants ability to express themselves beyond these expected parameters.

This research was observational, rather than interventional. Observational studies are typically seen as carrying fewer ethical concerns and minimal risk to participants. However, in the context of high levels of need, such as LMICs, conducting research without offering intervention also poses questions (Norris et al., 2012). In this study, there were concerns that the older people and their caregivers might perceive participation as a means of accessing additional care. Therefore, during the informed consent process it was made clear that there were no direct benefits to participants. During quantitative assessment, if any clinical needs were identified by researchers, they could be flagged to the treating team. However, in the qualitative strand, where older people were interviewed in the community, encountering an acute clinical need would raise more significant concerns. Fortunately, no such situations arose. However, the research team did encounter numerous chronic issues such as falls risks, inadequate clothing and undernutrition. While participants could be referred to community health services, the ability of these organisations to provide meaningful assistance was limited and could incur costs to the older person. This created a situation in which UK-based researchers, despite a stark and obvious wealth disparity between themselves and participants, were relatively powerless to help.

The analysis and dissemination of research findings from global health research partnerships pose another layer of ethical complexity. Failure to include the perspectives and interpretations of local experts in the analysis of the data is known as interpretive injustice, and it comes with the risks of marginalising local knowledge and perpetuating cultural misunderstandings (Fricker, 2007, Bhakuni and Abimbola, 2021). Data from this study were interpreted by the author, rather than local stakeholders. In the case of the qualitative data, this necessitated translation into English, potentially losing some of the original meaning. This was done with the intention of reaching a wider global audience through dominant English-language journals. Thus far, all output from this research has been presented at international conferences or published in open-access English-language journals. Though this widens access to its findings beyond Tanzania to other LMICs, it also serves to perpetuate the hegemony of the English-language in this arena. On a more positive note, findings were also disseminated locally in meetings with clinical leaders, and at Grand Rounds at each hospital. Furthermore, Tanzanian colleague Joseph Kilasara also presented findings at meetings at KCMC and Mwanza, and (as of Feb 2025) is using a part of the data for the statistics module of his own PhD.

The process of conducting this study highlighted a number of ethical complexities. Although many attempts were made to address some of the inherent power imbalances, there were several ways in which these methods fell short of evolving standards to support ethical practice (Bhakuni and Abimbola, 2021, Murphy et al., 2015a, Emilie, 2022). The Discussion section of this thesis considers how these could be addressed in future studies resulting from this research.

4.12 Summary

This chapter has critically discussed the philosophical orientation, and the specific methods used in the process of conducting this mixed methods research. The next two chapters report the results of the quantitative and qualitative strands respectively, with discussion of the findings.

Chapter 5. Quantitative results: The prevalence, characteristics and outcomes of frailty amongst older hospital inpatients in Tanzania

5.1 Chapter introduction

In this chapter, the quantitative results are presented in accordance with the Strengthening the Reporting of Observational studies in Epidemiology (STROBE) guidelines (Cuschieri, 2019). The sociodemographic and clinical characteristics of participants, and their outcomes, are explored in relation to frailty status with reference to the phenotype, the Clinical Frailty Scale (CFS) and the Brief Frailty Instrument for Tanzania. These findings and the limitations of these data are discussed in relation to the Tanzanian hospital setting and existing literature. Data relating to the frailty phenotype and CFS included in this chapter have previously been published elsewhere (Davidson et al., 2024a).

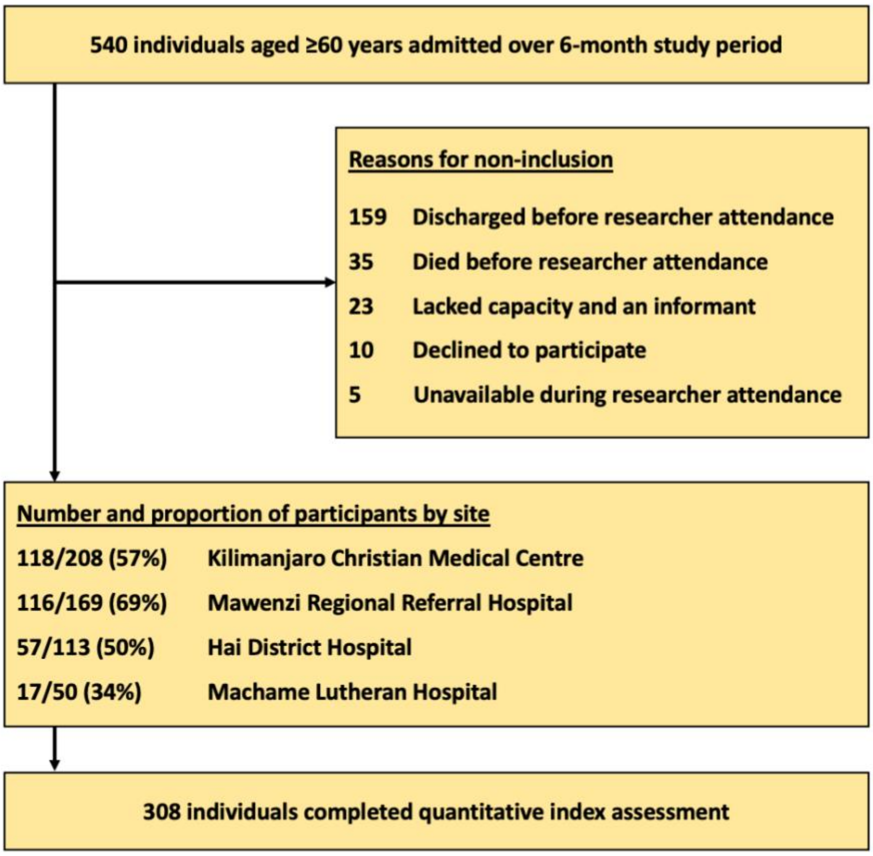
5.2 Participant recruitment

Between 24th of March and 19th of August 2022, 540 people aged ≥60 years were admitted across the four participating hospital sites. People aged over 60 years accounted for approximately 37.5% of total admissions to participating wards during the study. The quantitative baseline assessment was completed for 308 individuals, with an informant present in 232 (75.3%) cases. Data collection teams were primarily based in the urban hospital sites in Moshi and had to travel to Machame Lutheran Hospital (MLH) and Hai District Hospital (HDH). Consequently, the rates of inclusion were higher at Kilimanjaro Christian Medical Centre (KCMC) and Mawenzi Regional Referral Hospital (MRRH) (57% and 69% respectively), than in the more rural sites (50% at HDH and 34% at MLH). The most common reason for non-inclusion was discharge prior to researcher attendance. Figure 17 depicts participation rates for each site and reasons for non-inclusion.

A de-identified minimum dataset, including age and sex, was available for individuals who were eligible but not included in the study. Univariate analyses suggested that included participants were representative of this wider eligible population. The mean age was 74.9 years for both included participants and those who were eligible but not included

($t[538]=0.07$, p=0.947). For sex distribution, 50.3% of included participants were female, compared with 53.9% of those who were eligible but not included ($\chi^2[1]=0.67$, p=0.434).

Figure 17. Flow chart of participant recruitment and reasons for non-inclusion



5.3 Sociodemographic characteristics of participants

Amongst the 308 participants who completed assessment, 155 (50.3%) were female and the mean age was 74.9 years (SD 9.9). They belonged to 11 ethnic tribal groups, though there were likely several more, as a further 25 individuals stated their ethnicity as *"other"*. The most common ethnic group was Chagga – the most numerous in the Kilimanjaro Region – accounting for 218 (70.8%) participants.

Only 35 (11.4%) participants lived alone, while the average number of household members was 3.7 (SD 2.2) and the maximum number was 15. Most participants were married (n=158, 51.2%), or widowed (n=126, 40.9%). For 263 (85.1%) individuals, assistance was required for some aspect of their daily activities and this was most often provided by their children (n=190, 61.7%), or their spouses (n=116, 37.7%). Whilst care was shared equally between daughters and sons, amongst spouses and children-in-law there was around a 5:1 female predominance.

It is notable that only 25 participants (8.1%) had a pension despite all being above the national pensionable age. Only a minority had any form of health insurance (n=100, 32.5%) and only 14 individuals (4.5%) utilised an exemption from user fees. There was a broad spread in the educational status of participants which, in addition to the other characteristics of participants displayed in Table 9, is explored in relation to frailty status later in this chapter.

Table 9. Sociodemographic characteristics of participants

Sociodemographic variable	**Value**
Age (years)	
Mean (± SD)	74.9 (9.9)
60-69, N (%)	105 (34.1)
70-79, N (%)	99 (32.1)
≥80, N (%)	104 (33.8)
Sex	
Female, N (%)	155 (50.3)
Male, N (%)	153 (49.7)
Tribe	
Chagga	218 (70.8)
Pare	30 (9.7)
Maasai	17 (5.5)
Other[1]	43 (14.0)
Marital status	
Married, N (%)	158 (51.2)
Widow/ widower, N (%)	126 (40.9)
Divorced/ separated, N (%)	13 (4.2)
Never married, N (%)	11 (3.6)
Provider(s) of care and assistance with ADLs	
Mean number of caregivers, N (± SD)	1.6 (1.0)
Child, N (%)	190 (61.7)
Spouse, N (%)	116 (37.7)
Grandchild, N (%)	34 (11.0)
Child-in-law, N (%)	32 (10.4)
Paid caregiver, N (%)	5 (1.6)
Other[2], N (%)	77 (25.0)
Education	
Secondary or higher, N (%)	45 (14.6)

Primary complete, N (%)	143 (46.4)
Some primary, N (%)	36 (11.7)
No formal, N (%)	82 (26.6)
Don’t know/ refused, N (%)	2 (0.6)
Literacy	
Read/write well, N (%)	125 (40.6)
Read/write with difficulty, N (%)	69 (22.4)
Unable to read/ write, N (%)	113 (36.7)
Don’t know/ refused, N (%)	1 (0.3)
Pension	
No, N (%)	281 (91.2)
Yes, N (%)	25 (8.1)
Don’t know/ refused, N (%)	2 (0.6)
Health insurance	
No insurance, N (%)	208 (67.5)
National Health Insurance Fund, N (%)	96 (31.2)
Community Health Fund, N (%)	2 (0.6)
Other scheme, N (%)	2 (0.6)
Exemption from user fees granted	
Yes	14 (4.5)
No	294 (95.5)

[1]Other tribes included: Haya (n=1), Meru (n=7), Mbulu (n=1), Nyanwezi (n=1), Nyaturu (n=1), Rangi (n=4), Sandawe (n=1), Warusha (n=2), and other (n=25). [2]Other caregivers included: other relatives (n=51), neighbours (n=17), friends (n= 5), and other (n=4). SD, standard deviation.

5.4 Clinical characteristics of participants

Before exploring clinical variables by their relationship to frailty status, it is first worth giving a brief overview of these data for the sample population as a whole (displayed in Table 10) as they do help to paint a picture of who was being admitted and why.

Just under half of the older people who were admitted to hospital were multimorbid (n=135, 43.8%). Table 11 shows the number of participants reporting each diagnostic category of the WHO SAGE questionnaire. Hypertension and diabetes were the most common diagnoses in this group. In contrast, depression was not reported by any participants which is unsurprising given the differences in cultural expressions of mental distress and also highlights the limitations of using standardised tools like the WHO SAGE questionnaire in a uniform way across different cultural settings. Interestingly, the proportion with HIV was lower than the background population prevalence, which may reflect survivor bias.

A majority of participants were dependent for one or more of their ADLs according to the Barthel (n=209, 67.9%). A slightly smaller proportion of participants (118, 38.3%) were unable to perform one or more of the usual expected cultural roles of an older person according to the IDEA-IADL. Non-communicable disease was responsible for most admission episodes according to the recorded diagnoses of the admitting physicians (n=214, 69.5%), while infectious diseases only accounted for a small proportion (n=47, 15.3%). It was feared that COVID-19 may impact results as data collection took place in the wake of the omicron wave. However, only four (1.3%) participants tested positive despite both lateral flow and polymerase chain reaction testing being widely available. Smoking status was also recorded and in total 15 (4.9%) of participants currently smoked tobacco, whilst 76 (24.7%) had given up after smoking in the past. Around a third of participants drank alcohol on a regular basis (n=105, 34.4%). The full details of the clinical characteristics of the overall sample population are displayed in Table 10 and are explored in relation to frailty status later in this chapter.

Table 10. Clinical characteristics of participants

Clinical variable	**Value**
Number of self-reported chronic conditions	
0-1, N (%)	142 (46.1)
2, N (%)	92 (29.9)
≥3, N (%)	43 (14.0)
Don't know, N (%)	31 (10.1)
Physician recorded admission diagnoses	
Communicable disease, N (%)	47 (15.3)
Non-communicable disease, N (%)	214 (69.5)
Both, N (%)	38 (12.3)
Undifferentiated/ unclear, N (%)	9 (2.9)
COVID-19 status	
Positive test, N (%)	4 (1.3)
Negative test, N (%)	105 (34.1)
Suspected case with test result awaited, N (%)	8 (2.6)
Not suspected and not tested, N (%)	191 (62.0)
Barthel Index	
Median score (± IQR)	12.0 (4.0 – 19.0)
0 ADLs disability, N (%)	99 (32.1)
≥1 ADLs disability, N (%)	209 (67.9)
IDEA-IADL	
Median score (± IQR)	11.0 (8.0 – 18.0)

0 IADLs disability, N (%)	183 (59.4)
≥1 IADLs disability, N (%)	118 (38.3)
Incomplete data, N (%)	7 (2.3)
IDEA-Cog	
Median score (± IQR)	5.0 (0.0 – 9.0)
0-4 poor cognition, N (%)	144 (46.8)
5-7 moderate cognition, N (%)	63 (20.5)
8-12 good cognition, N (%)	101 (32.8)
EURO-D depression scale	
0-3 depressive symptoms, N (%)	54 (17.5)
≥4 depressive symptoms, N (%)	249 (80.8)
Incomplete data, N (%)	5 (1.6)
Confusion Assessment Method	
Positive for delirium, N (%)	39 (12.7)
Negative for delirium, N (%)	254 (82.5)
Incomplete data, N (%)	15 (4.9)

≥1 ADL disability according to the Barthel Index was defined as scoring a zero (indicating dependency) for one of more items. ≥1 IADL disability according to the IDEA-IADL was defined as scoring a zero ("cannot do this") for one or more items. Number of chronic conditions was self-reported. SD, standard deviation. IQR, interquartile range. IDEA-IADL Identification and Intervention for Dementia in Elderly Africans Instrumental Activities of Daily Living screen. IDEA-Cog, Identification and Intervention for Dementia in Elderly Africans Cognitive screen.

Table 11. Morbidities by WHO SAGE category, ordered by prevalence

Morbidity categories	**N=277**	**Percentage**
Hypertension	131	47.3
Diabetes	69	24.9
Chronic respiratory disease	50	18.1
Other	49	17.7
Heart disease	45	16.2
Stomach, bowel or liver problems	34	12.3
Chronic renal failure	25	9.0
Stroke	22	7.9
Cancer	11	4.0
HIV	10	3.6
Tuberculosis	9	3.2
Cataracts	7	2.5
Arthritis	7	2.5
Dementia	3	1.1
Epilepsy	3	1.1
Depression	0	0.0

5.5 Frailty prevalence

The prevalence of frailty was lowest according to the phenotype at 57.0% (95% CI 49.0 – 61.1%), and highest when using the B-FIT 2 at 71.1% (95% CI 66.1 – 75.8%). While it was possible to apply the CFS to all participants, missing data meant that 10 older people could not be classified using the B-FIT2 and over half of all participants (n=159, 51.6%) had too many missing items to calculate their phenotypic frailty status. Table 12 displays the frailty prevalence according to each tool and the number of participants and percentage for whom valid data were available (feasibility).

Table 12. Summary of frailty prevalence

Frailty instrument	Total valid, N (%)	Non-frail[1]		Frail[1]	
		N	% (95% CI)	N	% (95% CI)
Frailty phenotype	149 (48.4%)	64	43.0 (34.9 – 51.0)	85	57.0 (49.0 – 65.1)
Clinical Frailty Scale	308 (100%)	103	33.4 (28.2 – 38.6)	205	66.6 (61.4 – 71.8)
Brief Frailty Instrument for Tanzania v2	298 (96.8%)	86	28.9 (24.2 – 33.9)	212	71.1 (66.1 – 75.8)

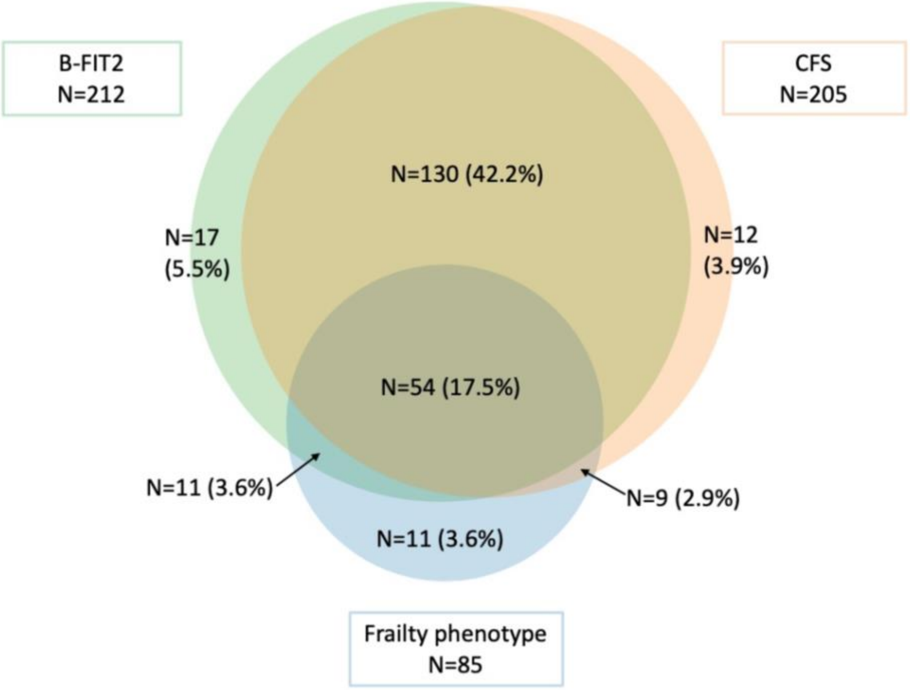
[1] *Data have been dichotomised so that pre-frail and robust categories are amalgamated and termed "non-frail". Cut-off scores used to define frailty: ≥3 for the frailty phenotype, ≥5 for the Clinical Frailty Scale, ≥8 for the B-FIT2. 95% CI, 95% Confidence Interval.*

The feasibility was highest for the CFS which was successfully applied to all participants and was closely followed by the B-FIT2. There were considerable problems experienced in operationalising the frailty phenotype which was applied to less than half of the participants and is discussed in detail in the next section.

For the 142 participants for whom the results of all three tools were available, statistical agreement between the different frailty constructs was good (Fleiss' $\kappa=0.624$, 95% CI 0.529 – 0.719, p<0.001). If the frailty phenotype is removed from the picture (due to the high proportion of missing data), agreement between the CFS and B-FIT2 was even stronger (Cohen's $\kappa=0.699$, 95% CI 0.612 – 0.778, n=298, p<0.001). The degree of agreement is displayed visually in the Venn diagram in Figure 18 which shows the overlap in older people classified as "frail" according to the three tools, and in Figure 19 which shows the overlap between those considered "non-frail". In addition, linear regression analysis (visualised in

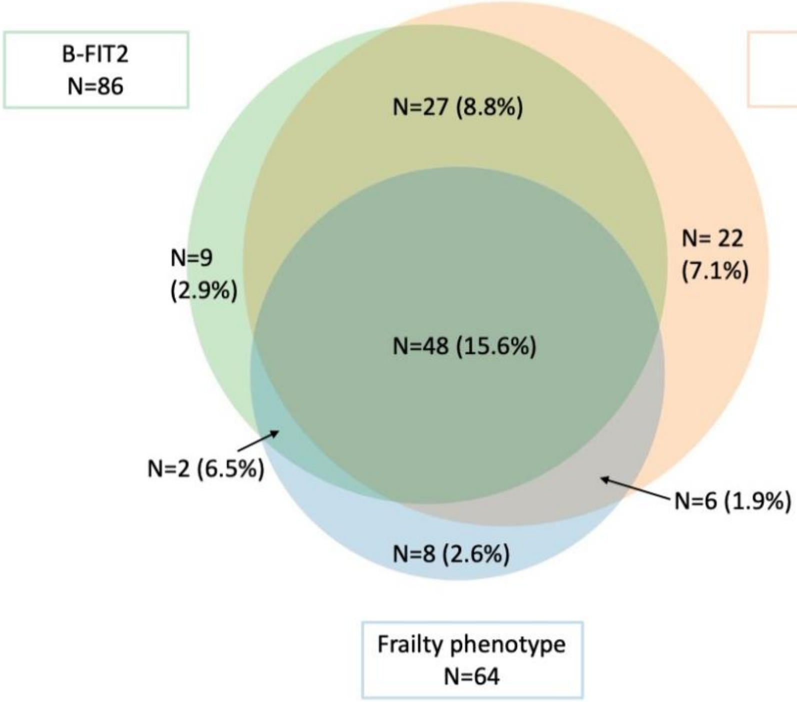
Figure 20) demonstrated strong evidence that B-FIT2 score was associated with CFS score (R^2=0.645, F(1,296)=539.0, p<0.001; β=0.803, p<0.001).

Figure 18. The overlap between "frail" status according to phenotype, CFS and B-FIT2



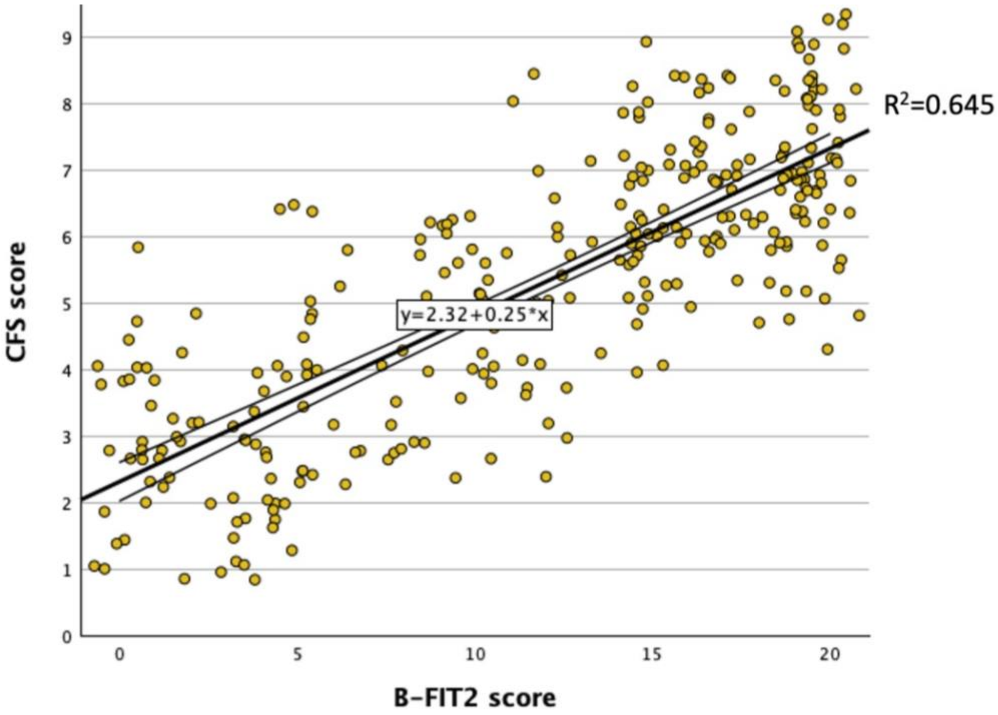
Cut-off scores used to define frailty: ≥3 for the frailty phenotype, ≥5 for the CFS, ≥8 for the B-FIT2. Percentages displayed as a proportion of the total sample n=308. B-FIT2, Brief Frailty Instrument for Tanzania v2; CFS, Clinical Frailty Scale.

Figure 19. The overlap between "non-frail" status according to phenotype, CFS and B-FIT2



Cut-off scores used to define frailty: ≥3 for the frailty phenotype, ≥5 for the CFS, ≥8 for the B-FIT2. Percentages displayed as a proportion of the total sample n=308. B-FIT2, Brief Frailty Instrument for Tanzania v2. CFS, Clinical Frailty Scale.

Figure 20. Jitter plot demonstrating the linear regression between B-FIT2 and CFS scores



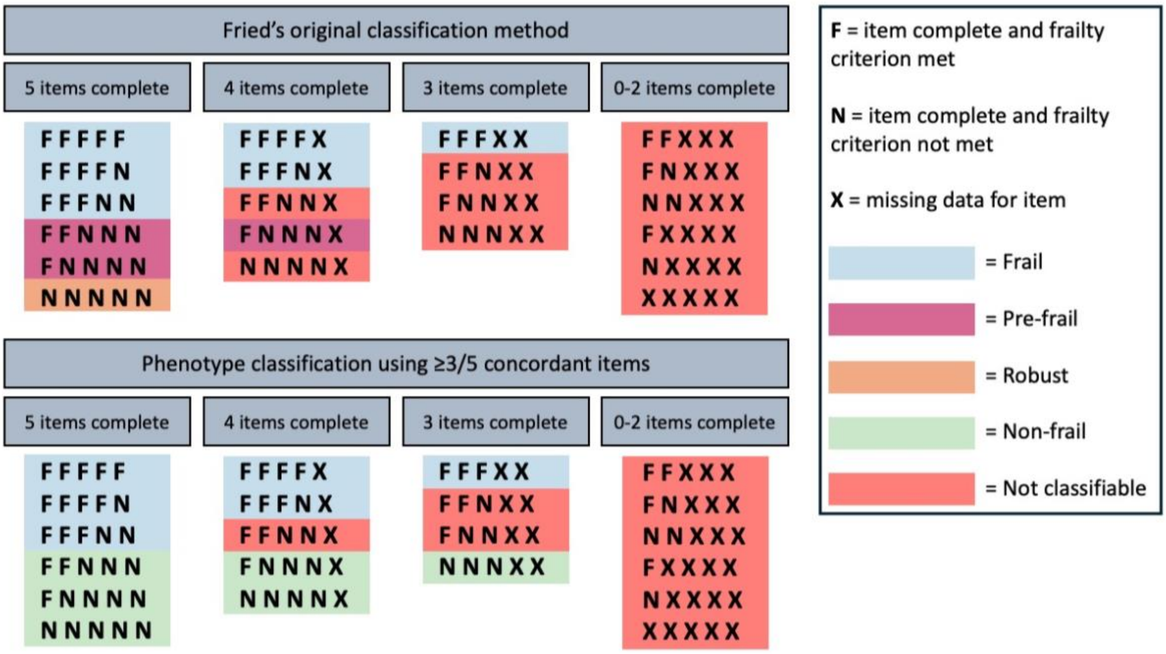
The SPSS jitter function has been applied here to help better visualise the relationship between these categorical variables. CFS, Clinical Frailty Scale. B-FIT2, Brief Frailty Instrument for Tanzania v2.

5.5.1 Frailty prevalence by phenotype

The frailty phenotype proved problematic to apply in this setting and there was a high proportion of missing data, too high to consider imputation. However, it was possible to make some inferences without imputation to make phenotypic classifications for just under half of participants. In this section, these inferences are outlined and the reasons for missing data are explored.

Fried's original thresholds consider 0 *"robust"*, 1-2 *"pre-frail"*, and 3-5 *"frail"*. However, where there are large amounts of missing data, participants could still be classified and included if they had ≥3/5 concordant items (all *positive* for frailty, or all *negative* for frailty). Those with ≥3/5 items *positive* may be classified as *"frail"*, and those with ≥3/5 items *negative* as *"non-frail"*. This method has previously been used in cases where there is a high proportion of missing data because it avoids the need for any imputation (Payne et al., 2017).

Figure 21. The classification of participants with missing frailty phenotype data items



Fried's original classification method

5 items complete	4 items complete	3 items complete	0-2 items complete
FFFFF	FFFFX	FFFXX	FFXXX
FFFFN	FFFNX	FFNXX	FNXXX
FFFNN	FFNNX	FNNXX	NNXXX
FFNNN	FNNNX	NNNXX	FXXXX
FNNNN	NNNNX		NXXXX
NNNNN			XXXXX

Phenotype classification using ≥3/5 concordant items

5 items complete	4 items complete	3 items complete	0-2 items complete
FFFFF	FFFFX	FFFXX	FFXXX
FFFFN	FFFNX	FFNXX	FNXXX
FFFNN	FFNNX	FNNXX	NNXXX
FFNNN	FNNNX	NNNXX	FXXXX
FNNNN	NNNNX		NXXXX
NNNNN			XXXXX

F = item complete and frailty criterion met

N = item complete and frailty criterion not met

X = missing data for item

This figure displays all the possible combinations for the five frailty phenotype items along with how they would be classified without imputation using Fried's original phenotype, and how this would differ using the ≥3/5 concordant items method. Items may be positive and indicative of frailty (F), negative for frailty (N), or there may be missing data for an item (X).

To be classified as *frail*, at least three items must be positive (FFF) and it does not matter whether the remaining items are negative (NN) or missing (XX), this is sufficient data to make the classification. Likewise, a person is definitely not frail if three of five items are negative (NNNXX), but they could still be *pre-frail* or *robust* depending on the value of the missing items (X). However, if the distinction between *pre-frail* and *robust* is dropped, and instead all participants re categorised in a binary manner, as either *frail* or *non-frail* then data from more individuals can be included. Even using this method, it is not possible to classify those with fewer than three concordant items without imputation.

Table 13 demonstrates the prevalence of frailty (and pre-frailty) using the methods outlined above. Using the ≥3/5 concordant items method allowed the inclusion of 18 more individuals and consequently led to a reduction in the prevalence of frailty when compared with Fried's original method.

Table 13. Prevalence of frailty according to Fried's classification method versus the ≥3/5 concordant items method

Frailty phenotype method	**Total valid, N**	**Robust or non-frail**		**Pre-frail**		**Frail**	
		N	**% (95% CI)**	**N**	**% (95% CI)**	**N**	**% (95% CI)**
Fried's original method	131	1	0.8 (0.0 – 2.3)	45	34.4 (26.7 – 42.7)	85	64.9 (56.5 – 72.5)
≥3/5 concordant items method	149	64	43.0 (34.9 – 51.0)	-	-	85	57.0 (49.0 – 65.1)

95% CI, 95% Confidence Interval.

Missing data meant that the frailty phenotype could not be calculated for 159 (51.6%) participants. Only 26 (8.4%) completed all five items, though 241 (78.2%) were able to complete at least three. The self-reported exhaustion and low physical activity items, which relied on verbal responses to statements, were completed by nearly all participants (n=307, 99.7%). By contrast, hand grip strength and walking speed – which required sitting/ standing and taking part in an activity – were less well completed. A total of 218 (70.8%) participants reported they could not stand at the time of interview, and their Barthel Index results indicated that at their usual baseline 114 (37%) could walk less than 50 yards and a further 20 (6.5%) could not walk at all. Though the weight loss item did not require any action on the part of the older person, a total of 166 (53.9%) participants answered *"Don't know"* to the question *"Have you lost weight during the last 3 months?"*. Table 14 displays the number of participants who completed each phenotype item and the reasons for missing data recorded by the research team.

Table 14. Proportion of missing data for each phenotype item and the reasons

Proportion of missing data for each phenotype item		
Frailty phenotype item	**Complete item N (%)**	**Incomplete item N (%)**
Weak grip strength	158 (51.3)	150 (48.7)
Slow walking speed	71 (23.1)	237 (76.9)
Self-reported exhaustion	307 (99.7)	1 (0.3)
Weight loss	142 (46.1)	166 (53.9)
Low physical activity	307 (99.7)	1 (0.3)
Reasons for missing items		
Reason		**N (%)**
Acute illness prevented completion of one or more items	Total	159 (51.6)
	General lethargy	41 (13.3)
	Hypo/hypertension	27 (8.8)
	Stroke/ TIA	26 (8.4)
	Shortness of breath	25 (8.1)
	Pain	12 (3.9)
	Medical devices	6 (1.9)
	Other acute	22 (7.1)
Chronic disability prevented completion of one or more items	Total	14 (4.5)
	Previous stroke	6 (1.9)
	Chronic immobility	5 (1.6)
	Amputation	3 (1.0)

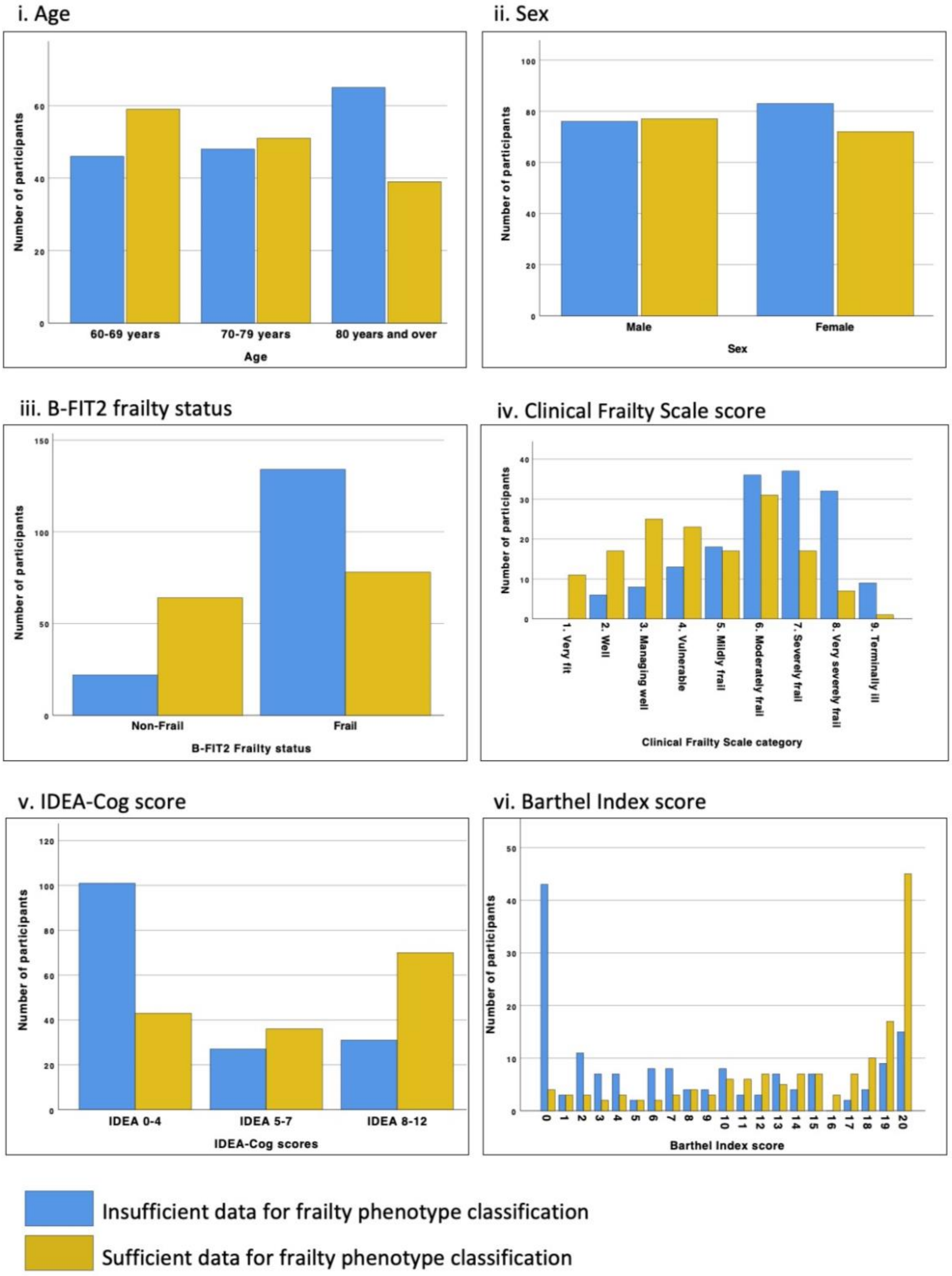
This raised the question: were frailty phenotype items missing at random, or as a result of the effects of acute illness, disability or frailty. To explore this, a post-hoc analysis was performed comparing the characteristics of participants whose frailty status could be classified (using the ≥3/5 concordant items method) against individuals with insufficient data. Characteristics selected for comparison were age, sex, B-FIT2 and CFS scores (all of which relate to frailty), as well as Barthel Index scores (as a measure of ADL disability), and the IDEA-cog (as an assessment of cognition). The findings of these post-hoc analyses indicate strong evidence that participants with insufficient data to be categorised according to the phenotype were older, with greater frailty (according to B-FIT2 and CFS), poorer cognition and greater disability. There was no evidence of difference in the distribution of the sexes between groups (see Table 15 and Figure 22).

Table 15. Comparison of participants with sufficient data for phenotypic classification versus those with insufficient data

Comparison variable	**Sufficient data (N=149)**	**Insufficient data (N=159)**	**Test statistic**	**P**
Mean age in years (SD)[1]	73.1 (9.4)	76.6 (10.1)	3.172	**<0.002**
Female sex N (%)[2]	72 (48.3)	83 (52.2)	0.463	0.569
B-FIT2 score (IQR)[3]	8.5 (3.0 – 15.0)	16.0 (10.3 – 19.8)	5963.5	**<0.001**
CFS median score (IQR)[3]	4.0 (3.0 – 6.0)	6.0 (5.0 – 8.0)	6121.5	**<0.001**
IDEA-cog median score (IQR)[3]	7.0 (7.0 – 10.0)	2.0 (0.0 – 7.0)	6922.0	**<0.001**
Barthel Index median score (IQR)[3]	17.0 (11.0 – 20.0)	6.0 (0.0 – 14.0)	5673.0	**<0.001**

[1]Independent samples t-test. [2]Chi-squared test. [3]Mann-Whitney U test. B-FIT2, Brief Frailty Instrument for Tanzania v2; CFS, Clinical Frailty Scale. IDEA-Cog, Identification and Intervention for Dementia in Elderly Africans Cognitive screen.

Figure 22. Comparison of participants with sufficient data for phenotypic classification versus those with insufficient data to be classified

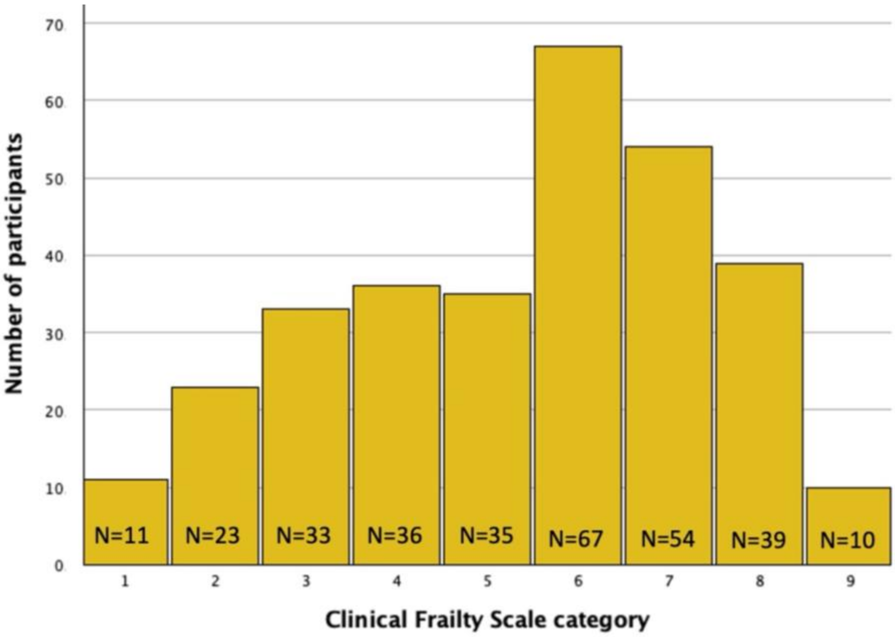


Participants for whom there was insufficient data to classify frailty status according to phenotype were more likely to be aged 80 years and over (i), more likely to be frail according to the B-FIT2 (iii) and scored higher on the Clinical Frailty Scale (iv). Compared with those with sufficient data to be classified, more participants displayed poor cognitive function (indicated by low IDEA-Cog scores [v]), and disability (indicated by lower scores on the Barthel [vi]). Brief Frailty Instrument for Tanzania v2. IDEA-Cog, Identification and Intervention for Dementia in Elderly Africans Cognitive screen.

5.5.2 Frailty prevalence by the Clinical Frailty Scale

The CFS was successfully applied to all 308 participants based on researchers' global judgement, with a total of 205 (66.6%, 95% CI 61.4 – 71.8%) scoring 5-9, indicating frailty. The distribution of CFS scores, displayed in Figure 23, showed a skew towards frailty with the most frequent category being *"Moderately frail"* (n=67, 21.8%). Very few of the older adults admitted to hospital were deemed *"Very fit"* (n=11, 3.6%) or *"Terminally ill" (n=10, 3.2%)* at the extremes of the scale.

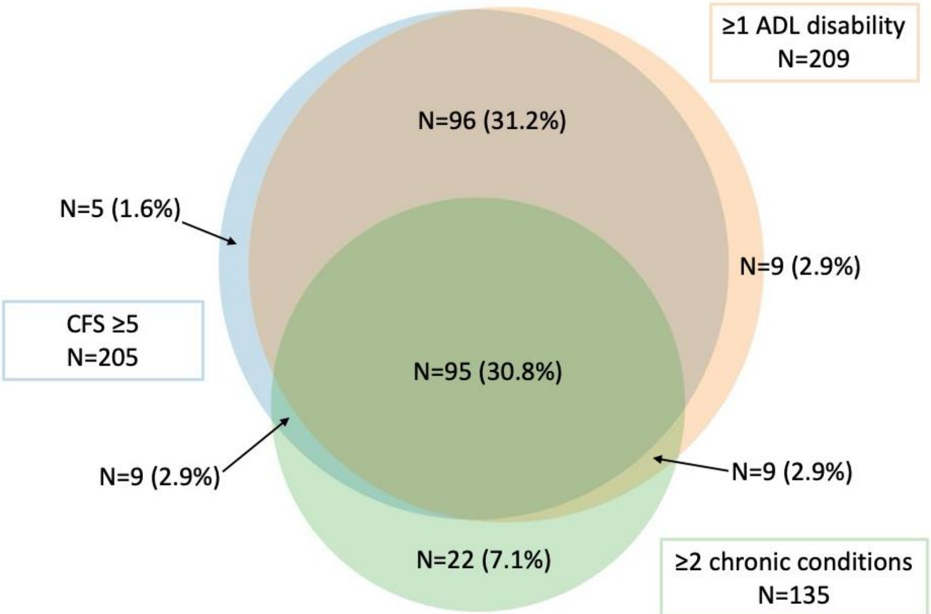
Figure 23. The number of participants in each CFS category



1. Very fit, 2. Well, 3. Managing well, 4. Vulnerable, 5. Mildly frail, 6. Moderately frail, 7. Severely frail, 8. Very severely frail, 9. Terminally ill.

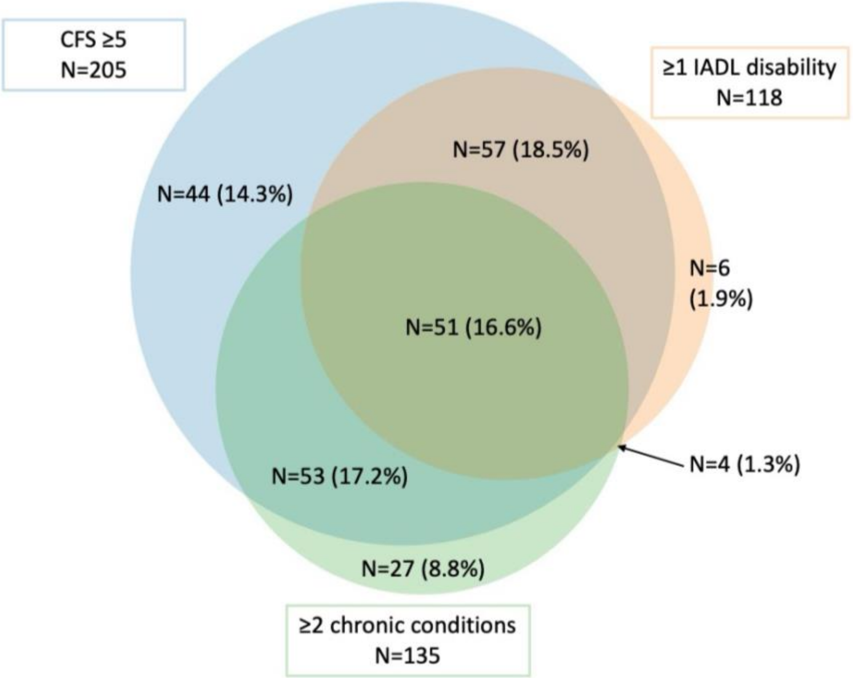
The overlap between frailty defined by the CFS, disability defined by the Barthel Index and self-reported multimorbidity is explored in the Venn diagram in Figure 24. This displays the considerable overlap between frailty and disability; 191 participants (62.0%) fulfilled criteria for both, while only 18 (5.8%) had disability without frailty, and 14 (4.5%) had frailty without disability. Though it was slightly more distinct, multimorbidity still demonstrated a large overlap with both frailty and disability. Figure 25 paints a very similar picture for disability according to the IDEA-IADL which concerns culturally specific aspects of social functioning.

Figure 24. The overlap between CFS frailty, multimorbidity and Barthel Index ADL disability



Percentages displayed as a proportion of the total sample for whom CFS was valid n=308. ≥1 ADL disability according to the Barthel Index was defined as scoring a zero (indicating dependency) for one of more items. Number of chronic conditions was self-reported. CFS, Clinical Frailty Scale. ADL, Activities of Daily Living.

Figure 25. The overlap between CFS frailty, multimorbidity and IDEA-IADL disability



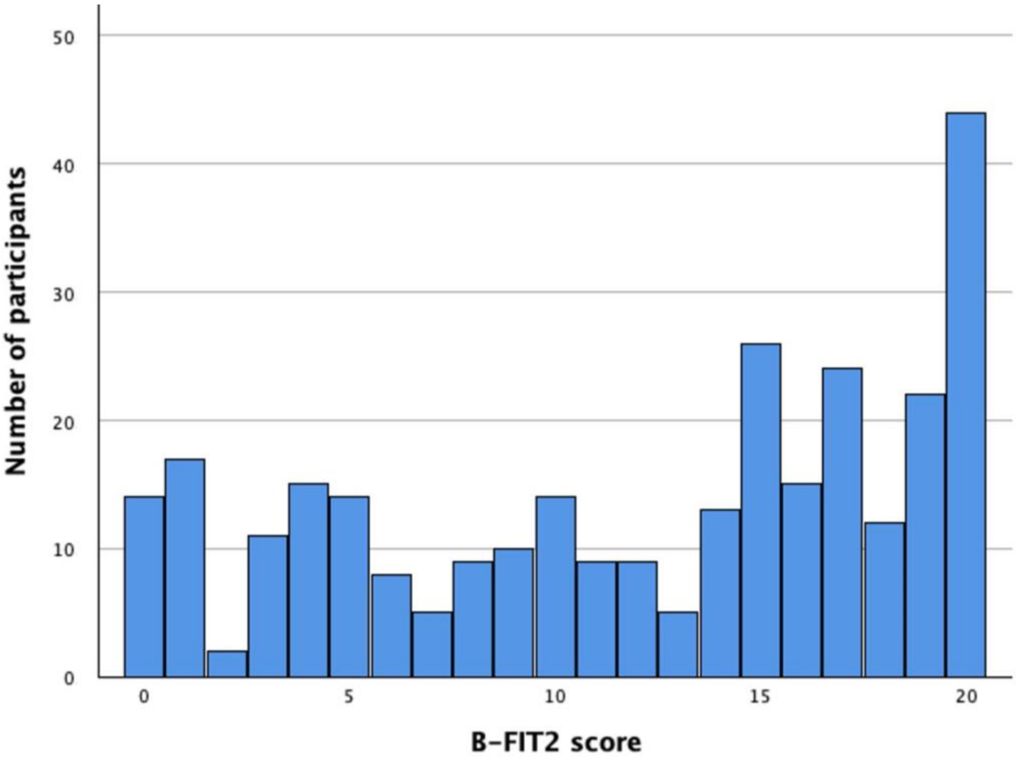
Percentages displayed as a proportion of the total sample for whom CFS was valid n=308. ≥1 IADL disability according to the IDEA-IADL was defined as scoring a zero ("cannot do this") for one or more items. Number of chronic conditions was self-reported. CFS, Clinical Frailty Scale. IDEA-IADL, Identification and Intervention for Dementia in Elderly Africans Instrumental Activities of Daily Living screen.

5.5.3 Frailty prevalence by Brief Frailty Instrument for Tanzania version 2

Using the B-FIT2, 298 participants (96.8%) had sufficient data for their frailty status to be calculated. For the 10 participants for whom B-FIT2 score was not available, missing calf circumference was the commonest reason (n=10, 3.2% of the total sample), with one participant also missing the distance vision item. Unfortunately, reasons were not provided so it is unclear why calf circumference was missed in these cases.

The number of participants living with frailty according to the B-FIT2 was 211 (71.1%, 95% CI 66.1 – 75.8%), and 44 (14.8%) older people scored the maximum 20 points. As a result of the weighting of the items (which varies from one to nine points, see Table 8) some scores were more frequent than others so data did not follow a normal distribution (see Figure 26). Table 16 provides a breakdown of the B-FIT2 items and the number of participants who met the criteria for each. This demonstrates a curious quality of the B-FIT2: it is possible to meet the criteria for frailty based only on severe disability according to the Barthel Index, because the weighting of this item (worth nine points) is greater than the cut-off for frailty of ≥8.

Figure 26. The number of participants with each B-FIT2 score



B-FIT2, Brief Frailty Instrument for Tanzania v2.

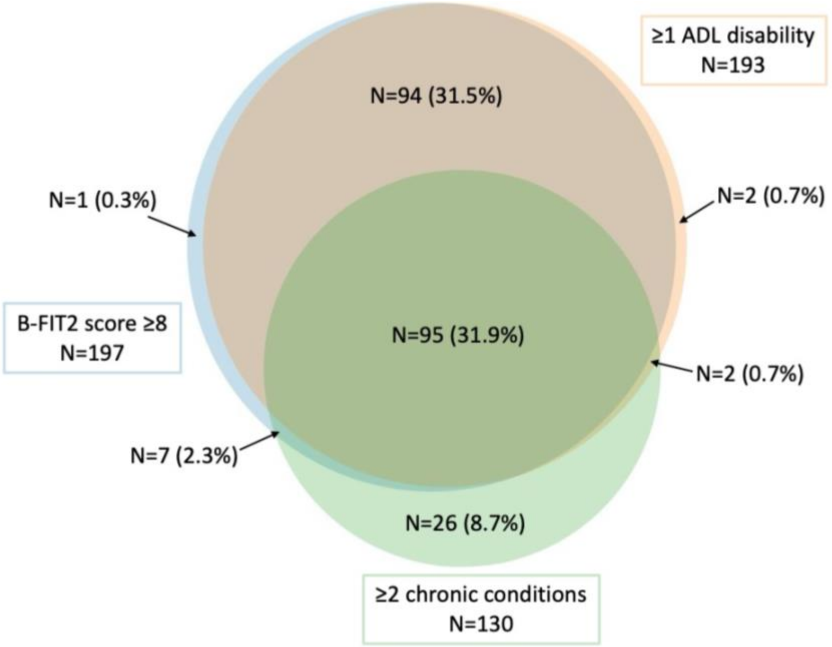
Table 16. How participants scored to determine their ultimate B-FIT2 frailty status

B-FIT2 component (score weighting)	**B-FIT2 <8, non-frail N=86 (%)**	**B-FIT2 ≥8, frail N=212 (%)**
Barthel Index		
19-20 Mild/ no disability (0)	70 (81.4)	13 (6.1)
15-18 Moderate disability (3)	16 (18.6)	25 (11.8)
0-14 Severe disability (9)	0 (0.0)	174 (82.1)
IDEA-Cog		
8-12 No impairment (0)	55 (64.0)	50 (23.6)
5-7 Possible impairment (1)	19 (22.1)	40 (18.9)
0-4 Probable impairment (2)	12 (14.0)	122 (57.5)
Calf circumference		
≥31cm (0)	49 (57.0)	82 (38.7)
<31cm (3)	37 (43.0)	130 (61.3)
Ability to join in community activities		
No, mild or moderate problems (0)	81 (94.2)	43 (20.3)
Severe or extreme problems (5)	5 (5.8)	169 (79.1)
Distance vision		
No difficulties (0)	46 (53.5)	64 (30.2)
Difficulties (1)	40 (46.5)	148 (69.8)

Brief Frailty Instrument for Tanzania v2 weightings reproduced from (Lewis et al., 2020b); IDEA-Cog, Identification and Intervention for Dementia in Elderly Africans Cognitive screen.

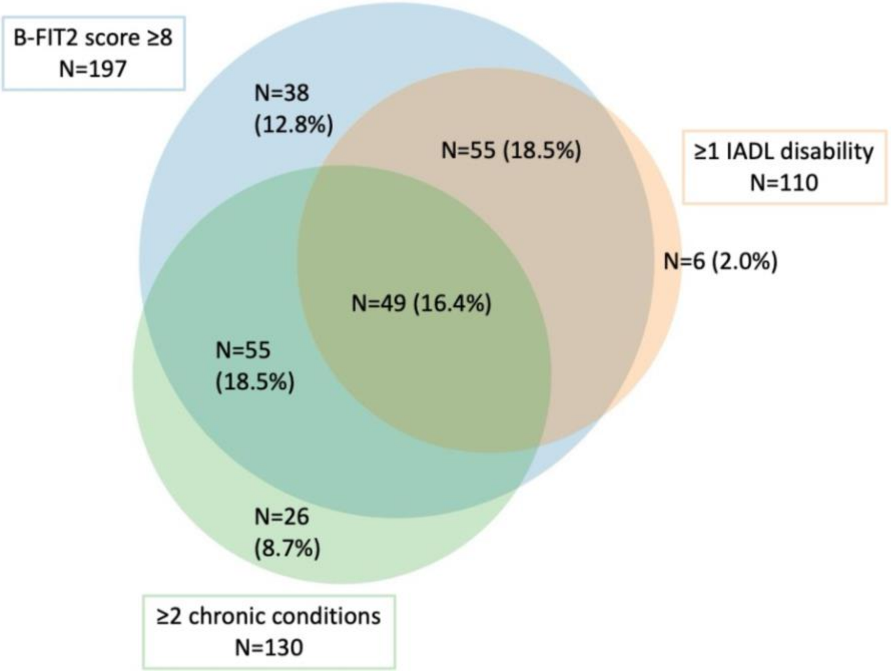
Given the moderate correlation between B-FIT2 and CFS scores, it is perhaps unsurprising that the two tools demonstrated similar overlaps with disability and multimorbidity. There was near complete overlap between B-FIT2 frailty status and having disability of at least one ADL (Figure 27), or IADL (Figure 28). However, this was to be expected given that the B-FIT2 incorporates, and gives a heavy weighting to, the Barthel Index score. In both figures it is possible to see that multimorbidity also overlaps with disability and frailty, yet appears to be slightly more distinct.

Figure 27. The overlap between B-FIT2 frailty, multimorbidity and Barthel Index ADL disability



Percentages displayed as a proportion of the total sample for whom B-FIT2 was valid n=298. ≥1 ADL disability according to the Barthel Index was defined as scoring a zero (indicating dependency) for one of more items. Number of chronic conditions was self-reported. B-FIT2, Brief Frailty Instrument for Tanzania v2. ADL, Activities of Daily Living.

Figure 28. The overlap between B-FIT2 frailty, multimorbidity and IDEA-IADL disability



Percentages displayed as a proportion of the total sample for whom B-FIT2 was valid n=298. ≥1 IADL disability according to the IDEA-IADL was defined as scoring a zero ("cannot do this") for one or more items. Number of chronic conditions was self-reported. B-FIT2, Brief Frailty Instrument for Tanzania v2; IDEA-IADL, Identification and Intervention for Dementia in Elderly Africans Instrumental Activities of Daily Living screen.

5.6 Characteristics by frailty status

Given the high proportion of missing data, and problems experienced in the application of the frailty phenotype, the characteristics of frailty in this setting were explored only in relation to the CFS and B-FIT2. Binary logistic regression was used to assess the relationship between sociodemographic and clinical variables, and the likelihood of frailty.

5.6.1 Sociodemographic and clinical characteristics by CFS frailty status

Table 17 displays the binary logistic regression between CFS frailty status and sociodemographic and clinical variables. Examining first the unadjusted (or crude) odds ratios, these data provide very strong evidence that CFS frailty was associated with increasing age, lower levels of education, poorer performance in cognitive testing, and greater disability of ADLs and IADLs. There was also strong evidence that older people with frailty according to the CFS were more likely to be living with multimorbidity and suffering from delirium at the time of assessment. There was some moderate evidence to support an association between CFS frailty status and having a higher number of depressive symptoms. However, these data provided no evidence to suggest an association between either sex, or marital status and CFS frailty.

Considering next the adjusted binary logistic regression model, holding all other variables constant, this demonstrated strong evidence that disability of one or more ADLs, or IADLs, was associated with CFS frailty status. There was also weak evidence of associations between CFS frailty and lower levels of education, as well as delirium. In contrast to the unadjusted analyses, in this model, there was little to no evidence of associations between CFS frailty status and age, multimorbidity, cognitive performance or number of depressive symptoms. Variance Inflation Factors did not indicate any multicollinearity between independent variables (including the Barthel Index) and CFS frailty status. However, disability of one or more ADLs according to the Barthel was so strongly associated with CFS frailty (crude odds ratios indicating those with ≥1 ADLs disability according to the Barthel were more than 64 time more likely to be frail [95% CI 30.62 – 135.53]) that this likely dominated the adjusted regression model.

Table 17. Sociodemographic and clinical associations of CFS frailty status

Sociodemographic or clinical variable	**CFS Non-frail N=103 (%)^2**	**CFS Frail N=205 (%)^2**	**Crude odds ratio (95% CI)**	**Unadjusted *p***	**Adjusted odds ratio (95% CI)**	***Adjusted p***
Age in years						
60-69	49 (47.6)	56 (27.3)	1.00	<0.001	1.00	0.453
70-79	31 (30.1)	68 (33.2)	1.92 (1.08 – 3.40)		0.51 (0.16 – 1.56)	
≥80	23 (22.3)	81 (39.5)	3.08 (1.69 – 5.62)		0.87 (0.24 – 3.14)	
Sex						
Female	47 (45.6)	108 (52.7)	1.33 (0.83 – 2.13)	0.243	0.55 (0.18 – 1.68)	0.295
Male	56 (54.4)	97 (47.3)	1.00		1.00	
Marital status						
Married	59 (57.3)	99 (48.3)	0.70 (0.43 – 1.12)	0.137	0.98 (0.36 – 2.69)	0.969
Unmarried^1	44 (42.7)	106 (51.7)	1.00		1.00	
Education						
Secondary or higher	22 (21.4)	23 (11.3)	1.00	<0.001	1.00	0.050
Primary complete	58 (56.3)	85 (41.9)	1.40 (0.72 – 2.75)		1.94 (0.53 – 7.06)	
Some primary	10 (9.7)	26 (12.8)	2.49 (0.98 – 6.33)		0.78 (0.13 – 4.59)	
No formal	13 (12.6)	69 (34.0)	5.08 (2.21 – 11.67)		9.05 (1.42 – 57.84)	
Number of self-reported chronic conditions						
0-1	55 (63.9)	87 (45.5)	1.00	0.005	1.00	0.330
≥2	31 (36.0)	104 (54.5)	2.12 (1.26 – 3.58)		1.61 (0.62 – 4.20)	
Barthel Index						
0 ADLs disability	85 (82.5)	14 (6.8)	1.00	<0.001	1.00	<0.001
≥1 ADLs disability	18 (17.5)	191 (93.2)	64.43 (30.62 – 135.53)		72.05 (24.00-216.28)	
IDEA-IADL						
0 IADLs disability	90 (90.0)	93 (46.3)	1.00	<0.001	1.00	0.010
≥1 IADLs disability	10 (10.0)	108 (53.7)	7.46 (3.98 – 14.00)		4.63 (1.44 – 14.90)	

IDEA-Cog						
0-4 poor cognition	22 (21.4)	122 (39.6)	7.48 (4.01 – 13.65)	<0.001	2.08 (0.64 – 6.84)	0.316
5-7 moderate cognition	23 (22.3)	40 (19.5)	2.35 (1.23 – 4.48)		0.81 (0.22 – 3.03)	
8-12 good cognition	58 (56.3)	43 (21.0)	1.00		1.00	
EURO-D depression scale						
0-3 depressive symptoms	24 (23.3)	30 (15.0)	1.00	0.040	1.00	0.321
≥4 depressive symptoms	79 (76.7)	170 (85.0)	1.89 (1.03 – 3.48)		0.53 (0.15 – 1.85)	
Confusion Assessment Method						
Positive for delirium	4 (4.0)	35 (18.2)	5.4 (1.86 – 15.68)	0.002	4.27 (0.74 – 24.52)	0.104
Negative for delirium	97 (96.0)	157 (81.8)	1.00		1.00	

[1] Unmarried includes widowed, divorced, separated and never married. [2] Percentages are of the valid N for each variable. IDEA-IADL Identification and Intervention for Dementia in Elderly Africans Instrumental Activities of Daily Living screen. IDEA-Cog, Identification and Intervention for Dementia in Elderly Africans Cognitive screen.

5.6.2 Sociodemographic and clinical characteristics by B-FIT2 frailty status

When examining the relationships between sociodemographic and clinical variables and B-FIT2 frailty status, the Barthel Index and IDEA-Cog were not included in analyses because they are both components of this instrument. The CAM was also removed from the analyses because only one person in the non-frail group was positive for delirium; at this very low event frequency the phenomenon of separation occurred in which the standard error for this variable became extremely large, producing unreliable regression coefficients.

Looking at the unadjusted binary logistic regressions in Table 18, these provide very strong evidence of an association between B-FIT2 frailty status and increasing age, lower educational level and increasing IADL disability. There were also moderate associations between frailty and a higher number of depressive symptoms, as well as being unmarried (widowed, divorced, separated or never married). Unadjusted regression did not show any evidence of an association between B-FIT2 frailty and sex.

In the adjusted model, the evidence for an association between B-FIT2 frailty status and disability of one or more items on the IDEA-IADL remained strong after controlling for the other sociodemographic and clinical variables. However, after adjustment the regression demonstrated only moderate evidence of an association with lower levels of education, and greater multimorbidity, as well as weak evidence of a relationship with age. Interestingly, in this adjusted model there was moderate evidence of an association with female sex. Again, Variance Inflation Factors did not indicate any multicollinearity.

Table 18. Sociodemographic and clinical associations of B-FIT2 frailty status

Sociodemographic or clinical variable	**B-FIT2 Non-frail N=86 (%)[2]**	**B-FIT2 Frail N=212 (%)[2]**	**Crude odds ratio (95% CI)**	**Unadjusted *p***	**Adjusted odds ratio (95% CI)**	**Adjusted *p***
Age in years						
60-69	45 (52.3)	57 (26.9)	1.00	<0.001	1.00	0.051
70-79	25 (29.1)	71 (33.5)	2.24 (1.23 – 4.09)		2.10 (0.95 – 4.62)	
≥80	16 (18.6)	84 (39.6)	4.15 (2.14 – 8.04)		2.63 (1.10 – 6.31)	
Sex						
Female	39 (45.3)	109 (51.4)	1.28 (0.77 – 2.11)	0.343	2.67 (1.17 – 6.01)	0.020
Male	47 (54.7)	103 (48.6)	1.00		1.00	
Marital status						
Married	53 (61.6)	98 (46.2)	0.56 (0.32 – 0.89)	0.017	0.64 (0.30 – 1.36)	0.244
Unmarried[1]	33 (38.4)	114 (53.8)	1.00		1.00	
Education						
Secondary or higher	17 (19.8)	27 (12.8)	1.00	<0.001	1.00	0.030
Primary complete	53 (61.6)	87 (41.2)	1.03 (0.52 – 2.07)		1.00 (0.39 – 2.53)	
Some primary	6 (7.0)	28 (13.3)	2.94 (1.01 – 8.57)		4.11 (0.84 – 20.07)	
No formal	10 (11.6)	69 (32.7)	4.34 (1.77 – 10.67)		3.50 (1.00 – 12.25)	
Number of self-reported chronic conditions						
0-1	45 (63.4)	93 (47.2)	1.00	0.020	1.00	0.011
≥2	26 (36.6)	104 (52.8)	1.94 (1.10 – 3.38)		2.47 (1.23 – 4.96)	
IDEA-IADL						
0 IADLs disability	77 (89.5)	103 (49.5)	1.00	<0.001	1.00	<0.001
≥1 IADLs disability	9 (10.5)	105 (50.5)	5.34 (3.12 – 9.16)		10.19 (3.45 – 30.14)	
EURO-D depression scale						
0-3 depressive symptoms	21 (25.3)	31 (15.0)	1.00	0.040	1.00	0.294
≥4 depressive symptoms	62 (74.7)	176 (85.0)	1.92 (1.03 – 3.59)		1.59 (0.67 – 3.76)	

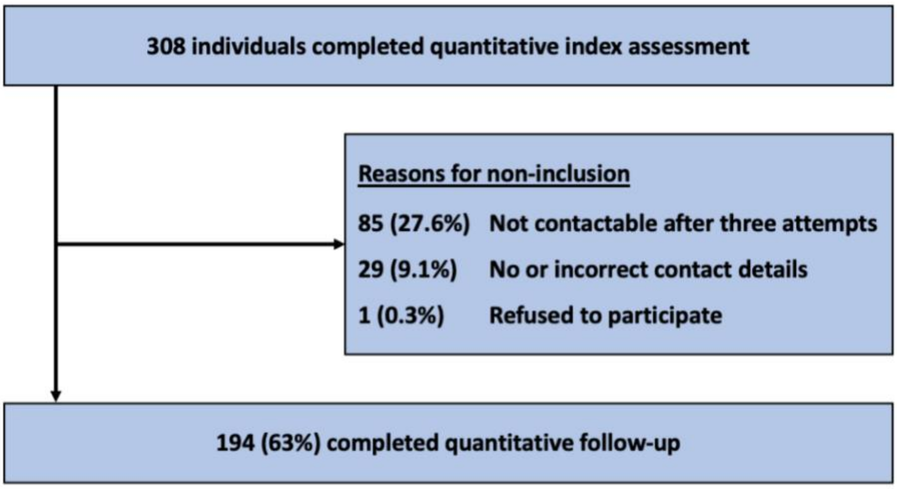
Confusion Assessment Method						
Positive for delirium	1 (1.2)	38 (18.9)	-	-	-	-
Negative for delirium	82 (98.8)	163 (81.1)	-		-	

[1] Unmarried includes widowed, divorced, separated and never married. [2]Percentages are of the valid N for each variable. IDEA-IADL Identification and Intervention for Dementia in Elderly Africans Instrumental Activities of Daily Living screen. IDEA-Cog, Identification and Intervention for Dementia in Elderly Africans Cognitive screen.

5.7 Clinical outcomes by frailty status

Telephone follow-up assessments were conducted between 7th of March and 2nd of May 2023. In total, primary outcome data regarding mortality were obtained for 194 (63.0%) of the original participants. The progression of participants through the study from baseline assessment to follow-up, along with reasons for loss to follow-up, are displayed in Figure 29. The average time from date of baseline admission to completion of follow-up assessment was 10.8 (± 0.9) months. Rates of successful follow-up were highest from MRRH (65.5%) and KCMC (65.3%), both of which are located in the urban centre of Moshi. Rates were lower for the more rural sites in HDH (57.9%) and MLH (47.1%).

Figure 29. Flow chart of participant progression and reasons for loss to follow-up



Despite taking multiple phone numbers for participants and their informants, many remained uncontactable (n=85, 27.6%), and this was the most common reason for loss to follow-up. A post-hoc binary logistic regression was conducted to assess whether frailty (or the sociodemographic and clinical factors associated with frailty status in adjusted regression models), altered the likelihood of successful follow-up. There was no evidence that any of the variables entered into this model were associated with follow-up participation (see Table 19).

Table 19. Sociodemographic and clinical associations of loss to follow-up

Variables associated with frailty status	**Respondents to follow-up N=194 (%)[1]**	**Lost to follow-up N=114 (%)[1]**	**Adjusted odds ratio (95% CI)**	***p***
Age in years				
60-69	65 (33.5)	40 (35.1)	1.00	0.825
70-79	63 (32.5)	36 (31.6)	0.93 (0.48 – 1.79)	
≥80	66 (34.0)	38 (33.3)	1.18 (0.62 – 1.38)	
Sex				
Female	99 (51.0)	56 (49.1)	0.80 (0.46 – 1.38)	0.422
Male	95 (49.0)	58 (50.9)	1.00	
Education				
Secondary or higher	26 (13.5)	19 (16.8)	1.00	0.647
Primary complete	96 (49.7)	47 (41.6)	1.35 (0.62 – 2.91)	
Some primary	25 (13.0)	11 (9.7)	1.36 (0.45 – 4.01)	
No formal	46 (23.8)	36 (31.9)	1.02 (0.41 – 2.53)	
Number of self-reported chronic conditions				
0-1	89 (51.4)	53 (51.0)	1.00	0.872
≥2	84 (48.6)	51 (49.0)	1.04 (0.61 – 1.77)	
Barthel Index				
0 ADLs disability	64 (33.0)	35 (30.7)	1.00	0.791
≥1 IADLs disability	130 (77.0)	79 (69.3)	0.88 (0.34 – 2.30)	
IDEA-IADL				
0 IADLs disability	119 (62.6)	62 (54.9)	1.00	0.461
≥1 IADLs disability	71 (37.4)	51 (45.1)	0.80 (0.45 – 1.44)	
Clinical Frailty Scale frailty status				
Non-frail	68 (35.1)	35 (30.7)	1.00	0.283
Frail	126 (64.9)	79 (69.3)	0.61 (0.24 – 1.51)	
Brief Frailty Instrument for Tanzania v2 frailty status				
Non-frail	55 (29.4)	31 (27.9)	1.00	0.714
Frail	132 (70.6)	80 (72.1)	1.18 (0.49 – 2.85)	

[1] Percentages are of the valid N for each variable. IDEA-IADL Identification and Intervention for Dementia in Elderly Africans Instrumental Activities of Daily Living screen.

5.7.1 Mortality

After an average 10.8 months follow-up, 100 (32.5%) respondents were confirmed deceased. However, with follow-up data missing for 114 participants, the true mortality rate lay somewhere between 32.5% (100 deaths) and 69.5% (214 deaths), depending on the vital status of those lost to follow-up. It is striking that 51 older people (40 with CFS frailty and 11 without), representing more than half of all of those who died within the follow-up period, did so within the first 30 days following admission. This number included all the older people who died during their index hospital admission (n=26, 13.4%). Of the follow-up respondents, 62 (32.0%) died in hospital, 30 (15.5%) died at home and the place of death was unknown for 8 (4.1%).

In total, 77 participants with frailty according to the CFS died during follow-up (meaning the true all-cause mortality for those with CFS frailty was between 37.6 and 76.1%), compared with 23 in the non-frail group (true all-cause mortality between 22.3% and 56.3%). To determine whether frailty affected the chances of survival, a multivariable Cox Proportional Hazards model was applied. Table 20 displays the results of these regressions including unadjusted models, and those adjusted for the potential confounding effects of age, sex and education. Covariates were selected a priori based on their clinical importance in the existing literature and were therefore retained for the adjusted analyses, even if the unadjusted models indicated no evidence of an association. Even when adjusting for these potential confounders there was strong evidence of a survival difference between frail and non-frail groups. Those with frailty according to the CFS were 2.26 (95% CI 1.34 – 3.83, p=0.002) times more likely to die during the follow-up period than those without, while frailty according to the B-FIT2 conferred a 2.63 (95% CI 1.45 – 4.77, p=0.001) times greater risk of mortality.

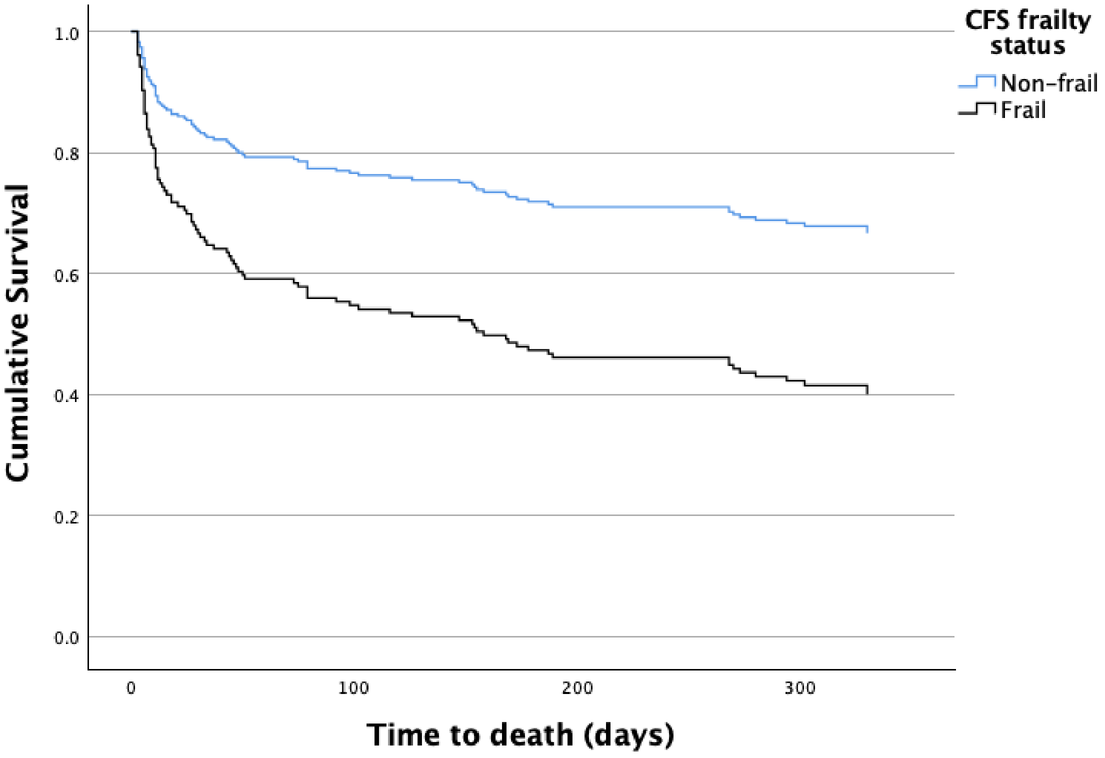
Table 20. Cox regression models of the relationship between frailty status and all-cause mortality

Variable	Coefficient (SE)	HR (95% CI)	*p*
Model 1. Age unadjusted			
Age	0.1 (0.1)	1.0 (0.99 – 10.3)	0.185
Model 2. Sex unadjusted			
Female sex	-0.16 (0.21)	0.85 (0.57– 1.27)	0.427
Model 3. Education unadjusted			
No formal education	0.45 (0.36)	1.57 (0.77 – 3.20)	0.216
Model 4. CFS unadjusted			
CFS Frailty	0.82 (0.25)	2.27 (1.39 – 3.69)	<0.001
Model 5. B-FIT2 unadjusted			
B-FIT2 Frailty	0.95 (0.28)	2.59 (1.48 – 4.51)	<0.001
Model 6. CFS adjusted			
CFS Frailty	0.81 (0.27)	2.26 (1.34 – 3.83)	0.002
Age	-0.00 (0.01)	1.00 (0.98 – 1.02)	0.842
Female sex	-0.35 (0.22)	0.71 (0.46 – 1.10)	0.121
No formal education	0.38 (0.41)	1.46 (0.65 – 3.28)	0.355
Model 7. B-FIT2 adjusted			
B-FIT2 Frailty	0.97 (0.30)	2.63 (1.45 – 4.77)	0.001
Age	-0.00 (0.01)	1.00 (0.98 – 1.02)	0.934
Female sex	-0.42 (0.23)	0.66 (0.42 – 1.03)	0.065
No formal education	0.46 (0.43)	1.59 (0.68 – 3.65)	0.284

SE; Standard Error. HR, Hazard ratio. CFS, Clinical Frailty Scale.

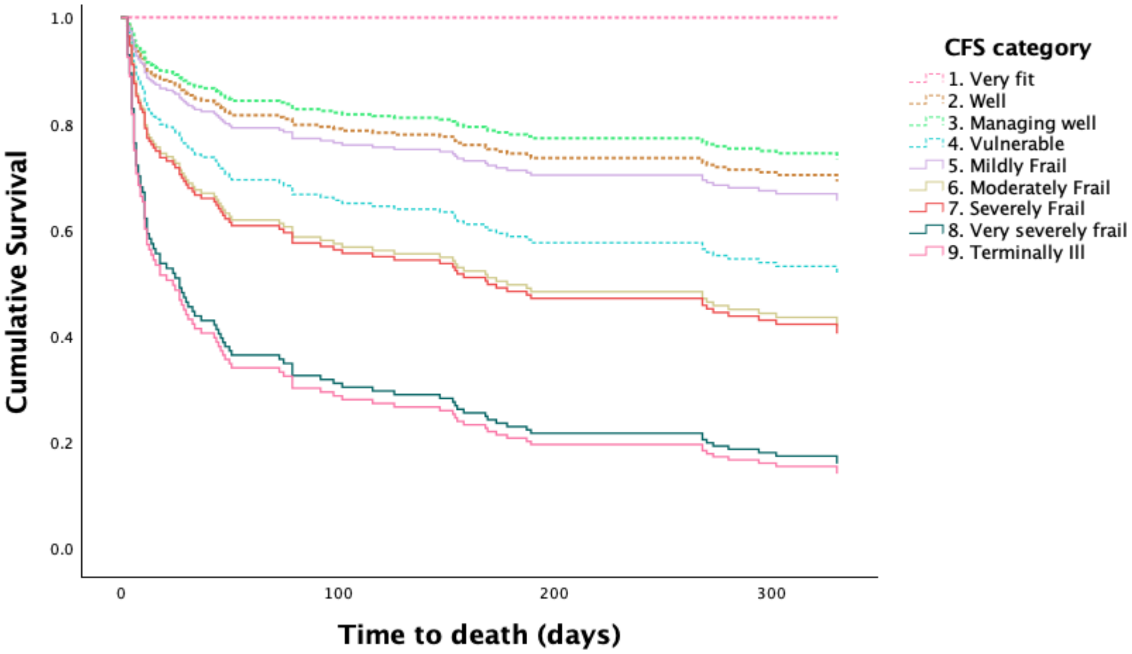
For all participants together the median survival time was 219.0 (95% CI 195.4 – 242.7) days. This figure was 189.8 (95% CI 160-8 – 218.9) days for participants with frailty and 264.4 (95% CI 228.5 – 300.3) days for those without. Log-rank (Mantel-Cox) tests were calculated to assess whether there were differences between older adults with, and without, frailty in terms of the distribution of time until death. For both the CFS and B-FIT2, these indicated moderate evidence of a difference between older adults with frailty and without (p=0.024 and 0.014 respectively). The Kaplan-Meier curves in figures 30-33 demonstrate that the highest rates of mortality were in the first 0-50 days following hospital admission, and that regardless of which tool was used, there was a marked and early separation in the proportion of deaths between participants with, and without, frailty.

Figure 30. Kaplan-Meier survival estimates by CFS frailty status



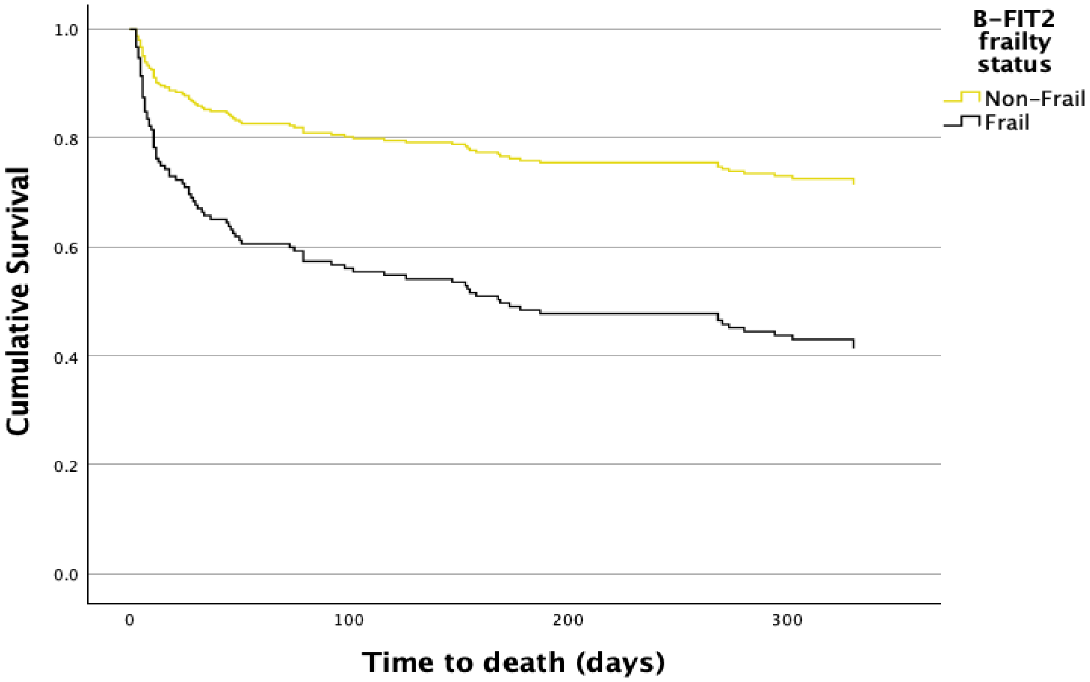
Frailty defined as CFS score ≥5. Adjusted for age, sex and education. CFS, Clinical Frailty Scale.

Figure 31. Kaplan-Meier survival estimates by CFS frailty category



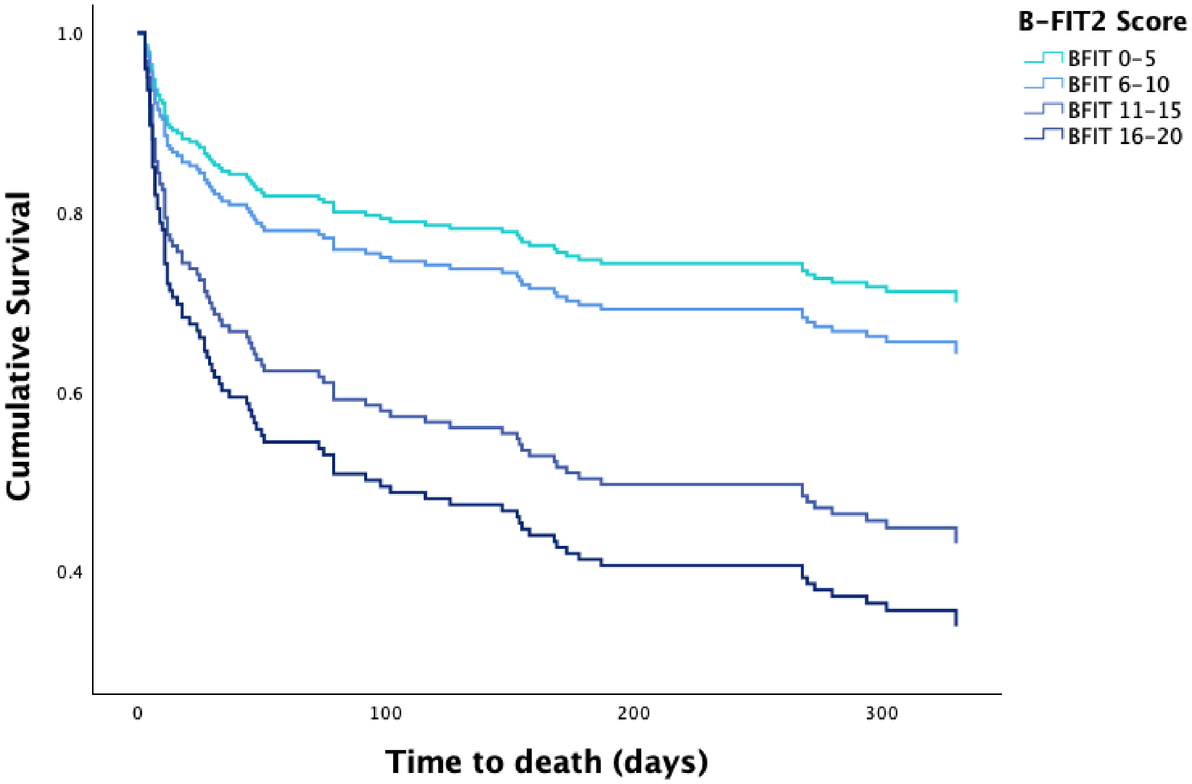
Dashed lines represent the cumulative survival of participants with CFS categories 0-4, and solid lines those with categories 5-9. Interestingly, participants whose frailty status was recorded as "5. Mildly frail" displayed lower rates of mortality than those who were categorised as "4. Vulnerable". Amongst all other categories, there was a reduction in cumulative survival with increasing CFS frailty. The greatest difference was between participants in the "7. Severely frail" and "8. Very severely frail" categories, with a 20% reduction in the rate of cumulative survival. CFS, Clinical Frailty Scale.

Figure 32. Kaplan-Meier survival estimates by B-FIT2 frailty status



Frailty defines as B-FIT2 score ≥8. Adjusted for age, sex and education. B-FIT2, Brief Frailty Instrument for Tanzania v2.

Figure 33. Kaplan-Meier survival estimates by B-FIT2 frailty score



The B-FIT2 provides binary frailty status with a cut-off score of ≥8. However, in this diagram it has instead been divided into equal bins in increments of scores of 5 to demonstrate the reduction in cumulative survival with increasing B-FIT2 score. B-FIT2, Brief Frailty Instrument for Tanzania v2.

It is important to note that the CFS and B-FIT2 tools were designed to detect frailty and not merely predict mortality, even though the two are often related. However, considering the ability of each frailty tool to predict mortality is one way in which they can be compared in the absence of a *"gold standard"*. With this caveat in mind, Harrell's C-statistic was used to evaluate the goodness-of-fit, or concordance, of the Cox regression models for the CFS and the B-FIT2. C-statistics indicated that both CFS and the B-FIT2 demonstrated some (albeit weak) discriminatory power, assigning higher hazard ratios to participants with shorter survival times. The two measures performed comparably with C-statistic values which were very similar at 0.58 (95% CI 0.53 – 0.63) for the CFS, and 0.59 (95% CI 0.54 – 0.64) for the B-FIT2.

Receiver Operator Characteristics (ROC) were also calculated to give an additional measure with which to compare the accuracy of the two frailty tools in their prediction of mortality. For the CFS, the Area Under the ROC Curve was 0.70 (95% CI 0.63 – 0.78, p=<0.001), indicating an acceptable level of accuracy. Based on inspection of the ROC coordinates, the optimal cut-off CFS score for accurate prediction of mortality was ≥5.5, somewhere between mild and moderate frailty (sensitivity 70.0%, specificity 63.8%). The B-FIT2 was fractionally less accurate, with an Area Under the ROC curve of 0.69 (95% CI 0.62 – 0.77, p<0.001)) and an optimal threshold score of ≥11.5 (sensitivity 69.1%, specificity 61.3%).

5.7.2 Length of stay

The length of index hospital stay (from admission to discharge, or death) ranged from 1-41 days with a median duration of 5.0 days (IQR 3.0 – 9.0 days). Mann-Whitney U tests demonstrated no evidence of differences in length of stay between participants with, and without, frailty when defined by the CFS (U=5939.5, Z=-1.06, p=0.294), or the B-FIT2 (U=4722.0, Z=-1.78, p=0.075).

5.7.3 Readmission

Accurate readmission data proved very tricky to obtain for several reasons. Of all the sites, only KCMC maintained an electronic database of admissions, with all the other participating hospitals relying on paper admission logs. Though these could be checked frequently by researchers during the initial recruitment stage, when the time came to follow-up it proved simply impractical to retrospectively obtain and screen all these log entries manually for the names of participants. Furthermore, due to the complex mix of traditional, *“western”* and Islamic naming conventions in Tanzania, many participants gave multiple name variations.

It was possible to obtain data regarding readmissions within 30-days of baseline admission. In-person visits to wards and monitoring of admission logs were continued for 30-days after recruitment ceased to give an estimate of the short-term readmission rate for all 308 participants, though even this may still have missed some people if researchers did not catch them in-person and if their names varied in the records. A total of 11 (5.5%) participants were readmitted within 30-days (7 meeting CFS frailty criteria and 6 with frailty according to the B-FIT2).

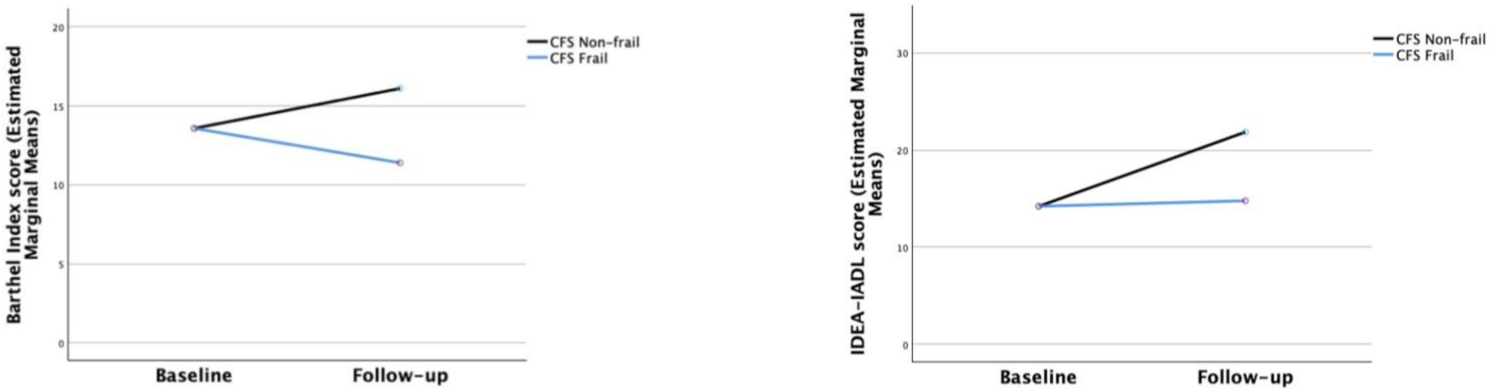
5.7.4 Disability transitions

For the 94 respondents who were alive at follow-up, the Barthel Index and IDEA-IADL were repeated. Unsurprisingly given the differences in mortality, this subgroup of survivors had lower levels of frailty and disability than the sample population as a whole. Amongst this group, 50 (53.2%) were female and the mean age was 74.0 (SD 10.3) years. A total of 49 (52.1%) were living with frailty according to the CFS, and this figure was 55 (59.1%, n=93 as data were missing for one individual) according to the B-FIT2.

Unsurprisingly, regardless of the tool used to define it, participants with frailty had lower baseline scores for the Barthel Index and IDEA-IADL than their non-frail counterparts (indicating poorer function for the ADL and IADL domains assessed). Repeated measures ANOVAs were performed to examine changes in Barthel Index and IDEA-IADL scores between admission and follow-up. Frailty status was included as a between-subjects factor to assess whether the pattern of change over time differed according to frailty classification. Age and baseline scores were included in each analysis as covariates to adjust for age-related declines in function and to account for ceiling effects.

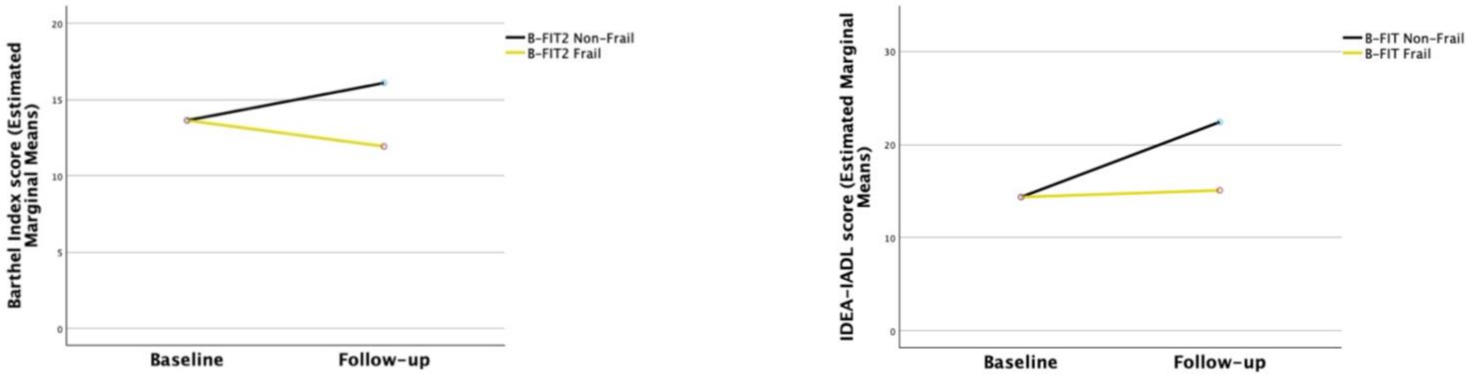
Repeated measures ANOVAs provided moderate evidence that change in Barthel Index scores over time differed between frail and non-frail participants, for both the CFS (F[1, 89]=6.84, p=0.010) and the B-FIT2 (F[1, 88]=5.77, p=0.018). Additionally, there was strong evidence that changes in IADL scores over time differed between frail and non-frail participants, again regardless of whether frailty was defined using the CFS (F[1, 87]=10.93, p=0.001), or the B-FIT2 (F[1, 86]=11.21, p=0.001). The directions of these differences are displayed and described in Figure 34.

Figure 34. Change in disability by frailty status, adjusted for age and baseline score



i. Change in Barthel Index by CFS frailty status

ii. Change in IDEA-IADL by CFS frailty status



iii. Change in Barthel Index by B-FIT2 frailty status

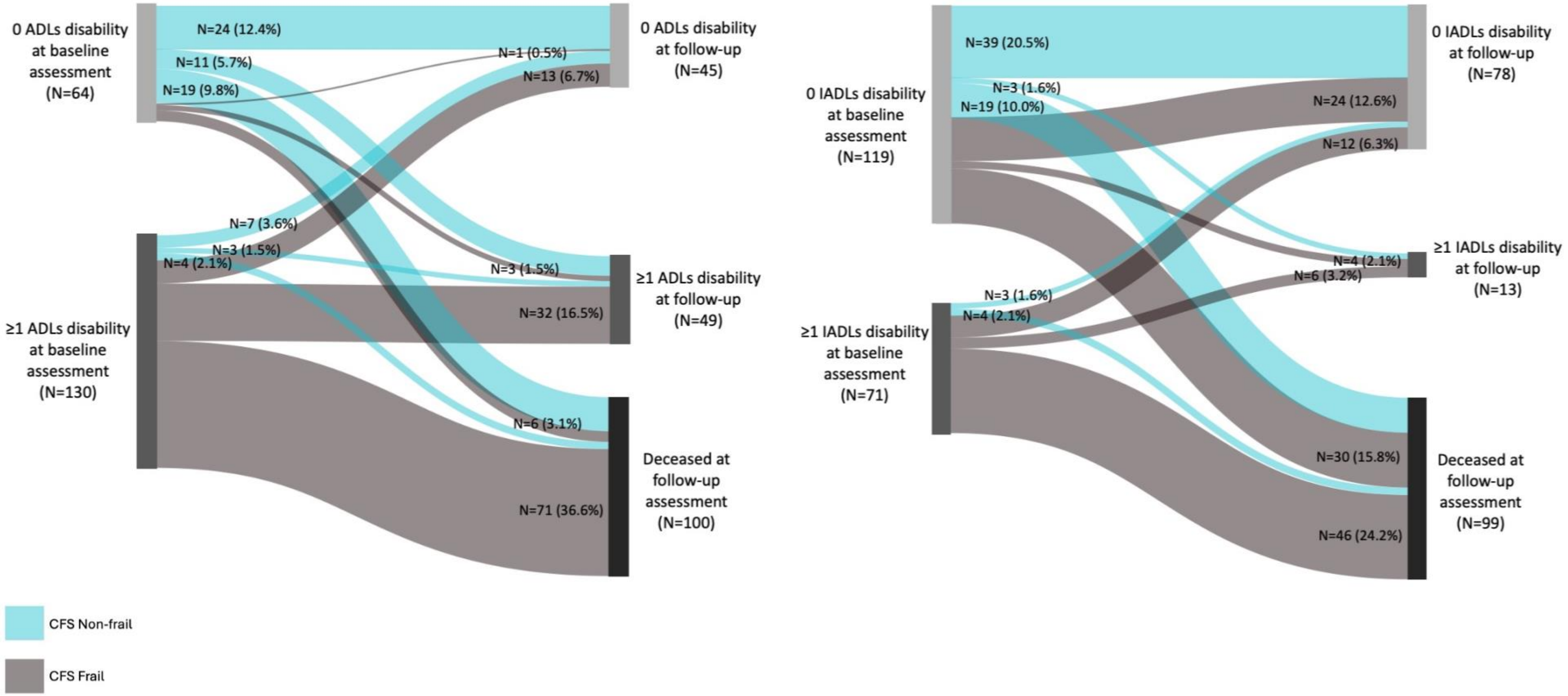
iv. Change in IDEA-IADL by B-FIT2 frailty status

These diagrams show the estimated marginal means for Barthel Index and IDEA-IADL scores over time, stratified by frailty status. They illustrate how average scores changed over time for participants of the same starting age and baseline score, but differing frailty status. Physical functioning (measured by the Barthel Index) tended to improve over time in non-frail participants, while those living with frailty showed a decline (i, iii). For social functioning (measured by the IDEA-IADL), non-frail participants tended to improve, whereas those with frailty largely remained at a similar level (ii, iv). The age and baseline scores assumed for each plot were as follows: i) Age 74.2 years, Barthel Index score 13.5; ii) Age 74.0 years, IDEA-IADL score 14.2; iii) Age 74.0 years, Barthel Index score 13.6; iv) Age 73.9 years, IDEA-IADL score 14.4. CFS, Clinical Frailty Scale. B-FIT2, Brief Frailty Instrument for Tanzania v2.

In the Barthel Index and the IDEA-IADL, a score of zero for an item indicates that the older person is unable to perform that activity unaided and is dependent on others for its completion. The Sankey diagrams in Figure 35 demonstrate the transitions of older people from baseline assessment to follow-up, between states of complete dependency on others for one or more activities (≥1 ADLs/IADLs disability) and other states in which they retain full or partial independence for all activities (0 ADLs/IADLs disability). This provides a different perspective from which to view disability transitions that cannot be captured by examining the average change in ADL and IADL scores.

At baseline, the majority of those with a disability of one or more ADLs/ IADLs were living with frailty. Amongst those who were alive at follow-up, for self-care and mobility (measured by the Barthel), as well as social functioning (measured by the IDEA-IADL), overall there was a slight reduction in the proportion of participants with one or more areas of complete dependency. Although there were many participants whose function deteriorated, there were also some who experienced improvements in function, even amongst those older people who had frailty at baseline assessment. On the one hand, this could indicate that there is the potential for physical and social function to improve. On the other hand, it may represent survivor bias. Amongst participants who were deceased at follow-up, the majority had frailty and disability of one or more ADLs according to the Barthel Index. The picture was more mixed when looking at IADL function according to the IDEA-IADL; although the majority of those who were deceased were living with frailty, there was a greater spread in their baseline social functioning, and those with and without IADL disability died in near-equal numbers.

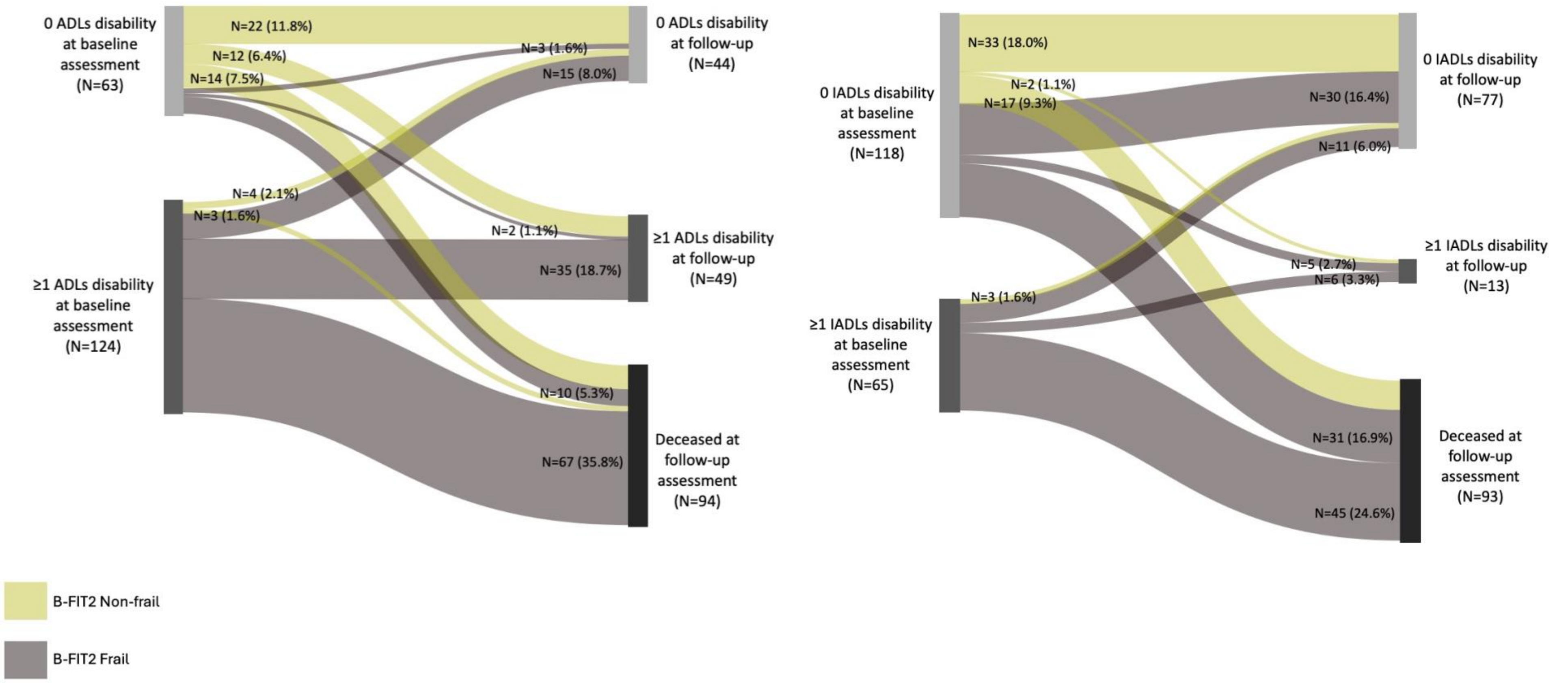
Figure 35. Sankey diagrams showing transitions between disability states by frailty status



i. Barthel Index transitions by CFS frailty status

ii) IDEA-IADL transitions by CFS frailty status

Figure 35. Sankey diagrams showing transitions between disability states by frailty status continued.



iii) Barthel Index transitions by B-FIT2 frailty status

iv) IDEA-IADL transitions by B-FIT2 frailty status

Amongst those alive at follow-up, there was a slight reduction in the proportion of older adults with one or more ADL disabilities according to the Barthel (i, iii), and with one or more IADL disabilities as measured by the IDEA-IADL (ii, iv). There was movement between categories in both directions. The distribution of disability amongst older people with and without frailty was similar according to the CFS (i, ii) and the B-FIT2 (iii, iv). For the Barthel Index (i, iii) the majority of participants who died had one or more ADLs disability at baseline. For the IDEA-IADL, those who died were more of an even mix between those with and without IADL disability at baseline. Percentages are given as a proportion of the total valid N for each diagram.

5.8 Discussion

This study included 308 older people admitted across four hospital sites in northern Tanzania with the aim of establishing the prevalence, demographic characteristics, clinical characteristics and outcomes of older people with frailty. The key findings are outlined in the bullet points below:

- The prevalence of frailty was high and ranged from 57% – 71.0% depending on the assessment tool, with the lowest estimate provided by the frailty phenotype and the higher estimates provided by the CFS and the B-FIT2.
- Considerable challenges were experienced when applying the frailty phenotype in this setting leading to a high proportion of missing data and a probable underestimation of the prevalence of physical frailty.
- There was strong evidence of associations between disability, lack of a formal and CFS frailty; meanwhile increasing age, female sex, multimorbidity were additional factors associated with frailty according to the B-FIT2.
- Follow-up data for 194 participants demonstrated that older adults with frailty were more than twice as likely to die over an average follow-up period of 10.8 months.
- Length of stay during index admission did not differ between participants with, and without, frailty and 30-day readmissions were too infrequent to draw any firm conclusions.
- In the 94 participants alive at follow-up, ADL function declined amongst participants living with frailty, whilst improving for those without. IADL function was largely maintained for individuals with frailty, whilst again improving for those without. Disability transitions demonstrated a complex picture in which there was potential amongst some older people, including individuals with frailty at baseline assessment, for function to improve with time.

5.8.1 Frailty prevalence

Due to the lack of a universal standard, every frailty tool assesses a slightly different construct. Despite this, the judgement-based CFS and the B-FIT2, derived from a multidimensional frailty index, displayed good agreement and similar prevalence estimates (66.6 and 71.1% respectively). Existing literature demonstrates that the frailty phenotype, with its restriction to physical domains, tends to produce lower estimates of the prevalence of frailty (O'Caoimh et al., 2021). This was the case in the present investigation where the prevalence of phenotypic frailty was 57.1%, although a high proportion of missing data for this instrument means there is reason to suspect this may be an underestimate.

In comparison to the community in Tanzania, this population of hospitalised older adults had a much greater burden of frailty. In 2017, Lewis et al. assessed 235 older people across five villages in the Hai District, an area within the catchment of the hospitals participating in this investigation. They found a phenotypic prevalence of 9.3%, rising to 19.1% when assessed using CGA (Lewis et al., 2018a, Lewis et al., 2018c). In other parts of the world, it has been consistently demonstrated that older people living with frailty are more likely to use hospital services, so this finding is not unexpected (Ambagtsheer and Moussa, 2021). However, health service utilisation relies on many local factors, not least geographical and financial barriers to accessing hospital services, so it should never be assumed patterns will be universal. This study gives the first hint that utilisation may be higher amongst older adults with frailty in Tanzania.

Due to the high proportion of missing data for phenotypic prevalence, caution must be applied in comparing these results with existing literature. However, it is possible to look for international comparators for the CFS. A 2025 systematic review by the author (which updated the contents of Chapter 2), identified four other studies from middle-income settings which used the CFS in hospital populations (Davidson et al., 2025). Amongst these studies, prevalence estimates ranged from 36.2 – 60.7%, incorporating data from China, Turkey and Vietnam (Liang et al., 2019b, Xu et al., 2020, Bozkurt et al., 2024, Van Nguyen et al., 2020). The lower prevalence of frailty seen in these studies may result from the different populations and health systems, but may have also been impacted by the decisions to exclude certain groups including those with impaired cognition (Liang et al., 2019b, Xu et al., 2020), sensory impairments (Liang et al., 2019b) and cancer (Van Nguyen et al., 2020). Nonetheless, compared with these middle-income settings the burden of frailty was greater amongst inpatients in Tanzania.

Looking for comparators within Africa, a recent systematic review identified four studies from healthcare settings (Kasa et al., 2024a). Two of these were in outpatient settings (Ajayi et al., 2021, Naeem et al., 2020), and another included participants from nursing homes (Hammami et al., 2020). The best comparator for the present study was conducted by Adebusoye et al. in Nigeria and recruited 450 older people admitted to medical wards in 2013/14, assessing for frailty using the Canadian Study of Health and Ageing (CSHA) Scale. Though this is not a direct comparator, the CHSA was used to produce the CFS. They found a frailty prevalence of 63.3% which is very close to the estimate produced in this Tanzanian sample population (Adebusoye et al., 2019a).

When considering the three frailty instruments used in this study, the CFS was the most feasible, with successful application to all participants. This is hardly surprising given that it is based on an overall clinical judgement and can be completed in conjunction with the older person, or an informant, in a relatively passive role. This has obvious advantages in acute settings where the older person may be unwell and less able to actively engage (Church et al., 2020). In this study, the CFS was conducted by trained researchers as a measure of *pre-admission* function, at the end of a multidimensional assessment structured around the CGA. However, it is an inherently subjective instrument, entirely dependent on the quality of the information gathered in the preceding assessment and the expertise of the user (Moreno-Ariño et al., 2020). When assessing an acutely unwell older person, lying in a hospital bed, there is a real danger of overlooking their baseline function and overestimating their frailty. In inpatient settings, reduced specificity has been observed for many different frailty instruments which tend to overestimate the burden due to acute illness effects (Oviedo-Briones et al., 2022). This is of particular concern with a judgement-based tool such as the CFS. If it were to be adopted in Tanzanian hospitals, where there is no history of geriatric training or services, considerable thought would need to be given to ensuring its appropriate use.

In contrast to the CFS, the B-FIT2 required more active participation on the part of the older person, particularly the cognitive assessment and calf circumference items. The latter was the most often missed, though unfortunately the reasons for this were not recorded.

Although calf circumference was originally intended to be measured in the standing position, in this study most participants had it measured while seated. A key practical insight was that seated measurement is often more feasible and appropriate for inpatient populations. Overall, the B-FIT2 was feasible, being successfully applied to 96.8% of participants. However, it did produce a very high estimate of frailty prevalence of 71.1% and because of the weighting of the Barthel Index, 174 participants (58%), scored sufficiently highly to be classified as frail based on their ADL function alone. As a result, the B-FIT2 discriminated poorly between disability and frailty, though multimorbidity remained more distinct. When completing the Barthel, older people and their informants were asked to consider their function 30 days prior to admission. However, if the decline occurred over a slightly longer period, or recollections were coloured by the acute illness, again it is possible that the B-FIT2 may have overestimated frailty and underestimated function.

This is the first time the B-FIT2 has been applied in a hospital context, having been developed as a community tool (Lewis et al., 2020b). In community settings, the cognitive component, (the IDEA-Cog) was included in the B-FIT2 primarily to detect dementia. However, in the context of acute illness and hospital admission, the prevalence of delirium is likely to be higher than in the community. This poses a problem, as in medical inpatient settings the IDEA-Cog was sensitive for both delirium and dementia (92% and 88%), but lacked specificity (64% and 71%) and was unable to differentiate between the two (Paddick et al., 2018). One might argue that because both delirium and dementia are related to frailty this is not a major concern. On the other hand, the case could also be made that the lack of specificity could also lead to the B-FIT2 overestimating the frailty burden in this acute setting. One potential remedy for this would be to increase the cut-off score used to define frailty in the hospital setting; analysis of these Receiver Operator Characteristics demonstrated that using a cut-off of ≥12 could certainly make the B-FIT2 more accurate when predicting mortality in this setting. This would also remedy the issue that with the existing cut-off applied in the present study, an older person was able to be classified as frail on the basis of their Barthel Index score alone due to the heavy weighting given to this item.

Unlike the CFS and B-FIT2, there were major problems in applying the frailty phenotype in this population. Only 26 (8.6%) participants were able to complete all five items, while 271

(78.2%) completed at least three. The were several reasons for this, which are explored briefly here, but are also discussed more comprehensively elsewhere (Davidson et al., 2024a). First, this study included non-ambulatory individuals while, others exclude them on the basis that it is not possible to assess the gait speed phenotype item (Öztürk et al., 2017, Oliveira et al., 2013). Symptoms relating to acute illness, particularly inability to stand, were the most common reason given by researchers for missing items and have caused problems in other studies using the phenotype in acute settings (Ostir et al., 2012, Ibrahim et al., 2019). Furthermore, the weight loss item proved problematic because most people in Tanzania do not routinely weight themselves or have access to scales. Future studies could seek to mitigate this challenge by using Body Mass Index as an alternative (though again inability to stand poses an issue), or calf circumference which is used as a surrogate for sarcopenia in several other frailty scales (Landi et al., 2014, Lewis et al., 2020b).

5.8.2 Demographic and clinical characteristics of frailty

Before examining the features that distinguished participants living with frailty from their non-frail counterparts, it is first worth remarking on some characteristics of this sample population as a whole. First, most participants lived with others and more than 85% received some kind of informal care. Much of this was provided by other older people, usually the spouse of the participant. This form of *"elder-to-elder"* care has become increasingly accepted in Tanzania and, in keeping with this study's findings, is more commonly delivered by wives to husbands (van Eeuwijk, 2016). The lack of formal support in old age was further emphasised by the low proportions of participants with health insurance (32.5%) or a pension (8.1%). In theory all participants in this study were eligible for exemption from out-of-pocket payments for hospital care, however these exemptions were only utilised by 4.5%. As a result of this finding, health insurance and exemption were identified as important factors to explore qualitatively in the interview stage of this mixed methods research.

Secondly, it is worth highlighting the high levels of multimorbidity and non-communicable disease in this sample of older people. Traditionally, hospital services in sub-Saharan Africa have been orientated towards the treatment of infectious diseases, but they are increasingly having to adapt to the growing burden of non-communicable disease (Gouda et al., 2019). Just under half (43.9%) of the older people in this study's sample reported having two or more chronic conditions and non-communicable disease dominated, accounting for 69.5% of admissions. Existing studies in the community of people of all ages in East Africa have reported the prevalence of multimorbidity at greater than 30% (Micklesfield et al., 2023). However, the lack of access to healthcare in the community means this may be a gross underestimate. This was demonstrated effectively in the community in Tanzania, where the prevalence of multimorbidity was 26.1% by self-report, but rose to 67.3% when participants were clinically assessed and screened for common conditions (Lewis et al., 2022). Therefore, it is likely that the 43.9% of participants with self-reported multimorbidity in the present study is also an underestimate.

Moving on now to consider the characteristics of frailty, in adjusted regression models increasing age was associated with B-FIT2 frailty status but interestingly was not for the CFS. Age is usually considered the greatest risk factor for frailty, so this finding was somewhat surprising (Wang et al., 2022). Although there was no multicollinearity between the variables in the binary logistic regression, disability of one or more ADLs on the Barthel was so strongly associated with CFS frailty that this came to dominate the regression model. When the Barthel was not included (as in the B-FIT2 regression model, in the crude odds ratios, or in univariate analyses as in Davidson et al. (2024a)) additional variables associated with frailty, including increasing age, became apparent.

Amongst data from high-income settings, it is generally women who experience higher rates of frailty, for greater proportions of their lives than men, despite greater longevity. This phenomenon is often referred to as the “male-female health-mortality paradox” (Gordon et al., 2017). In an African context, this pattern is evident in community-based studies which look at self-reported health status (Mwanyangala et al., 2010, Ng et al., 2010). However, the picture is less clear in relation to frailty, where sex differences are not consistent (Kasa et al., 2024a, Naeem et al., 2020, Ebeid et al., 2016, Adebusoye et al., 2019a). In the present investigation, the prevalence of frailty between the sexes was similar, with adjusted regression analyses demonstrating moderate evidence of an association between female sex and frailty according to the B-FIT2 but not the CFS. This lack of a marked difference in the risk of frailty between the sexes echoes findings from the community in Tanzania (Lewis et al., 2018a).

Similarly, there was little to no evidence of an association between marital status and frailty in this cohort. This finding runs contrary to existing data which comes largely from *"western"* HICs where being unmarried, or widowed, is generally considered to lead to greater social isolation and vulnerability and confer a greater risk of frailty (Kojima et al., 2020). However, such associations may not generalise across different sociocultural contexts. In Tanzania, extended family structures remain common and most participants in this study lived with more than three other people in their household. It is plausible that the social and functional support typically lost with the death of a spouse may be buffered by the presence of children, grandchildren or other relatives. However, it is not possible to determine from these data alone whether such support mechanisms explain the absence of an association.

Amongst the older people admitted in this study, there was evidence that lower education level was associated with frailty status, regardless of which assessment tool was used. It is worth noting that access to formal education has expanded over time, and that older participants may have had fewer opportunities. However, age was included as a covariate in the regression analysis and this finding persisted after adjustment, suggesting the association cannot be explained solely by the older age of those living with frailty. These findings echo work from both community-based studies in Tanzania, and international research across a range of settings (Wang and Hulme, 2021, Lewis et al., 2018a). In one such study by Hoogendijk et al., a group of 1,205 adults aged over 65 from the Netherlands were followed up over a period of 13 years. Those with a low educational level were 2.94 (95% CI 1.84 – 4.71) times more likely to develop frailty compared with those with high levels of education. However, this odds ratio was diminished to 1.47 (95% CI 0.85 – 2.54) once other explanatory factors, including income, were accounted for (Hoogendijk et al., 2014). Having a low level of education in itself could be a risk factor for the development of frailty, but it is more likely that it forms part of a range of indicators for socioeconomic status (such as occupation, income and wealth), all of which have the potential to affect health in old age (Wang and Hulme, 2021). The cross-sectional design of the present study limits the ability to disentangle these complex and potentially bidirectional relationships.

This study provides strong evidence of an association between the two frailty constructs assessed (the CFS and the B-FIT2) and disability amongst older people in hospital in Tanzania, both in terms of basic self-care and mobility (ADLs), as well as more complex social functions (IADLs). These findings are in keeping with literature from HICs (Doody et al., 2022, Kojima et al., 2018), and LMICs (Kang et al., 2015, Xu et al., 2020, Öztürk et al., 2017). As with frailty, disability at baseline could also have been overestimated due to the effects of acute illness. Interestingly, rates of IADL disability were lower than for ADL disability, suggesting that many individuals were still able to participate in traditional social roles despite challenges with physical functioning. In the *"cycle of frailty"*, first proposed by Fried et al. (2001), it was the vulnerability at the heart of frailty that was considered to lead to the consequences of disability, dependency and death. While it appears frailty and disability were associated in this cohort, the cross-sectional nature of the index assessment limits our ability to determine whether frailty predisposes to disability, whether disability contributes to the development of frailty, or whether both are driven by shared underlying vulnerabilities.

Cognition and frailty are strongly interlinked. Cognitive testing often forms part of frailty indices and dementia has been incorporated more explicitly in later versions of the CFS (Church et al., 2020). A very large proportion of participants in the present study (n=144, 46.8%) scored four or less on the IDEA-Cog screening instrument, indicating poor cognitive performance. Although a greater proportion of participants with frailty fell into in the lower score brackets, and there was a strong association with CFS frailty in unadjusted analyses, the overall adjusted regression model showed no evidence of association with frailty status. While it is a possibility that many participants had dementia, the low scores observed likely reflect a range of contributing variables. In the acute hospital setting, it is well understood that cognitive performance can be impacted by several other factors including mild cognitive impairment, speech problems, mental and physical illness (Collingwood et al., 2014). For instance, in the present study the CAM, which has greater specificity for delirium than the IDEA-Cog, identified 39 individuals as positive for delirium, the vast majority of whom were frail. Another potential contributing factor to low cognitive scores was the high burden of depressive symptoms identified by the EURO-D, though whether this truly represents depression must be considered with caution in this cultural context. These data serve to demonstrate the complexities of cognitive screening in acute hospital environments, where the interplay of frailty, acute illness, and potentially mood can obscure cognitive function and complicate clinical interpretation.

5.8.3 Clinical outcomes of frailty

The rate of all-cause mortality in this population of older adults was high with between 32.5% and 69.5% dying during the follow-up period. These data are broadly reflective of other examples in the literature from sub-Saharan Africa. Perhaps the most readily comparable data comes from Tumaini et al. (2019), who conducted a multi-centre study in the capital of Tanzania, Dar Es Salaam. They recruited people aged ≥60 years admitted to medical wards and found that, after a median admission of 5 days, all-cause mortality was 25.9%. They found strong evidence that Barthel Index was a predictor of inpatient mortality and the majority of deaths were attributed to non-communicable disease (Tumaini et al., 2019). This study was the most similar environment to the present investigation, nonetheless there are several other examples from Tanzania, South Africa and Nigeria that have also noted similarly high rates of inpatient mortality amongst hospitalised older people (Adebusoye and Kalula, 2019, Obiora, 2020, Mboera et al., 2018). One study which considered outcomes over a slightly longer period was conducted by Bgeasor-Komlanvi et al. (2020), who followed-up a cohort of 650 adults aged ≥50 years admitted to medical wards in Togo over three months. All-cause mortality was 17.2% and baseline functional status, measured by the Katz ADL Index, was a predictor (Gbeasor-Komlanvi et al., 2020). By its nature, unplanned admission to hospital is associated with adverse outcomes. However, delays in hospital treatment due to transport challenges, financial issues and use of traditional healers have all previously been raised as potential contributors to the high rates of mortality observed in hospitals in Tanzania (Sadiq et al., 2023).

In community dwelling adults in LMICs, including Tanzania, frailty is associated with greater risk of hospitalisation, dependency and mortality (At et al., 2015, Gray et al., 2017). This study was the first to demonstrate that frailty independently predicts all-cause mortality following admission to hospital in Tanzania and echoes findings from HICs where this is well-established (Cunha et al., 2019, Boucher et al., 2023). There remain relatively few studies from LMICs which explore the association between frailty status and outcomes following hospital admission. Those that do exist are summarised in Chapter 2, Table 6, where it can be seen that rate of inpatient mortality amongst older people with frailty ranged from 6.0 – 25.3% (Adebusoye et al., 2019a, dos Santos Tavares et al., 2015, Khandelwal et al., 2012), rising to between 28.6 – 73.1% amongst studies with longer follow-up periods (Hao et al., 2019, Kizilarslanoglu et al., 2017, Pinheiro et al., 2021). In spite of the range of cultural and healthcare settings, in all of these studies frailty was also a strong independent predictor of all-cause mortality.

Despite the differences in mortality, there was no evidence that length of stay during index admission differed between participants with frailty and their non-frail counterparts. In the process of conducting this research, it became apparent there were many determinants of length of stay that were not related to clinical factors. Anecdotally these included financial factors, older people *"abandoned"* by their families who were unable to pay for care, or transfer to a referral hospital. These were highlighted as factors worth exploring qualitatively.

Following admission to hospital, data from HICs suggests that decline from baseline function is by far the most common trajectory for older people, and that this is accelerated in those with frailty (Rodrigues et al., 2020, Hartley et al., 2017). When adjusted for age and baseline function, respondents with frailty in the present study tended to decline with respect to their physical functioning (measured by the Barthel Index), whilst maintaining aspects of their social functioning (measured by the IDEA-IADL). Meanwhile, those without frailty improved with respect to both measures. Looking at these data through the lens of disability transitions revealed that while function for older people with frailty may decline overall, there were also many individuals who were able to improve with time, gaining independence or requiring only partial assistance for ADLs and IADLs they were previously unable to perform, or needed full support with.

The subgroup of participants who were alive at follow-up represent a less frail and less disabled group than the initial cohort, many of whom were deceased. Any improvement seen in ADL and IADL scores, or disability transitions, could be interpreted as genuine recovery following admission. However, it is also possible that these changes represent improvement secondary to an underestimation of baseline function, regression to the mean, or survivor bias. Underestimates of baseline function may have occurred in older people with subacute presentations in which a longer prodrome influenced function for longer than 30 days. Alternatively, it could be that recall of function during baseline assessment was biased by the current state of acute illness. Nonetheless, it was somewhat encouraging to see that within this subgroup, the picture was more complex than the usual decline in functional trajectory seen in existing literature, and that there was the potential for improvement in some participants with frailty.

5.8.4 Limitations

There were several limitations to the quantitative strand of this mixed methods research. Firstly, it is worth noting the potential selection bias that occurred during the cross-sectional index assessment, in which many older people who were eligible were discharged (n=159), or died (n=35) prior to assessment. It is likely that individuals who were either relatively well and discharged quickly, or who were severely unwell and died early in their admission, were not captured. As a result, the least and most frail segments of the population may be unrepresented in the estimates of frailty prevalence. Although univariate analyses comparing the age and sex distributions of included and excluded participants did not indicate any major differences, the fact that early discharge was by far the most common reason for non-inclusion may have contributed to an overestimation of frailty prevalence.

Power calculations were based on an estimated true population prevalence of frailty of 37%, a figure based on the systematic review of the literature from LMICs. This study was only able to recruit 308 participants in the 6-months available, rather than the 359 that were desired. This was partly because estimations of the number of admissions were based on pre-COVID estimates (which fell considerably during and post-COVID, a phenomenon observed in all participating hospitals) but was also due to the challenges of recruiting participants across four sites. As data were collected over only a six-month period, this study was not able to analyse, or adjust for, seasonal variations in hospital admission rates or in the relative burden of communicable versus non-communicable diseases.

Although the index assessment was structured around the domains of the CGA, a full clinical assessment by clinicians with experience in geriatrics was not conducted due to a lack of time and resources. CGA would have allowed for more thorough examination of topics such as continence, falls and social support, which were relatively underexplored within the evaluations of frailty. Moreover, in the absence of this *"gold standard"* with which to compare the various frailty instruments, their validity could only be assessed in reference to one another. Furthermore, acceptability and the time taken to administer each tool were not explicitly included as part of the assessment, meaning the only indicator of feasibility was based on the proportion of people to whom the instrument could be successfully applied. In this regard, the frailty phenotype proved particularly challenging to administer, perhaps due to broad inclusion criteria of this study. Presenting data from participants with three concordant items allowed an estimate of physical frailty without imputation, but led to the exclusion of large numbers of participants and amalgamated pre-frail and robust categories. The limitations of the frailty phenotype data were so great that further evaluation of characteristics and outcomes by phenotype was not conducted.

In the absence of the frailty phenotype, data regarding pre-frailty were not available. The B-FIT2 does not produce a pre-frail category, and the CFS was dichotomised into frail versus non-frail categories. There are studies which split the CFS into three categories, with differing combinations of *"Managing well"*, *"Vulnerable"* and "Mild frailty" constituting the equivalent of pre-frailty (Nguyen et al., 2020a, Adebusoye et al., 2019a). However, there is no universally accepted way of doing this and the extent to which these categories really constitute pre-frailty is debateable. In the present study, the fact that mortality increased in a relatively linear fashion with increasing CFS score suggests there may have been value in analysing three categories. However, this was ultimately not performed due to concerns this would come at the expense of statistical power.

The instruments selected to assess frailty, cognition, mood and disability in this study were chosen on the basis of their previous successful use, translation and adaptation for Tanzania. Nonetheless, problems experienced in using the weight loss element of the frailty phenotype highlight the dangers of applying instruments developed for a *"western"* context in sub-Saharan Africa. Though the social construct of frailty has previously been interrogated in Tanzania (Lewis et al., 2021), and is further exploration in the qualitative components of this research, the applicability of some of these other instruments was not. The EURO-D in particular warrants cautious interpretation as several of its items – such as fatigue, reduced appetite, poor concentration and sleep disturbance – overlap with frailty, dementia and delirium. Furthermore, the EURO-D does not capture culturally specific expressions of depression which have been reported in Tanzania such as *"pain of the whole body"* and *"overthinking"* (Howorth et al., 2019, Howarth-Maddison et al., 2022). These limitations highlight both the challenges and importance of culturally adapting assessment tools when applying them in new settings.

On the one hand, all researchers completed training in the standard operating procedures for questionnaires and anthropometric assessments, and author SD moved between teams in an attempt to provide some overall consistency and quality control. The use of Kobo Toolbox ensured that the "scripts" used to give instructions to participants for index and baseline assessments were also standardised. On the other hand, interrater reliability was not formally assessed meaning that despite efforts to ensure standardisation, subtle variations in how assessments were conducted or interpreted across data collectors may have introduced measurement bias. This limitation also affects the reproducibility of the research, as the degree of consistency between assessors cannot be confidently established or replicated.

Follow-up outcomes were only available for 63% of participants, which was lower than the 80% hoped. This lower response rate introduces the potential for survivor bias, particularly if being uncontactable was associated with a specific outcome. For example, it may be that older people were uncontactable because they were deceased, or because of other factors such as residing in rural areas with limited network coverage. Both factors could have introduced a systematic bias into the data that could have affected mortality figures in one direction or another. It is however somewhat reassuring that the binary logistic regression did not indicate any evidence of differences in the baseline characteristics of participants who did, and did not, respond.

Although telephone assessment was used for logistical and resource reasons, this is likely the main reason and it is probable that improved follow-up rates would have been seen if in-person assessments were conducted. Poorer mobile reception coverage in rural areas may explain why follow-up completion was higher for older people admitted to urban hospitals (KCMC and MRRH), than amongst those admitted to rural sites (HDH and MLH). It is possible that some further information regarding primary outcomes for the remaining participants may be accessible if ethics were amended to allow access to data from the Hai District Demographic Surveillance Site. In future, studies in northern Tanzania could seek to improve response rates through the provision of airtime as an incentive for participation. Furthermore, using enumerators in the Hai District Surveillance Site and more frequent follow-up (for example at three-, and six-months following admission) could provide a more complete picture of fluctuations in function during this period. While capturing data for readmissions and length of stay was a challenge in the present study, future work will benefit from plans which seek to digitise the recording of admissions, which will make collecting these data easier, more accurate and efficient.

Finally, as the B-FIT2 requires calf-circumference and the CFS utilises visual cues, neither of these could be performed over the phone so frailty transitions over the follow-up period could unfortunately not be performed. The Barthel Index and IDEA-IADL were reassessed, but due to the relatively low follow-up rate and high overall mortality these results represent only a small number of participants. These data demonstrated a somewhat complex picture, which raises questions regarding the ability of older people and informants to accurately assess function prior to their acute illness. Moreover, as survivors, this group had lower levels of disability and frailty than the sampled population as a whole. Had follow-up been conducted at three or six months, when a greater proportion of those with frailty were still alive, a clearer picture may have developed.

5.9 Summary

This chapter has reported the quantitative results of this mixed methods research. This multi-centre study demonstrated that frailty is prevalent in this setting and associated with a considerably greater risk of mortality over the year following hospital admission. In the broader context of this thesis, these quantitative data highlighted several areas of interest which influenced the development of topic guides and vignettes for the qualitative interviews. Examples included, but were not limited to: What factors influence an older person’s decision to seek hospital treatment? Why might they delay? What role does insurance play? Why were exemptions utilised so infrequently? What roles did extended family play in care? What were the implications of large numbers of older people with disability, multimorbidity and non-communicable disease for the functioning of the wards? The next chapter qualitatively explores these questions and the broader experiences of older people, their families, and healthcare professionals during hospital admission.

Chapter 6. Qualitative results: The experience of service users with frailty, their caregivers and service providers in the period surrounding hospital admission

6.1 Chapter introduction

In this chapter, the results of the qualitative interviews with older people with frailty, their caregivers (service users), and healthcare workers (service providers) are described. As is outlined in the methods section, a reflexive thematic approach was used to analyse interview content and identify the themes that are here presented. For five of the six themes, a conceptual model was produced. The six main themes were: 1) Health in old age; 2) Hospitalised older people have greater needs than younger adults; 3) Roles in caring for older people during hospital admission; 4) Death and dying are a challenge to discuss; 5) Impacts of resource scarcity throughout the patient journey; 6) Responsibility for the care of older people. Elements of these results have been presented been presented at conferences (Davidson et al., 2024b, Davidson et al., 2024c)

6.2 Demographics of qualitative interview participants

A total of 37 interviews were conducted over March, April and May 2023, involving 58 participants. Of these interviews, 22 were with service users and 15 were with service providers. All but one of the service users were interviewed with a caregiver or relative as a dyad, with the remaining case being a one-to-one interview. All service providers were interviewed in a one-to-one format. The mean duration of interviews was 46.2 minutes. The demographic details of participants are displayed in Table 21.

Table 21. Demographics of qualitative interview participants

Service users: Older people		**N=22**
Age (years)	60-69	5
	70-79	6
	80-89	7
	90+	4
	Mean = 79.5 years	
Sex	Female	12
	Male	10
Hospital site of admission	Hai District Hospital	6
	Kilimanjaro Christian Medical Centre	8
	Machame Lutheran Hospital	2
	Mawenzi Regional Referral Hospital	6
CFS on admission	0-4 “Non-frail”	2
	5-9 “Frail”	20
Educational level	Secondary or higher	5
	Primary complete	7
	Some primary	2
	No formal	8
Health insurance	Yes	10
	No	12
Exemption granted	Yes	2
	No	20
Pension	Yes	3
	No	19
Service users: Caregivers and relatives		**N=21**
Age (years)	18-29	1
	30-49	10
	50-69	7
	70+	3
	Mean = 52.5 years	
Sex	Female	17
	Male	4
Relationship to participant	Child	13
	Daughter-in-law	1
	Spouse	7
Service providers		**N=15**
Age (years)	20-29	3
	30-39	4
	40-49	4
	50-59	4
	Mean = 33.6 years	
Sex	Female	8
	Male	7

Hospital site of employment	Hai District Hospital	3
	Kilimanjaro Christian Medical Centre	3
	Machame Lutheran Hospital	4
	Mawenzi Regional Referral Hospital	5
Job role	Doctor	3
	Healthcare assistant	1
	Nurse	9
	Physiotherapist	2
Time in role (years)	0-5	9
	6-10	4
	10+	2
	Mean = 5.9 years	

6.3 Overview of themes and subthemes

In the iterative process of coding data, 40 codes were identified. Within these codes, six themes and 16 sub-themes were identified. Themes are summarised in Table 22 and described in detail in the following text.

Table 22. Overview of themes and subthemes

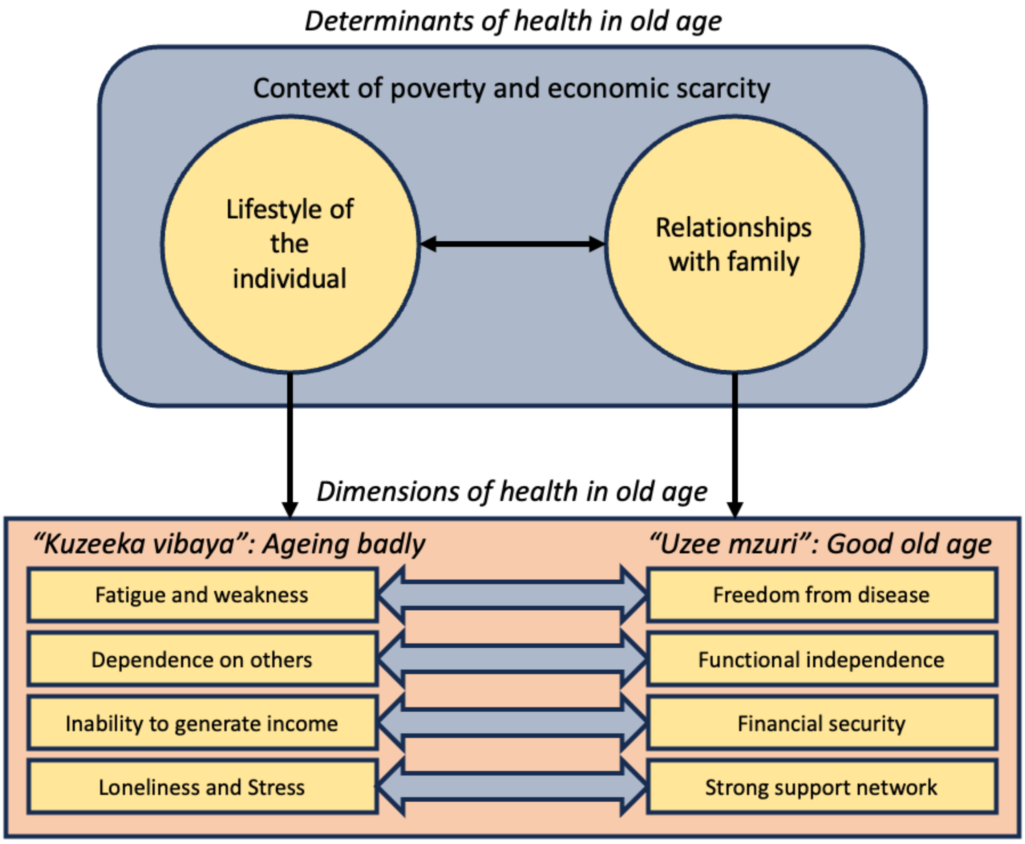
Theme	Subtheme
1. Health in old age	Dimensions of health in old age
	Lifestyle of the individual
	Relationships with family
2. Hospitalised older people have greater needs than younger adults	Multiple and complex health problems
	Significant care needs
	Communication challenges
3. Roles in caring for older people during hospital admission	Mutual respect
	Variation in caregiver roles during admission
	Disagreement around visiting hours
4. Death and dying are a challenge to discuss	No subthemes
5. Impacts of resource scarcity throughout the patient journey	Access to hospital care
	Provider frustrations with resource constraints
	Limited resources in community health services
6. Responsibility for the care of older people	A special group
	Competing responsibilities
	Abandonment in hospital
	Government should do more

6.4 Theme 1: Health in old age

Service users and providers discussed the different dimensions of health in old age and the determinants which can affect the outcome. The *dimensions* outlined the form, or shape, of health in old age. At one end of this spectrum were people deemed to have aged gracefully achieving *“uzee mzuri”*/ *“good old age”*. Health in this context was viewed as independence, freedom from disease, financial security and engagement with the community. Conversely, *“kuzeeka vibaya”*/ *“ageing badly”*, was characterised by fatigue, dependency, disease and loneliness.

There were several factors, here termed *determinants*, which interviewees attributed as decisive in affecting how a person ages. Differences in the health of older people were most often attributed to lifestyle decisions and to the quality of individuals’ relationships to family. It was clear that participants viewed these two strands – the lifestyle of the individual and their relationship to their family – as highly interconnected. Economic scarcity was a prominent and recurring feature of all the narratives, and it pervades all themes to some degree. In the context of this theme, poverty was viewed as a major determinant of health in old age. Figure 36 provides an overview of this theme, visualising the *dimensions* of health in old age, its *determinants*, and the direction of the underlying relationships.

Figure 36. Theme 1: Health in old age



This diagram displays the relationship between sub-themes relating to healthy ageing. The dimensions of health in old age were seen as a consequence of the determinants, both of which were externally influenced by a backdrop of economic scarcity.

6.4.1 Dimensions of health in old age

Old age was often characterised as a *"wearing out"* of the body, with fatigue and loss of physical strength being the hallmark signs of this process. Lack of energy and an inability to perform energetic activities were frequently raised by healthcare providers as one of the key features differentiating older patients from youths. The appearance of older people, including grey hair, wrinkled skin and a slow gait were referenced as outward manifestations of this *“wearing out”* process:

> *“Sometimes some youths, they look like old people because they don’t take good care of themselves. The young man has grown old and his body is worn out” Service user K0162 referring to her husband, former subsistence farmer, female, aged 71.*

This quote suggests that some people can appear older than their years, something that was widely acknowledged amongst both service users and providers. This particular interviewee also hints at factors underlying this variation: *“they don’t take good care of themselves”*. These factors are expanded upon in later subthemes.

The inability of older people to perform activities that they once considered routine was raised in relation to this lack of energy and decline in physical vigour. Frequently mentioned activities included walking, and small tasks around the home such as washing clothes. The majority of the older people interviewed had worked in agriculture, the largest industry in the Kilimanjaro Region. Some had been subsistence farmers, whereas others had worked as employees on commercial farms. Consequently, the inability to engage in tasks related to farming was often given as an example of how *“wearing out”* impacted on activities. One service user, quoted below, went as far as to define old age in relation to one’s ability to work:

> *“The meaning of being old is not being able to work, you are active while young but at a certain point you start to get tired” Service user K0076, retired government veterinarian, male, aged 69.*

A minority of the older people interviewed were still able to participate in farming work. In most cases this was through light duties. Examples included taking feed to animals or walking with livestock to graze when the temperatures were not too hot or too cold. Most tasks fell to other family members, or for a small minority with larger holdings, to younger people hired to do the work:

> *“[I cannot do] anything that takes energy like farming, I can only visit the farms to see how things are going. I can’t graze animals on sunny days, I*

> *just do simple work." Service user H0082, former engineer, publisher and farmer, who hired others to maintain his crops and livestock, male, aged 67.*

Of all the older people with frailty interviewed, only two had pensions. In both cases, they were retired government employees. For the remaining majority, without the ability to support themselves through subsistence farming or generating income through employment, they felt completely dependent on others:

> *"In the past, I was a farmer but now that I am old I can't work again, and I depend on help from my children and neighbours." Service user H0055, subsistence farmer, male, aged 86.*

In many of the narratives surrounding *"kuzeeka vibaya"*/ *"ageing badly"*, dependency was not only financial, but also for basic activities of daily living and self-care. Cooking, feeding, bathing, going to the toilet and mobilising were all basic needs that older people with frailty required assistance with.

> *"There is nothing I am capable of doing now… Food is brought here where I sit." Service user MW0097, former agricultural worker, female, aged 83.*

> *"He has lost his walking ability, so he just sits for the whole day, and we carry him to bed." Daughter of service user H0030, female, aged 49.*

Several of the older people interviewed and their caregivers mentioned a rapid decline in their functional ability and a corresponding increase in the degree of dependency during the period surrounding hospital admission. Following discharge, many older people were no longer capable of things that they had previously been able to do independently. Caregivers found themselves having to adapt to this new normal. In some cases, gradual improvement was seen with time, while in others it was not:

> *"When I was discharged from the hospital, my health condition had not improved much compared with when I was admitted. I was not able to walk, wash my body, my hands were weak, but, after some time, I improved. My family was taking good care of me, sometimes forcing me do*

> *things that I don't like to do." Service user H0082, former engineer, publisher and farmer, male, aged 67.*

This quote demonstrates how the period following an acute admission can be a time of change and transition. Older people with frailty and their caregivers must adjust to meet new and fluctuating needs following the move from hospital to community.

Not all older people had support networks like the one described by the interviewee above. Another dimension to health in old age was psychological wellbeing. Several service providers mentioned the loneliness and hopelessness they encounter in older people, particularly those with poor social support networks:

> *"Especially at the hospital you sometimes find elderly who come to the hospital but when you talk to them, they are not sick, they are lonely. They just want someone to talk with because there is no one to talk to them at home. Some of the elderly feel like the community has isolated them" Service provider HCP13, physiotherapist, female, aged 29.*

Isolation and loneliness were two aspects of poor psychological wellbeing in old age described by healthcare providers. Another that was recounted more widely across interviewees was the stress arising from financial insecurity. In the absence of the safety net of organised social security, many older people with frailty who were unable to work depended financially upon others. Those without the support of others were left without income in a state of constant anxiety about the future:

> *"There are old men like this one [indicating her husband], their children live far away, they don't give them anything and they were used to having some money, so when they don't it affects them psychologically" Wife of service user MW0056, female, aged 63.*

In considering the dimensions of health in old age, thus far the focus has been placed on negative aspects: fatigue, dependency, inability to generate income, loneliness and stress. However, interviewees also set out the indicators of *"uzee mzuri"/ "good old age"*:

> *"Good elderly life is living an independent life, like being able to do activities without help, like walking around the house or walking short*

> *distances, taking a bath, eating, and washing yourself." Service provider HCP13, physiotherapist, female, aged 29.*

In the above quotation, this interviewee's perspective of good health in old age was perhaps influenced her professional role. She emphasised *"an independent life"* and defined this in relation to mobility and activities of daily living. Earlier in her interview, she described the role of a physiotherapist as to *"try to help them [older people in hospital] to be able to live independently, at least to be able to do simple activities without help"*. Several of the nurses stressed similar factors when considering *"uzee mzuri"*/ *"good old age"*, again possibly influenced by their own experiences of providing personal care to older people in hospital.

Doctors on the other hand, tended to describe a different order of priorities, emphasising freedom from disease, something not raised by any of the other healthcare providers. This is perhaps understandable when considering that the primary role of the hospital doctor in this setting is in treating disease, rather than providing assistance with mobility or activities of daily living. In spite of this difference, other aspects of their responses were more holistic, including the emphasis placed on independence and good relationships with family.

> *Interviewer: What your understanding of graceful ageing?*
>
> *Interviewee: "[Graceful ageing] It is a life without disease, with regular check-ups, outdoor activity, and the ability to manage daily activities" Service provider HCP12, male, doctor, aged 27.*

Just as the inability to generate income was seen as a key dimension of *"kuzeeka vibaya"/ "ageing badly"*, its antithesis – financial security – was seen as desirable in healthy old age. Making financial preparations for old age and planning ahead was considered important by both providers and caregivers:

> *Interviewer: What do you understand about graceful ageing?*
>
> *"Graceful ageing is a function of many factors. One is that your mental power is still strong, with wisdom and sobriety. Also, if one is financially well-prepared ahead of time. All [these] amount to graceful ageing." Daughter of service user K9996, female, aged 36.*

In this subtheme, the *dimensions* of health in old age have been explored, leaving *determinants* for later subthemes. However, the distinction between these factors has been drawn for clarity of presentation, and the picture painted by interviewees was complex and not so clearly delineated. One healthcare provider illustrated this point when she said:

> *"If you live well and have money, you will grow old well. It will not be the same as the one who was a farmer who was used to farming with his own hands, today he has grown old and doesn't have the power to farm, he no longer has it, maybe he can only farm a few steps. He will grow old badly because hunger will kill him. And then the diseases will really develop. He is different from the one who has good income: he has a good life and sleeps well." Service provider HCP11, nurse, female, aged 41.*

This interviewee draws parallels between the *determinant* "*context of poverty and economic scarcity"* and the *dimension "financial security".* Their perspective was that if a person had ample income throughout their working life, and was able to save for the future, they would enjoy financial security in old age. Money was also considered to provide people with other benefits throughout their life which influenced their health in old age, for example less physically demanding work, better nutrition, and greater access to healthcare.

6.4.2 Lifestyle of the individual

Lifestyle factors were raised by all participants as key determinants of whether someone ages well, or ages badly. The consumption of alcohol was by far the most frequently mentioned lifestyle factor, with many interviewees also raising smoking, chewing tobacco, and the use of drugs such as marijuana and cocaine. It was universally agreed that the consumption of alcohol and use of substances during one's adult life negatively affects health in old age:

> *"The main cause here [for his father's poor health in old age] is smoking and alcohol. Later, he had his teeth removed and his ability to eat declined as a consequence." Son of service user MW0111, male, aged 24.*

This second quote emphasises dentition, a factor raised by a small minority of service users as a reason for diminished food intake. Diet and nutrition featured more broadly in the narratives. Service providers, operating in a medicalised context, tended to emphasise the importance of a *"balanced diet"* to health in old age, whereas service users mostly spoke of "*access"* to food and undernutrition.

> *"The main reason [people age differently] is the lifestyle. Your lifestyle determines a large percentage (apart from genetics) of how a person ages. So what you were eating while you were a youth, what you were drinking while a youth, the way you live. I mean if you were exercising and such things." Service provider HCP03, doctor, male, aged 28.*

Interestingly, this interviewee mentioned heritable or genetic factors. This was something that was only raised by one other participant, also a doctor. Exercise too was raised overwhelmingly by service providers and only by a small minority of service users. While exercise as a part of an active job was considered protective for health in later life, at times the damage inflicted to the body by hard physical labour was also emphasised:

> *"I once visited one of the countries who offer free gym services to the elderly, doing exercise could help the elderly to maintain their health, the elderly who are doing outdoor activities live a long life." Service provider HCP12, doctor, male, aged 27.*

> *"He would do difficult manual work like farming and sometimes he would spend nights in the bush harvesting honey." Son of service user MW0111, describing the reasons underlying his father's current ill health, male, aged 24.*

For service users engaged in agriculture, work involved hard manual labour, carrying heavy loads, ploughing and harvesting by hand. The idea of exercising in moderate amounts for health, in the way that was suggested by some of the service providers, was not a realistic option.

Service providers suggested an array of lifestyle measures to improve the health of older people over the life course. Some of the specific measures suggested included "*regular check-ups"*, and abstinence from alcohol, tobacco and drugs. In relation to the *"balanced diet",* suggestions included *"food supplements"* and *"multivitamins"*. In most cases, these measures were raised in the context of a broader desire for improved health education, health literacy and engagement with health services amongst the older population:

> *"Government and hospitals should provide health education to the elderly concerning non-communicable diseases, I think the government started to implement this program, there is a project funded by the Dar es salaam Church Health Commission. They started a community health education project and provide free diabetic and blood pressure measuring equipment." Service provider HCP15, doctor, male, aged 55.*

There was a spectrum of opinion, which divided all participants groups, regarding the extent to which lifestyle determinants of health in old age were a result of an individual's choices, or challenging life events and economic hardship. At one end were those who felt that health in old age was entirely down to the choices of individuals. There was a moral and religious element to this, with poor health in old age being attributed to bad lifestyle choices and *"bad company"*, while good health was related to *"a person's faith"* and *"God's mercy"*. In the extreme, one participant even cited criminal behaviour as a cause for ageing badly:

> *"Fast ageing is a personal choice… they are young men who have lost their direction in life." Daughter of service user MW0021, female, aged 43.*

In contrast, others were much more deterministic. In their view, external factors, rather than personal choice, drove health behaviours which affect health in old age. When discussing use of alcohol and other substance use, these interviewees cited *"life stresses"* (by which they were chiefly referring to financial concerns) as the reason people engage in health behaviours which were damaging later in life. *"The care one receives"*, and the lack of a social network, was another external influence which was felt to determine a person's health behaviours throughout their life:

> *"A person might age faster because of hardships in their life, living a stressful life and the challenges they are facing in life... if someone gets good care and lives with no stress, they will have good health." Daughter of service user MW0132, female, aged 35.*

6.4.3 Relationships with family

The *"care one receives"*, primarily from close family members, was identified as an important dimension of "*uzee mzuri"/ "good old age"*. A strong social support network was associated by participants with good health, and a poor network with loneliness and stress. The financial help, and attention to physical and psychological needs provided by family, were also viewed as a decisive factor in *determining* health in old age. Interviewees reported that having support and care in old age was dependent upon having cultivated strong relationships with family throughout one's adult life:

> *"If a child is educated, even if they aren't employed by the government, they will employ themselves. And when they are told that their parent is sick, they will listen and go to their parent. But if you haven't educated a child and you were of just drinking alcohol and you are now old, then…"*
>
> *Wife of service user MW0056, female, aged 63.*

In this quotation, the care provided to older people by their children described as a reciprocal transaction. This was a common feature of many of the narratives. There was a perception that if the older person had been a good parent, and provided for their children growing up (chiefly through education), then they were well cared for by their children in turn. It followed in discussions that the opposite was also true, and that failure to maintain good relationships, or provide education, for children meant they felt less obliged to care for parents in old age.

In the quote above, the interrelationship with the *lifestyle of the individual* subtheme is also made evident. In this, and in several of the other interviews, alcohol was raised as something that drives a wedge between a person and their family leading to poor relationships and lack of people to care for them in old age. Difficult relationships, not having married or had children, moving away from one's own parents or siblings, or having children who lived far away were all reasons suggested for why an older person might live without support. Regardless of the reason, lack of family to provide care was universally regarded by interviewees as having a negative influence on health:

> *You might find a husband and wife, and all their children are employed far away. The father and the mother are old and stay at home by themselves.*

> *If they do not have good care they will die there, and might not even have someone to find them when they are dead." Service user K0076, retired government veterinarian, male, aged 69.*

For older people who had good reciprocal relationships with family, and people around to look after them, interviewees still related the quality of their care strongly to their financial context. Greater wealth meant better food in greater quantities, greater ability to pay for healthcare, reduced stress and the ability to pay for additional caregivers at home. The result being that well-off families were capable of keeping older people in better health than those without the means:

> *"It depends on the family, and it depends on the family income level. If a family is financially well off, it can provide for the needs of an elder. Even food and medicine can be provided. The main aspect here is the family's financial capability." Daughter of service user MW0097, female, aged 40.*

The caregivers interviewed were all the children or spouses of the older person, and in one case the daughter-in-law. Most were not the sole caregiver, but shared responsibility with other members of the family. However, care was not always provided directly by family members. Interviewees also spoke of older people whose children had moved to major cities for work. Instead of direct care, in these cases children provided financial support and paid caregivers in their stead. Most expressed positive views about these arrangements, though one service provider raised concerns regarding delays in accessing hospital occurring as a result of these arrangements:

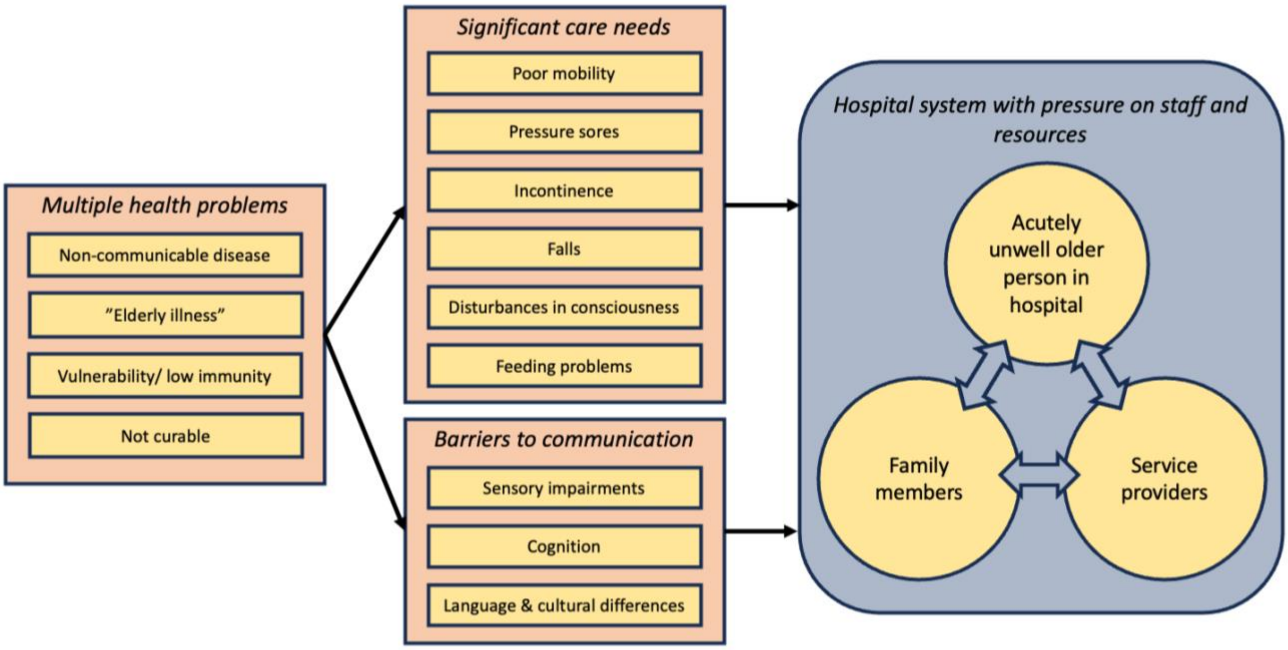
> *"You find that an elder is left alone at home with a paid servant. This person has to consult with people who are living far away on every matter relating to the elder's treatment." Service provider HCP10, nurse, female, aged 32.*

In summary, the relationship between an older person and their family was regarded as a major determinant of health in old age. Good relationships, cultivated over a lifetime, ensured reciprocity when the older person themselves required care. However, the economic situation of the family was still regarded as having a major bearing on health in old age.

6.5 Theme 2: Hospitalised older people have greater needs than younger adults

The care of older people during an acute admission to hospital was acknowledged by service providers and caregivers as more challenging than looking after younger patients. This complexity was felt to arise due to multiple health problems, especially non-communicable disease, as well as states of vulnerability unique to older patients. It was expressed that acutely unwell older people have significant needs, requiring more intensive nursing care. Moreover, healthcare providers described barriers and challenges in communicating with the older people they care for, because of the effects of acute illness, language and cultural differences between generations.

Figure 37. Theme 2: Hospitalised older people have greater needs than younger adults



Multiple health problems were seen to give rise to significant care needs and barriers to communication, which in turn were felt to impact the service providers and service users interacting within a resource-limited hospital system.

6.5.1 Multiple and complex health problems

Older people, their caregivers and service providers associated old age with multiple diseases. Non-communicable diseases were the main culprits, with diabetes, hypertension, stroke, heart disease and cancer being the most frequently discussed in the narratives:

> *"The first thing that started was the high blood pressure, then later diabetes and a big heart" Service user K0046, former agricultural worker, female, aged 80.*

While both service users and providers emphasised the presence of multiple health problems, the following perspectives in this sub-theme focus more on how these complexities affected medical care, and thus reflecting the views and experiences of service providers. One nurse described the difficulties of caring for older patients with "*whole system problems*", referring to the complexity of balancing the treatment of multiple health complaints. Amongst service providers more generally there was also a recognition that, although some older people presented to hospital with features of specific diseases, in other cases clinical features were indistinct. Such cases were described using terms like *"elderly illness"*, *"weakness because of age"* and *"illness due to old age"*. In most cases, these terms were used to describe a state of ill health related to age and distinct from disease. However, a minority of providers also incorporated non-communicable diseases like hypertension and diabetes under these banners, to be considered as natural and expected aspects of ageing:

> *"In most cases, they [older people] are unwell with stroke, diabetes, and others. They are just diseases of the ageing process." Service provider HCP04, nurse, aged 28.*

Further complexity in caring for older people in hospital was discussed by service providers as arising from their increased vulnerability. In many cases this was attributed to *"low immunity"*. As a consequence, older people admitted to hospital were seen as more likely to experience frequent health problems, greater recurrence following treatment and slower recovery, when compared with younger patients:

> *"Attending to the needs of the elderly is a heavy thing. They improve, but slower than youths. For example, you find an elder who has suffered a stroke, even twice, at the same time they are suffering from UTI [urinary tract infection], high blood pressure, sugar, and the majority come to hospital while in critical conditions which makes prognosis difficult." Service user HCP12, doctor, male, aged 27.*

By contrast, the treatment of younger people was described by service providers in simplistic terms, they were perceived to present with discrete problems, and responded to treatment before discharge home. In these scenarios, the treatment aim was a full recovery. However, when caring for older people, service providers described having different treatment aims, and different measures of success. Symptomatic relief and pursuit of quality of life were emphasised rather than curative treatment:

> *"Most of the diseases of the elderly are not curable disease, so we are only able to help them get relief and not healing." Service provider HCP14, physiotherapist, male, aged 25.*

6.5.2 Significant care needs

As was described in theme one, *health in old age*, interviewees tended to view dependency on others as a dimension of "*kuzeeka vibaya"*/ *"ageing badly"*. These discussions referred mainly to dependency on family and other members of the community. However, most interviewees also raised the often considerable needs of older people during acute hospital admission:

> *"He was not able to do anything, he couldn't walk, eat, wash himself or do anything, I helped him with everything." Wife of service user H0076, female, aged 60.*

Amongst service providers, nursing staff in particular emphasised the physical needs of older people including help taking medications, feeding, mobilising, turning in bed to prevent pressure sores, and maintenance of personal hygiene. It was common for these needs to be compared to those of children and contrasted against the needs of younger adults:

> *"The youth are very strong but the elderly need extra care like a child. If a young person is not in a critical condition, you can just give them instructions and they can follow, also when eating the young are not stubborn like the elderly. I see many differences, you must turn an elderly person from one side to another when sleeping, also you must give them some exercises." Service provider HCP02, nurse, female, aged 34.*

Amongst both service providers and users, the period surrounding admission was seen as a time in which the needs of the older person intensify. This was usually attributed to disturbances in consciousness. The ways in which these were described varied, with no one term predominating, and a range amongst both service users and providers. Terms used to denote this state included: *"kupoteza fuhumu"*, to lose understanding; *"kuzidiwa"*, to be overwhelmed; *"kupoteza kujitambua"*, to lose self-awareness/ self-recognition; *"yasio jiweza"*, helpless; and *"kichwa kimeharibika"*, the head is damaged. Some healthcare providers also used the English term, *"unconscious patient"*. In all cases these terms were not used to describe unresponsiveness or coma, but rather symptoms such as problems with memory, recognising people, following instructions and performing usual activities:

> *"It was a problem that caused me to lose understanding completely. My wife told me about the condition and how I was taken to the hospital, I couldn't recognise anyone, if I looked at my relatives I couldn't see or recognise them." Service user K0076, former taxi driver, male, aged 95.*

In addition to disturbances of consciousness, acute urinary and faecal incontinence in the time surrounding admission were clinical features raised by many interviewees. However, in many cases what was described was incontinence as a result of reduced mobility:

> *"When she was sick, she couldn't go to the toilet as she wasn't even able to walk." Son of service user MW0101, male, aged 48.*

Older people who were unable to mobilise independently had to seek help from others to use the toilet, or use bottles and bedpans. Several service providers also gave examples of catheterisation and the use of continence pads (referred to as nappies here) as a way of managing some older people with continence and/or mobility issues:

> *"Those who are unconscious are unable to go to the toilet so we put them on NGT for feeding, a catheter for urinating and nappies … sometimes up to five patients are unconscious, and they need complete support from you." Service provider HCP04, nurse, female, aged 28.*

Additionally, many interviewees recounted difficulties with eating experienced by older people during hospital admission. Reduced appetite, inability to physically feed oneself, poor dentition and trouble swallowing were all raised as potential contributing factors:

> *"He could not eat hard foods like bananas, ugali and others. He could only eat mtori, porridge and other soft foods made of milk and blended banana." Wife of service user H0076, female, aged 60.*

There was general agreement that mtori, a banana and meat soup, was a suitable food for acutely unwell older people because of its nutritional value and soft texture. However, hospitals that provided food for patients – and not all did – usually only provided meals based around rice or ugali, the latter being a dense porridge-like carbohydrate made with maize flour. Hence even at hospitals that did provide food, it was reported that older people could not eat the meals. Relatives, staff members, or *"Good Samaritans"* were required to bring in homemade mtori.

Furthermore, many service providers gave examples of older people with severe swallowing difficulties, most commonly due to stroke. These patients required nasogastric tube feeding, something that again required intensive nursing input of a kind that was less common in younger adults. Nasogastric tube feeding required special soft food to be prepared by the hospital kitchens and visiting family members were educated about how to take over this aspect of care:

> *"Some have not been able to eat on their own yet, so we teach them to use the NGT. We teach them how to feed the patient and we tell them for how long, how many times and what kind of food they should serve them"*
> *Service provider HCP11, nurse, female, aged 41.*

Interestingly, only two service user interviews discussed falls and the subject was only mentioned by providers on direct questioning. In these discussions, it was striking that several service providers spoke in the singular, recalling specific cases of older people falling, rather than a generalised pattern. Furthermore, two providers working at the same hospital reported no personal experience of patients falling, while another relayed that it happened *"maybe once per year or not at all"*. In the cases that were raised, the cause of falls was speculated to be either weakness, or the older person forgetting their mobility difficulties:

> *"I should say that it has happened before that an old man has come here to be treated but unfortunately he found… the nature of the bed he was placed on, with these side rails... He did not have a good memory at that*

> *time, and maybe he wanted to go to the toilet by himself, so while supporting himself to get up, with no one around to help and his condition weak, he must have sat down or even fallen down." Service provider HCP09, nurse, male, aged 32.*

This subtheme has summarised interviewees' views that older people have significant care needs during acute hospital admission. Nearly all providers interviewed emphasised the considerable challenge that these needs place on the time of healthcare providers, particularly nursing staff:

> *"We are facing a lot of difficulties, sometimes the number of patients is high compared to the number of nurses, and sometimes up to five patients are unable to help themselves, and they need complete support from you. And remember, the relatives don't stay with them at the hospital. So you need to do all activities by yourself, cleaning them, feeding them, giving them medication, changing their bed sheets, and so on. So just think, if you are alone on the ward you are supposed to do all those things by yourself. Don't forget there are also patients who are a little better, but they still need your support. Sometimes we provide insufficient and low-quality care." Service provider HCP04, nurse, female, aged 28.*

6.5.3 Communication challenges

Communicating with older people, especially during a period of acute illness, was seen as more challenging than with younger adults in the eyes of caregivers and service providers. Some of this was down to disease processes, for example hearing deficits, problems with memory, acute disturbances of consciousness and speech problems (including dysphasia):

> *"Even when she was discharged, she was unable to speak. You could hear her only if you listened very attentively." Daughter of MC0021, female, aged 43.*

Another problem raised by a minority of participants was language. Though Swahili is the national language of Tanzania, for many communities it is not the first language. In the Kilimanjaro Region, the largest tribes the Chagga and the Maasai often use their own dialects. Though it is uncommon amongst younger people, interviewees reported there were older people – particularly in rural areas – who did not speak Swahili. For the Chagga, the largest tribe in the region, this posed less of a problem because many staff members spoke this dialect. However, for the Maasai and other smaller tribal groups who were less well represented amongst healthcare providers, this could pose a greater problem.

Even when language was not an issue, many service providers commented that older people were more likely to refuse interventions such as medications, injections, catheters, blood transfusions or meals. This was attributed to them being *"slow to comprehend instructions"*, acting *"like a child"*, and being *"stubborn"*. There was a sense of frustration in some of the providers responses:

> *"As the health provider you are expected to discover the health problem of an elderly person without them telling you anything. Youth are able to discuss their treatment plan, they can even advise you, which is unlike the elderly" Service provider HCP05, nurse, male, aged 28.*

Amongst this cohort of interviewees, there was evidence of cultural differences between service providers and the older people they cared for. On average almost 50 years older than the healthcare providers, the older people interviewed had lived through the colonial and socialist eras, had limited educational opportunities, and overwhelmingly lived and worked in rural agricultural communities. By contrast, healthcare providers were well educated and studied in urban centres, even if they now lived and worked rurally.

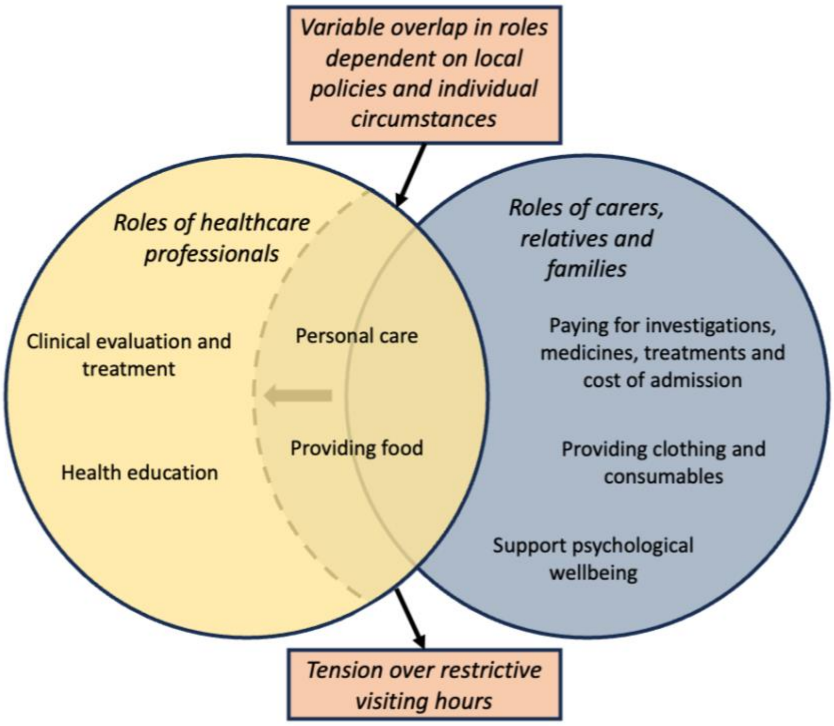
Solutions to barriers in communication, proposed by caregivers and providers alike were use of family as an intermediaries, reassurance, patience and careful explanation:

> *"All you need is to be closer to her and have patience because sometimes she becomes frustrated easily." Daughter-in-law of service user H0085, female, aged 45.*

6.6 Theme 3: Roles in caring for older people during hospital admission

The relationship between the family of the older person admitted to hospital and healthcare providers featured strongly through the narratives. There was clear mutual respect between caregivers and providers, with both parties valued as important in the care of the older person in hospital. However, roles and responsibilities were inconsistent. In some wards, relatives were expected to take a role analogous to a member of staff, while in others this was seen as an encroachment on the responsibilities of the professionals. Visiting hours, implemented at all participating sites, were waived flexibly to allow visitors to stay with their loved ones and to assist the workload of nursing staff in caring for older people in a critical condition. However, implementation of visiting rules was inconsistent with waivers granted mostly on a discretionary basis, sometimes resulting in dissatisfaction and conflict.

Figure 38. Theme 3: Roles in caring for older people during hospital admission



The roles of caregivers, relatives and families in caring for older people during hospital admission overlapped with the roles of healthcare providers. However, the degree to which roles overlapped was variable which could result in tension regarding restrictive visiting hours.

6.6.1 Mutual respect

Respect for healthcare professionals was a strong element that was identified in the data from interviews with older people and their caregivers. In most cases, it was clear service users trusted hospital staff to look after them and their relatives, and that they were grateful for the care received during admission. Working in healthcare was seen as a virtuous career and doctors were held in particularly high esteem; at times a career in medicine was even compared to a religious calling:

> *"…the doctor's vocation is an inner call. It is like it is for the bishops because a bishop cannot let his believer sink, he wants to hold him and lift him up."*
> *Wife of service user MW0056, female, aged 63.*

Similarly, it was clear service providers felt that it was important to have the input of family in meeting the needs of older people in hospital and valued their specific knowledge of the patient. When discussing the communication barriers that can affect care, healthcare providers often gave examples where they had utilised family to help remedy these situations. In these examples family worked as intermediaries, providing reassurance, language translation, or persuasion, in order to facilitate treatment:

> *"Sometimes it's really hard to understand the needs of the patient. At least when the relatives are around helping it minimizes this challenge because they are familiar with the patient so it is easy for them to understand each other. Also, if relatives are around we will inform them of all kinds of treatments we intend to provide the patient." Service provider HCP05, nurse, male, aged 28.*

Despite clear mutual respect, relationships between service users and their caregivers, and service providers, were not universally smooth. There were a small number of examples in which service users described conflict for reasons including a healthcare provider speaking to a patient in harsh terms, a misunderstanding around the timing of discharge, noise on the ward, and a patient being transferred without relatives being informed. Other than these examples, most instances of conflict arose in relation to two main issues, that are expanded upon in the next subthemes: 1) the roles of healthcare professionals and families in providing care and 2) visiting hours.

6.6.2 Variation in caregiver roles during admission

In caring for older people admitted to hospital, some roles of healthcare providers and relatives were poorly demarcated and varied between sites. In examining these role conflicts, it is first worth outlining the areas of responsibility over which there was more general agreement.

Clinical aspects of care, such as medical assessment, investigation and administering treatment were firmly considered by all parties to be the responsibility of healthcare providers. It was also seen as their role to provide information and education to the individual older people who were admitted and their families. This role as health educator was raised by almost all participants and included providing information about management of long-term conditions, health promotion advice around keeping active, dietary advice (particularly in diabetes), and teaching patients and their families to empty catheters or to take over nasogastric feeding when approaching discharge:

> *"…the doctors have instructed me, I should not eat certain foods for example bananas, although I was raised here and I am used to eating bananas, I have been told that bananas have a lot of potassium, so when I eat bananas they affect my kidneys. So, I don't eat such things like mtori… I have been told to eat fruits like tangerine, apples I have been allowed..." Service user K0076 discussing his low-potassium diet for his chronic kidney disease, former taxi driver, male, aged 95.*

Meanwhile, the consensus roles of families were neatly surmised by the following interviewee:

> *"…relatives should be involved in the whole admission, that is, all the financial and psychological issues for the patient" Service provider HCP09, nurse, male, aged 33.*

"Financial issues" included paying for consumables (e.g. soap, shaving materials etcetera) and clothing, as well as the costs of admission including investigations and medications. Bills for admission were usually settled on discharge, however relatives had to go to external pharmacies with prescriptions provided by the doctors to pick-up many medications which were not stocked internally and pay for them at the time. For expensive investigations, such

as a CT scan, receipts were required from the accounts department as proof of payment prior to the scan being performed. It was not only close relatives who were expected to bring money to help cover the costs of hospital admission, but it was also considered polite practice for friends or neighbours who were visiting the older person in hospital to do so.

Support for psychological wellbeing of older people in hospital was also seen as a key responsibility of the family, not because healthcare workers do not try to provide this, but because of the unique comfort that can be found in one's close family:

> *"…their importance is when they tell you they feel sorry for you, to comfort me and to wish me to get better. So it gives me strength when they comfort me… that I am still needed" Service user MW0055, retired government construction manager, male, aged 67.*

Outside of these areas, there were differing views regarding who ought to be responsible for which aspects of care. The two areas of greatest disagreement were around providing personal care (washing, toileting) and around the provision of food. At one end of the spectrum were those who considered relatives to have a very extensive role to play:

> *"We treat them [relatives of the patient] well as we consider them our fellow workers." Service provider HCP04, nurse, female, aged 28.*

Those who held this view often also emphasised the pressures placed on staff by the high number of older people and their often considerable care needs. In this regard, treating relatives as further members of staff – particularly for activities that did not require a nurses training, such as helping with washing or walking the patient to the toilet – helped to ease the workload of the healthcare providers.

On the other hand, some providers strongly held that all aspects of care for an admitted patient were the responsibility of the professional ward team:

> *"Interviewee: We are the ones hired to look after the sick. Therefore, the relatives have no role to play.*
>
> *Interviewer: Don't you see that allowing them [to assist] would have relieved you of your work burden?*

> *Interviewee: We have enough in number and capability in terms of workforce." Service provider HCP02, healthcare assistant, female, aged 29.*

On the whole, at the larger, urban hospital sites – KCMC and MRRH – a greater proportion of personal care was provided by nursing staff, whereas at the smaller hospitals – HDH and MLH – staff were more likely to place greater responsibility for this on family members:

> *"Interviewer: Who helped you when you were admitted [with things like] cleaning you and taking you to the toilet?*
>
> *Interviewee: My son did those things for me.*
>
> *Interviewer: What if he didn't come on time, or didn't pay you a visit?*
>
> *Interviewee: I asked for help from the relatives of other patients and they helped me." Service user H0082, former engineer and publisher, male, aged 67.*

Here, the older gentleman admitted to one of the smaller sites received help to the toilet from the relatives of other patients when his son was not available, rather than from ward staff. Similar experiences were described by others, some of whom felt that nursing staff were not able to meet the needs of older patients once visiting time was over:

> *"…you cannot miss the opportunity to befriend a nurse. You must find at least one who can be of help to your sick relative. I may ask such a friend to assist my mother, say to prepare milk for her to drink. If you don't do so she will not be assisted, even though we are told to leave everything with the nurses when visiting time is over." Daughter of service user MW0097, female, aged 40.*

Aside from personal care, the other area where roles of healthcare providers and families in providing care was inconsistent was around food. While KCMC and MRRH provide food, the smaller sites do not. This means relatives had to prepare and bring in food from the outside. In some cases, caregivers of older people described bringing in food and feeding the patient themselves, in other cases they gave it to nursing staff who then fed the patient.

> *"[Relatives] have a great role since they are the ones who bring food from home and buy it. The patient can't heal well if they do not eat well. Also, we guide them to the kind of food the patient needs. They provide all needs of patients like paying the bills and they sometimes help us to clean the patient and all other kinds of needs, they support us and give us the strength to do our work." Service provider HCP04, nurse, female, aged 28.*

Many service users thought it was a positive thing to have food from home brought in, as it was suited to their personal preferences. However, preparing food and taking it to an older person in hospital could place a huge strain on caregivers, particularly when they did not live close by. Furthermore, healthcare providers described incidences where older people were hungry and having to wait until late in the evening for their relatives to bring in food after they had finished work.

In contrast, at KCMC and MRRH food was provided. However, as was discussed in theme two, this food was not always suitable, particularly if the older person had dental or swallowing difficulties. Even at these sites, it was also very common for relatives to bring in meals, with the hospital food as a fallback:

> *"The hospital was providing food for us, they provided tea and porridge so no one was staying without eating, even if their family did not bring food."*
> *Service user K0162, former farmer, female, aged 71.*

In summary, during the acute admission of an older person, the roles of healthcare providers and family in providing care were variable. While clinical treatments and health education were the purview of healthcare providers, almost all other aspects of care could also be considered the responsibility of family, with the extent of this depending on the site of admission. At a minimum, families' role in care involved providing emotional support, clothing, consumables, and finances to pay for admission, investigations and medications. More often than not, family also provided food and took some or full responsibility for personal care.

6.6.3 Disagreement around visiting hours

Given the extensive role that family members were often expected to take in the care of an older person admitted to hospital, it is not surprising that restrictive visiting hours were a source of disagreement with service providers. In the past, it was often the norm in Tanzania for a relative to stay with each patient in hospital throughout their admission. However, this practice is becoming less common. Interviewees discussed a range of reasons for this change. Some healthcare providers expressed the opinion that having relatives on the ward could lead to a crowded ward environment and interference with clinical work:

> *"…we can see that if we say let the relative stay, services will be interfered with and will be compromised because when the relatives are there … depending on the nature of the services provided, it may cause problems. Service provider HCP09, nurse, male, aged 32.*

Others expressed concerns over the pressure and scrutiny that is place on service providers when relatives are present all of the time. Two interviewees cited performing intravenous cannulation as an example of this and implied that the additional stress made them less likely to perform the procedure successfully. Privacy of other patients on the ward was another problem that service providers highlighted, and one individual even raised concerns about the privacy of staff members:

> *"…now there has been globalisation, you might be working and relatives are taking photos of you, later you see yourself in social media." Service provider HCP08, nurse, female, aged 38.*

Infection control was another widely cited reason for restricting visiting hours and visitor numbers. The COVID-19 pandemic was cited as a catalyst that sped-up this process:

> *"Before COVID-19 we were allowed to stay with our patient in the wards, but after COVID we were restricted." Daughter of K0062, female, aged 55.*

For these reasons, visiting hours were the norm on all the participating wards in this study. Hours varied from ward to ward, even within the same hospital, but generally visiting periods occurred three times a day, corresponding with mealtimes. With a few exceptions, visitors were not permitted to stay outside of these times or overnight. While most wards did not specify the number of visitors, those at KCMC were restricted to one per patient and relatives took turns while the rest of the family waited in the corridor.

Older people and their families generally expressed negative feelings regarding set visiting hours. The reason most emphasised by caregivers was the simple desire to continually monitor their loved one and watch their progress. This was considered preferable to relying on reports from medical staff:

> *"Staying at the hospital with your patient makes you feel somehow comfortable. Because you are able to trace her condition every minute…sometimes I couldn't fall asleep thinking about her. But I had no choice but to obey the hospital rule." Daughter of K0062, female, aged 55.*

Hospital was often described as a frightening place by older people who had been admitted, particularly by those who had acute disturbances in consciousness and were unaware of what was going on. They found reciprocal comfort in the presence of family during admission:

> *"…my mother was very scared. She told the nurse 'I need my children around me' and they told her that they are not allowed to stay at hospital and she tried to abscond from the hospital, one day we found the nurses forcing her to get back in the ward." Daughter of service user K0186, female, aged 65.*

Beyond comfort and reassurance, a minority of caregivers were distrustful of the service provided in hospital. They expressed that they wanted to be present with their relative to ensure they were receiving a good standard of care:

> *"We also had to keep vigilance when he was put under medical support in order to be able to inform the nurses as soon as the oxygen was finished. Most of the time the oxygen was finished before the expected time so if we were not there, he was at high-risk of death. The nurses are not always with the patient." Son of service user MW0111, male, aged 24.*

Going into the hospital three times a day to provide the older person with meals, and sometimes personal care, was a big challenge. Distances and the cost of travel to and from the hospital made leaving for a few hours impractical for many family members. Some travelled home just delivering food once per day, others stayed around the hospital site, or with friends and relatives nearby. Several interviewees described conflict and disagreement occurring as a result of relatives attempting to stay with their loved ones in hospital:

> *"Challenges are there, such as their [relatives] refusal to vacate the wards when visiting time is over. Some go to the extent of throwing insults at you!" Service provider HCP02, healthcare assistant, female, aged 29.*

Similar circumstances were described by others who had managed to stay in spite of hospital visiting hour policies. Rules were waived on a case-by-case basis by the intervention of ward staff:

> *"I was told to leave by the security officers but a nurse came and spoke in my favour… Only for one day, my mother was removing the drip and cannula, so she received closer care. The day after the drip was taken off I went back home." Daughter of MC0021, female, aged 43.*

One nurse described situations where he had granted a favour by waiving the rules, only to be taken advantage of later on:

> *"…you might have given them [the relatives] a favour, maybe you allowed them to stay nearby and come in every hour to see the patient… but now they come in and just stay. They are now preparing a place by the patient, so that now the nurse is required to give services." Service provider HCP09, nurse, male, aged 32.*

In general, the reasons for allowing relatives to stay on the ward with and older person were if the older person was in a critical condition or if they needed closer supervision than that which could be provided by nursing staff. Even in these cases, visitors were still ejected during the doctors' ward rounds and for cleaning. In most of the examples given waivers were granted at the discretion of the nurse-in-charge of the ward at the time. One service provider recounted more formalised procedures, though other providers from the same site did not mention them, suggesting they may not have been applied consistently.

6.7 Theme 4: Death and dying are a challenge to discuss

Death and dying were discussed more openly in interviews with service providers than with service users. As is discussed in the methods section regarding the development of the topic guides, death is considered a taboo topic in Tanzania. Therefore, discretion was used when deciding whether it was appropriate to broach the subject. In practice, interviewers were more comfortable raising the topic with service providers than with service users. Nonetheless, the topic was worth exploring as a theme in its own right. Due to the more focussed nature of the discussions on this topic, it was not felt necessary to develop a conceptual model for this theme as its content was already relatively concise.

Service users and providers alike tended to discuss death in religious terms. It was widely acknowledged that the prediction of the timing of death is very challenging, if not impossible, and that God is the only being that knows when a person's time is up. From healthcare providers, there was a sense of loss of control over the patient's condition, or a ceding of control to God:

> *"It [identifying an older person who is dying] is difficult for sure; this is a secret that God didn't reveal to human beings. The doctor may notice some changes, but it's difficult to know the exact time a patient may die." Service provider HCP15, doctor, male, aged 55.*

Death arose as a topic in interviews with service users primarily in the context of fear of the hospital environment. Older people outlined how alien the environment of the medical ward felt, being surrounded by other unwell patients and tended to by uniformed staff. However, the most frightening instances recalled were when they had been confronted by the death of other patients. This was a common experience and two recalled being deeply affected by watching staff removing bodies to the mortuary. It acted as a frightening reminder of their own vulnerability and mortality. Furthermore, in the mixed-age general ward, these experiences were especially shocking when the death was of a younger adult:

> *"She was a young girl, she had three children, at time she was helping me to communicate with my family, but suddenly her condition changed and she died. I was scared to see that happen." Service user K0162, former farmer, female, aged 72.*

In the community, older people recounted hearing stories of deaths occurring in hospital from peers who had been admitted. Also prominent in their thoughts were the friends who had gone to hospital and not returned. These examples served to strengthen the association between hospital and death and in some cases engendered a reluctance to access hospital care:

> *"Ahh, I didn't like to go to the hospital. I would say it's better I die. When I see those who became ill after me and before me, all are gone, like ten people. I'm afraid of going to the hospital." Service user K0065, former subsistence farmer, male, aged 78.*

Healthcare providers highlighted several signs that they used to identify whether an older person in hospital might be in the process of dying. These included clinical signs such as failure to respond to medication, gasping for air, agitation, or changes in blood pressure and heart rate. However, the majority highlighted behavioural changes. These included the avoidance of eye contact, not wanting to be around people, and discussing deceased relatives. There was a perception amongst some interviewees that an individual knows they are going to die before it becomes apparent to anyone else. Signs of this premonition included expression of loss of hope and requests for last rights, to call relatives, to have a favourite meal or to dictate a will.

> *"I often see them saying 'you think I'm recovering, I'm not'. So, if they talk like that, you just encourage them, you continue to really care for them, but after a while you wonder whether they really will die." Service provider HCP11, nurse, female, aged 41.*

Once these signs were identified by service providers, what was discussed with the older person and their family varied considerably. Some interviewees (all service providers) advocated full disclosure, with the news delivered by a doctor. These individuals had a conception of a *"good death"* which involved allowing the patient to prepare psychologically, to say final words to family, and to confess or repent to an appropriate religious representative. Advocates suggested being open could spare families the costs of futile treatments, and prepared them for loss, thus avoiding shock, anger or blame:

> *"We tell them everything, that at a certain time this and this happened. There is a way of explaining until someone understands. If they want to cry we let them do that, but they must know the truth. We do this to avoid the blame from the relatives, and to let them see the efforts we used to rescue their patient." Service provider HCP04, nurse, female, aged 28.*

After the death of a loved one in hospital, it was also the view of some service providers that this approach results in families speaking well of the hospital on their return to the community. It appeared that the norm was for patients to die in hospital and there was a perception that palliative discharge was rare, however some examples were discussed:

> *"…if he dies, it is God's time. Even when we returned home, many could see he has been brought back home so as he can die at home. So he is not doing well but they returned him home to die." Wife of MW0056, female, aged 63.*

There were service providers who were not so direct in their discussions with patients and family around death and dying. Instead, they preferred to update service users with sometimes euphemistic language. For example, expressions such as "*God knows"*, *"we must trust in God"* or that what is needed is *"divine intervention"*. Summoning a religious representative was another common tactic which was felt to be understood by all parties without discussing death directly.

The remaining service providers did not think it was appropriate to discuss death. For some, this was because of an experience where they had felt sure a patient would die, but they did not. Therefore, they did not want to give incorrect information. Others expressed superstitions that discussing death would risk the patient losing hope, or somehow make death more likely to occur:

> *"Let's say according to the African community, death is like.. death is a sad thing to all, and they don't speak about it much. They say it is like foretelling the future. So they don't talk much about death until it happens. We talk about it when it is over then it is not a thing that will be discussed again." Service provider HCP03, doctor, male, aged 28.*

When an older person had a cardiac arrest in hospital, service providers reported that the majority received cardiopulmonary resuscitation (CPR). When asked whether this was discussed with the patient and family, the most common response from service providers was that there was no time to discuss it because it was an emergency situation. The only scenario in which interviewees could recall it being discussed in advance were in the Intensive Care Unit, when families were being counselled regarding the withdrawal of ventilatory support.

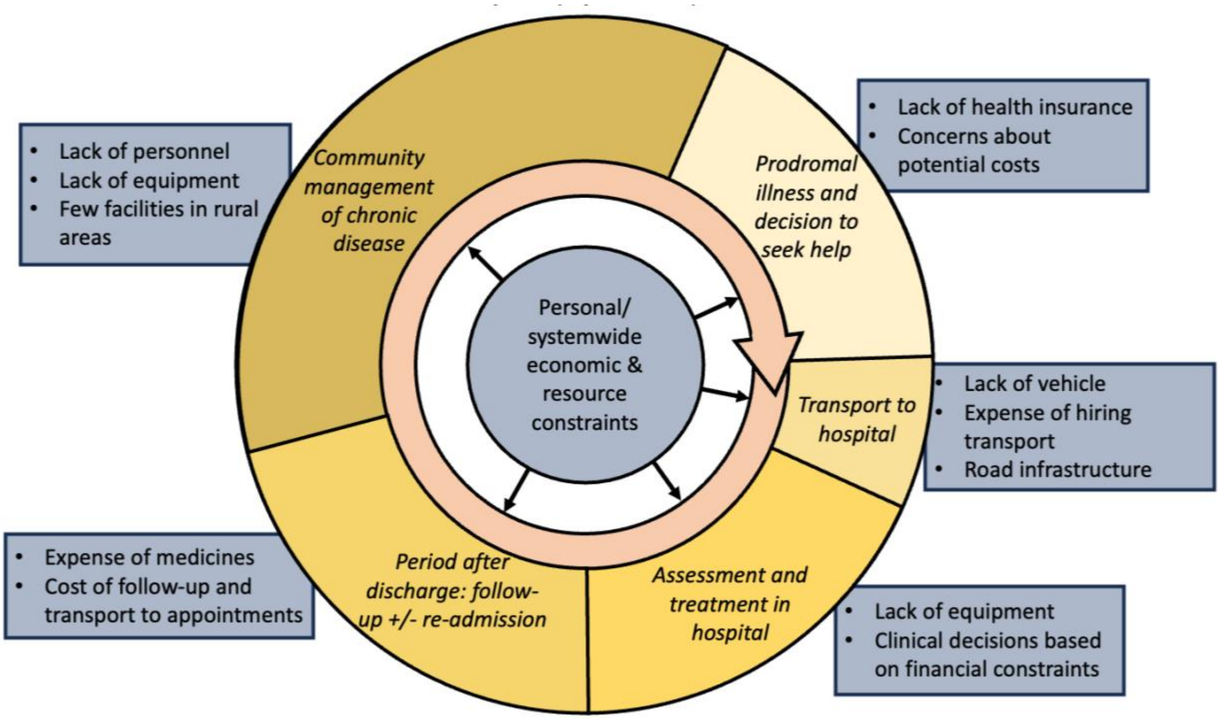
CPR was usually initiated by nursing staff who would continue until a doctor was present to advise whether to continue, or to stop. One nurse acknowledged that CPR could result in *"a painful death"* and one of the doctors reported that it was sometimes not initiated:

> *"Sometimes if we see that the patient has chronic diseases and they have suffered we say it's better for him to rest." Service provider HCP015, doctor, male, aged 55.*

6.8 Theme 5: Impacts of resource scarcity throughout the patient journey

Resource constraints play their part in most of the themes to a greater or lesser degree. Nonetheless, the journey of the older person through a period of acute illness was marked by resource scarcity on a personal level and at the level of the healthcare system and it is worth presenting as a theme in its own right. Economic constraints meant that accessing hospital was not straightforward and this was further exacerbated by geographic and cultural factors. During admission, lack of equipment led to interhospital transfers, and greater financial means bought better access to investigations and treatments, while those without money missed out. Finally, there was a perception that many admissions to hospital, and readmissions following discharge, occurred as a result of deficiencies in community care and aftercare for decompensated chronic diseases.

Figure 39. Theme 5: Impacts of resource scarcity throughout the patient journey.



The phases of the admission journey of the older person with the points at which personal and systemic resource constraints impacted upon access to care and care quality.

6.8.1 Access to hospital care

Several factors were identified which deterred older people and their caregivers from accessing hospital services or led to delays in presentation. It was the view of both service users and providers that this often resulted in worse outcomes or even preventable deaths:

> *"You find someone has a diabetic foot, maybe it started only with the toe, maybe he just hit it, but by the day the Good Samaritans bring him, you find he needs his leg cut off. It could have been just the toe." Service provider HCP11, nurse, female, aged 41.*

Economic means and good relationships with family were identified as key determinants of health in old age in theme one. Here, participants alluded to one of the key mechanisms underlying this relationship. The costs of hospital treatment are extremely high in an environment where most older people are uninsured and are forced to pay out-of-pocket. Some of the main barriers to older people seeking hospital care when unwell were the fear of medical expenses, a lack of relatives to draw upon for financial support, and concerns about being an economic burden on others. Interviewees spoke of examples where older people were not admitted due to the costs of care:

> *"You find that others have no ability [to pay for care]. They'll look at what he [the older person] is sick with, maybe he is suffering from throat cancer. The first thing they see is an 80-year-old, and they think the patient will never recover, so they let him die." Service provider HCP11, nurse, female, aged 41.*

In this cohort of service users, recruited following their admission to hospital, it is perhaps not surprising that traditional medicines were not seen as an alternative to hospital care. Only a small minority of the older people interviewed were using any of the heterogeneous remedies that are often referred to as *traditional medicine* and most reported these practices were no longer widespread. One service user even remarked that this was because *"most of the people are educated now".* Christian faith healing was mentioned briefly in a few of the narratives, but again it was not seen as an alternative to mainstream medical care through the dispensaries, local clinics or hospitals.

On the other hand, transport did present a major barrier to accessing hospital for a majority of service users. Most did not own a vehicle so instead were reliant on borrowing or paying for motorbikes, auto-rickshaws (known by the name of the manufacturer Bajaji), public buses (known as *daladalas*) or private cars. Depending on the distances involved and how rurally they lived, paying for transport could cost anything from 8,000 Tanzanian Shillings (TZS) to 100,000 TZS (approximately £2 to £33 GBP). There were a small number of older people who reported that neighbours with vehicles had taken them to hospital without charge. However, for the majority transport was a problem for the initial journey to hospital and posed an ongoing problem for relatives visiting them on a daily basis:

> *"Hiring a car to go and return costs TZS 70,000. Now with the cost of fuel going up, it might go as high as TZS 100,000. Now I have this prostate challenge. I cannot control my passing of urine, and therefore I cannot travel by public transport. I will be ashamed." Service user MC0015, former tailor and village Balozi, male, aged 86.*

It was not only the cost that was problematic. As in the quote above, several of the older people interviewed reported that their medical problems or disability impacted their ability to travel. Other examples included the inability to hold the position required to remain on the back of a motorbike, and pain experienced as a result of the cramped conditions in the back of a Bajaji. When roads were not accessible by vehicle, older people were carried in makeshift stretchers:

> *"The last time she had pneumonia, it was the rainy season and [we had] no transportation, so we made a stretcher ourselves and carried her to the main road." Daughter-in-law of service user H0085, female, aged 45.*

In a similar situation, one older people also reported having to be carried on someone else's back for a distance of up to one and a half kilometres to get to the road over otherwise impassable terrain.

Though families living in the town undoubtably benefited from easier transport access to hospital, there were differing views as to whether living in an urban or rural setting was better for an older person's health. On the one hand, living in an urban setting also meant greater likelihood of having electricity and running water. However, there were those who felt living in a rural setting had more advantages:

> *"Elderly who live in rural areas are the ones who have a good life because they don't have to buy food, they have everything in their farm, they don't pay rent because they live in their own house. But elderly in town, they have to pay rent and to buy food." Service user K0162, former farmer, female, aged 71.*

Advocates of this view portrayed older people living rurally as more active, better fed due to their proximity to the farms, and more likely to own their own home thus enjoying greater financial security. Aside from access to health services, the main downsides highlighted were hostile cold and wet weather during the rainy season and the toll that hard physical labour takes on the body.

6.8.2 Provider frustrations with resource constraints

Service users and providers portrayed large disparities between the facilities available at different hospital sites. KCMC, a large zonal hospital with extensive international input, was universally acknowledged to have the greatest range of services. However, many of the referrals for older people from the other hospital sites were made only because of a lack of diagnostic equipment, rather than competency in management of the condition:

> *"Most referrals for the old are done due the need for advanced medical investigations unavailable due to the lack of medical equipment here. But referral is restricted to the investigation. Once that is done and results obtained, they return here." Service provider HCP07, nurse, female, aged 45.*

The most cited reason for such an interhospital transfer was for a CT scan following a suspected stroke, though transfers were also made for echocardiograms and even electrocardiograms. These interhospital transfers occurred via public transport or privately hired taxi or Bajaji. The perception that district facilities were underequipped led to some service users bypassing their closest hospital entirely, going straight to one of the larger centres.

Aside from the resource constraints of the environment they worked in, service providers shared feelings of helplessness and failure when finances of the patient were a limiting factor:

> *"Sometimes you find a patient, maybe they have some kind of problem and now needs to undergo some kind of operation, and you find that the elder can't afford the operation. So the reality is that it is very challenging. You are determined to help them but now you are failing, you find that it is something that is beyond your power and you are unable to help them." Service provider HCP09, nurse, male, aged 32.*

Similarly, frustration was expressed by doctors regarding the challenge of having to adjust their clinical recommendations on the basis of the financial constraints of the patient and family. This applied to both investigations, and medications:

> *"If relatives are not financially well-off, it gives me a difficult time because I become reluctant to suggest some of the medical tests, and thus have difficulty in prioritising the tests." Service provider HCP12, doctor, male, aged 27.*

6.8.3 Limited resources in community health services

Some hospital admissions and readmissions of older people were regarded as potentially avoidable. Resource limitations were the key determinant in these situations. Community services were regarded as lacking in equipment and personnel. Meanwhile older people did not always have the financial means to pay for care provided by local dispensaries or outpatient clinics. In some case, the consequence of this was decompensation of chronic disease, resulting in admission or readmission:

> *"Let us take the example of hypertensive or diabetic elders. We discharge them because we have managed their complications, but when they go back home they stop using the medicine and after a short time they suffer a stroke and they come back to the hospital again. Also some diabetic patients stop using their medicines and they may get kidney problems, other elderly people don't attend the clinics as they were recommended." HCP12, doctor, male, aged 27.*

As in the quote above, there was sometimes an air of frustration (at times bordering on blame) in the responses of service providers regarding the readmission of older people. From their perspective, providers worked hard in hospital to help rectify health problems, only for them to deteriorate again in the community upon discharge because of poor adherence with medications, diet or failure to attend outpatient appointments. A few service providers also believed returning to stresses at home, as well as the inability of family to maintain hospital standards of care, also led to preventable readmissions. Examples in these cases included older people with reduced mobility readmitted with pressure sores, or those with swallowing difficulties returning with aspiration pneumonia.

On the other hand, in the eyes of service users it was systemwide resource constraints that were highlighted as the main problem in caring for older people's health in the community:

> *"They said he should be attending clinic on Monday and Wednesday, but we couldn't do that as we couldn't afford to because you have to open a file every time you go and you have to pay 10,000 TZS. And it is different to the treatments or the medicines that you have to pay for too. So sometimes we can't, so when the blood pressure isn't much trouble…" Wife of MW0055, female, aged 60.*

The costs of travel, clinic appointments and medications were often unrealistic for service users. For conditions such as hypertension, which are often asymptomatic and where treatment is about managing abstract risk, service users wondered whether the costs of treatment were worth it when treatment did not cause any appreciable symptom relief.

Common non-communicable diseases such as type two diabetes and hypertension can be managed at community clinics and dispensaries with appropriate equipment. However, lack of sphygmomanometers and blood glucose monitors meant that some older people had to go to hospital to have these conditions checked. One participant had been issued a blood glucose monitor as part of a new programme, but he had not been supplied with any further test strips, rendering the device useless. Others described going to rural publicly funded dispensaries for treatment but found this to be unfruitful due to the lack of resources:

> *"…they [government] helped us to finish the building and they sent the doctor for us. The doctor only worked for 8 hours and, when we go there, they can only give us advice because of the lack of equipment." Service user H0082, former engineer, publisher and farmer, male, aged 67.*

Though the balance of opinion was that there is a deficiency in the services and support available for older people and their caregivers in the community, there were some hopeful positive examples. One which has already been outlined is healthcare providers' tendency to view health education as a crucial part of their role, especially for self-management of chronic conditions. Additionally, there were also examples of hospital aftercare for some patient groups (such as those who had suffered a stroke) that reached out to patients in the community directly, rather than requesting that they travel back to the hospital for appointments:

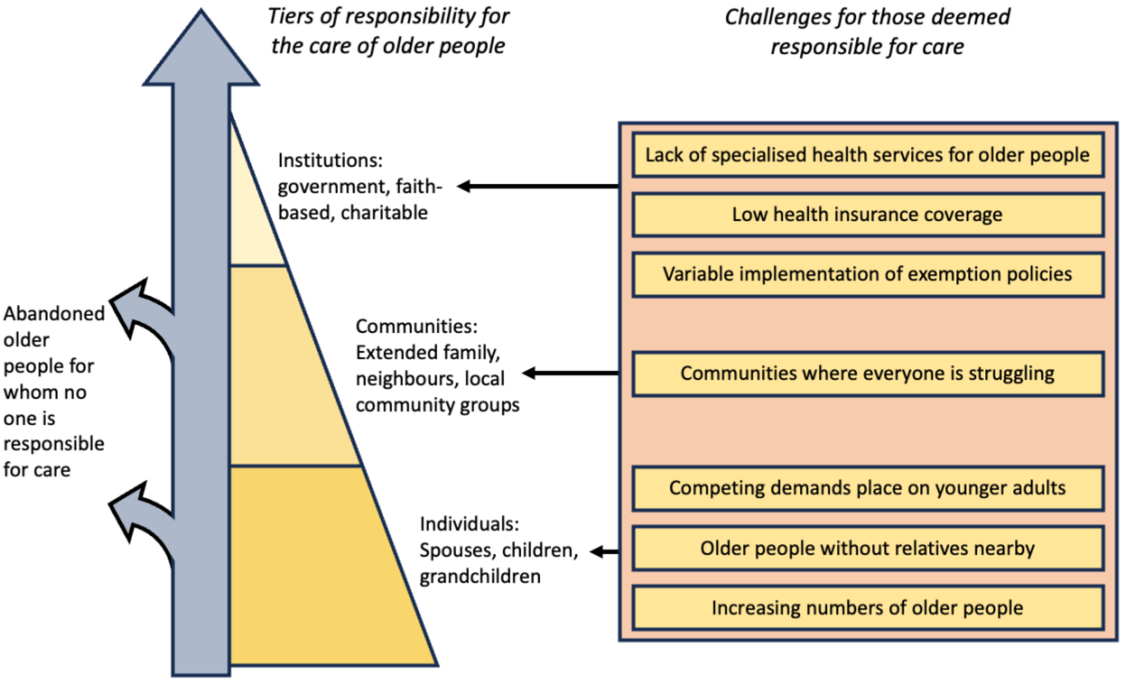
> *"…patients who suffer from an illness that would take time to recover, in order to save them medical cost we allow them to go home and we give training to the patient and relatives on how to handle the situation. Once we are satisfied that they understand how the situation should be handled, we give them medication to be used for the longer period of time and subject them to home-based medical care and our medical care team will visit the patient once a week." HCP05, nurse, male, aged 28.*

This represents a rather resource intensive approach on the part of the hospital. However, several service users highlighted the benefits of remote forms of follow-up, such as telephone contact with the medical teams after discharge. This seemed for the most part as if it was done on an informal basis, nonetheless there was at least one example, in which a nurse gave advice to relatives about feeding position for someone with stroke, that potentially prevented a hospital admission.

6.9 Theme 6: Responsibility for the care of older people

When asked the question *"Who should have responsibility for caring for older people?"*, interviewees' responses ranged from individuals, to the wider community and institutions. Answers reflected the cultural norm of respect for older people in Tanzanian society and highlighted the importance of reciprocating the contribution they made to the nation. The overall picture was that of a loosely tiered structure, in which close relatives were most often responsible for care. Where an older person lacked this support, because they had no family or their close relatives were struggling to manage the demands in their own lives, responsibility for their care often fell to neighbours in the local community. Where reciprocity completely broke down, as in the examples of older people *"abandoned"* in hospital, government social welfare was utilised. There were also accounts of older people who fell through the gaps in the community, for whom nobody else was responsible for care.

Figure 40. Theme 6: Responsibility for the care of older people



The tiers of responsibility for care, along with the challenges which have the potential to affect all tiers, leading to a breakdown in the norm of reciprocity of care.

6.9.1 A special group

The role of the older person in society was chiefly described as that of an advisor or an arbiter of disputes. By contrast, younger adults were sometimes portrayed by interviewees as concerned only with trivial matters and needful of guidance when it came to anything serious or contentious:

> *"I think the big issue when you are an elder, is they [younger adults] come for advice for some issues that are bothering them. The elders tell them that 'you should do this'. Left to themselves they will think it is too complicated and they lose hope." Service user MW0055, retired construction engineer, male, aged 67.*

In theme one, some interviewees described a transactional reciprocity, in which children cared for parents, provided the parent had invested in them, primarily through education. In discussions regarding the cultural norm of respect for older people, the concept of reciprocity of care was seen again. Whether as a professional in hospital or in a personal capacity in the community, caring for older people, the *"builders"* of the community, was viewed as a virtue and a privilege:

> *"I think it is African culture that elders should be highly respected. And according to our culture, caring for elders is a blessing from God, but it is also a profession that I have studied, so [for me] it is a normal part of the job. It is something that we do willingly from our hearts." Service provider HCP03, doctor, male, aged 28.*

Several healthcare providers explained how older patients reminded them of their own parents and made them reflect upon their own futures. These were universally positive experiences which engendered empathy and led to feelings of fulfilment and satisfaction in their work:

> *"Sometimes I try to think, what if it were me or my parents facing such challenges? This gives me a reason to do it passionately." Service provider HCP01, nurse, female, aged 34.*

> *"…every time I serve the elderly I wonder what will become of me when I grow old. I counsel myself that by faith I am investing by serving the elderly. I believe that when I become old I will receive the treatment that I'm giving the elderly now" Service provider HCP06, nurse, male, aged 33.*

The latter of these two quotes was from a service provider working at Machame Lutheran Hospital, where every morning began with a service for staff and the affiliated faith school in the hospital chapel. Their conception of reciprocity bears a strong resemblance to what is often referred to as the "*Golden Rule",* to treat others as you yourself would like to be treated, expressed across Abrahamic religions and other faiths.

Respect for older people, and their treatment as a special group, was formalised by all hospitals through policies giving them priority over younger adults:

> *"Everyone who is close to the elderly should take on the responsibility for looking after them. The elderly are a treasure we have, so they need to be prioritised in everything. That is why here in the hospital we attend to the elderly first." Service provider HCP012, doctor, male, aged 27.*

In practical terms, prioritisation took several forms. In the Emergency Departments, there was an understanding that, because of problems with mobility or continence, it was undesirable for older people presenting acutely to wait for a long time to be seen. To tackle this, all sites implemented systems to reduce wait times for older people such as a separate service window for people aged 60 years and over, and policies in which older people were pulled from the queue to be seen ahead of younger adults:

> *"…they [hospital staff] give her highest priority… The elderly cannot tolerate waiting a long time for services, but the youth can. Therefore, the elderly are prioritised so that they can leave the hospital earlier and, if they are admitted, they can go to the ward and take some rest." Daughter-in-law of service user H0085, female, aged 45.*

There were also two examples of prioritisation in areas of the hospital outside of the Emergency Department. On one ward, staff reported that they allocated older patients beds closer to the nurses' station so that they could monitor them more intensively. The second example was in an outpatient clinic, in which one hospital provided older people with tea whilst waiting for their appointments to prevent them from becoming dehydrated in the heat.

In the community too, several service users gave examples illustrating how older people were treated as a special group. These included exemption from communal village work and taxation, as well as raising funds to help cover the cost of medical care through community organisations:

> *"If my family can't collect enough money to cover the medical costs, they would go to the church, or my political party, to tell them your leader is sick and then they would offer some help." Service user H0082, former engineer, publisher and farmer, also the leader of a local branch of a political party, male, aged 67.*

Overwhelmingly, interviews portrayed a picture in which older people were respected and treated as a special group. Nonetheless, a minority were aware of people who did not see the value or contribution of older people, even if this was not their personal view:

> *"Another big challenge is the attitude in society that when a person reaches 80 or 90 they are almost ready to die so they don't need any care anymore." Service use HCP05, nurse, male, aged 28.*

6.9.2 Competing responsibilities

The acute admission of an older person placed pressure on their caregivers and wider support network. While families played an important role in financially supporting hospital admission, as well as often providing food and personal care, this required sacrifices on the part of caregivers. Such sacrifices included requesting time off work from employers, advances in salary, selling possessions, or borrowing money from neighbours and relatives.

Likewise, the responsibility for caring for an older person with ill health in the community was also a considerable source of stress for caregivers. Those of working age found themselves battling with the competing responsibilities of supporting two generations: their children and their parents.

> *"The cash they [his children] receive as salary is insufficient to take care of me and their families. They live in urban environments and have relatively larger families. The majority have three to four children who go to school. I must admit though, that they take care of me. They share with me whatever they are blessed to earn." Service user MC0015, former tailor and village Balozi, male, aged 86.*

One service user did not leave the house because the older person's needs were so great and was herself reliant upon other members of the family to bring food and supplies. Witnessing these kinds of sacrifices engendered feelings of guilt and shame amongst some older people:

> *"I would pray to God to restore my health to what it was before I got sick so that I did not have to be dependent on my children" Service user MW0132, former business owner selling agricultural products, female, aged 60.*

In a minority of interviews, caregivers also described tensions within families about the equity and distribution of caring duties; some felt they were doing more than their fair share while others were seen to be shirking their responsibilities.

6.9.3 Abandonment in hospital

A scenario frequently highlighted by service providers (though not by the included group of service users all of whom had family caregivers) was that of older people who were admitted to hospital and lacked the means to support themselves but also had nobody else to care for them. In some cases, these were people without family nearby, for example migrants to Tanzania or those whose children had moved to the city, who had been brought to hospital by concerned neighbours. However, in the majority of cases discussed, these so-called *"abandoned patients"* were brought to the hospital by relatives, who then left them there because of fears they would be unable to cover the cost of treatment:

> *"Working in the male ward the big challenge I face is that the elders are neglected, they are brought to hospital and left without treatment, food, or relatives to care for them. So it becomes a challenge for the nurse when they lack someone close to them." Service provider HCP06, nurse, male, aged 33.*

The perception amongst healthcare providers was that abandonment was an increasing problem and that it gave them more work. Without relatives, the responsibility for securing clothing and toiletries, as well as food in those sites that did not provide it, overwhelmingly fell upon nurses. Items were procured from the nurses themselves, neighbouring patients on the ward, or *"Good Samaritans"* from charitable organisations.

Moreover, there was also the problem of who then was responsible for covering the medical costs of admission. The majority of respondents were of the opinion that was the job of the hospital and the government. In practice, abandoned older patients were referred to Social Welfare Officers who would seek government funding for their care, whilst also searching for people in the community willing to take responsibility for the cost and/or ongoing care for the older person on discharge:

> *"When they [Social Welfare Officers] go to visit and ask for the village chairman, they often find the person's home. So they look at the environment, see if the relatives are there and they tell them their brother is in hospital. And if they are not able to go and pick him up, then they will inform them that on a certain day they will bring him." Service provider HCP11, nurse, female, aged 41.*

At the time of discharge, a minority of service providers also recounted examples of families who had refused to take the older person home for fear that they would be unable to provide for their needs. One nurse also described situations in which older people refuse to return home because of these concerns:

> *"Those who refuse [to go home], you find it is because of the good handling and holistic care provided by the hospital, such as body cleanliness, changing clothes, being fed, and at home there is no one to care for them and provide them with good food." Service provider HCP01, nurse, female, aged 34.*

6.9.4 Government should do more

The need for government intervention to help manage the health problems of increasing numbers of older people arose in several contexts. Almost everyone agreed that government could and should do more, though there were differences in opinion regarding what interventions would have the greatest impact. The main areas of discussion were around insurance and exemption policies.

The quantitative data highlighted just how few people had health insurance. Consequently, a conscious decision was made to recruit service users with and without insurance to explore this in greater detail. Those with insurance (10 out of the 22 older people interviewed) are therefore overrepresented in this qualitative sample. For those that did not have it, all reported that they would prefer to be insured but it was cost that was the prohibitive factor. For older people that were insured, it was universally regarded as helpful, allowing them to access care when they needed it with reduced anxiety around the costs:

> *"Maybe without insurance, she could have died." Daughter of K0046, female, aged 62.*

Although positive overall, there were also caveats to owning insurance expressed by those who had it. Depending on the policy, not everything was included which sometimes led to paying out-of-pocket, in addition to insurance premiums, for tests, medicines, or specialist care at non-government hospitals:

> *"Not all the tests are covered with this insurance, the greatest coverage includes a lot…but some medicines are sometimes not covered which is the biggest challenge." Son of service user K0065, male, aged 37.*

In theory, government policy states that citizens aged 60 years and older should be exempt from user fees in publicly funded facilities if they are unable to pay for care. However, the quantitative phase of this research highlighted just how infrequently this policy is implemented in practice, and only two of the service users interviewed here had utilised it during their baseline admission. Awareness of exemption policies was low, processes were viewed as bureaucratic, and the implementation of these processes was highly variable:

> *"If you happen to meet the [Social Welfare] Officer, you will be told to bring a letter from the Ward Executive Officer and the Balozi. Securing all that documentation takes time. They further wish to know how much cash you have at the same time before they approve it. The exemption they offer is partial. You will still be required to pay in terms of cost sharing. For example, if the cost is 600,000 TZS, you will be required to settle 400,000 TZS, 200,000 TZS will be exempted. The scheme is very bureaucratic." Son of MW0111, male, aged 24.*

Exemption policies do not apply in non-government run institutions. Nonetheless, service providers working at privately run institutions described other mechanisms by which care could be provided to those who were unable to pay in these hospitals. Mechanisms included systems of credits and bonds, or debt-forgiveness with treatment paid for by charitable welfare funds.

Extensive suggestions were made regarding government interventions to improve the health circumstances of older people in hospital. These fell into two categories: 1) greater funding; and 2) specialist services. Within greater funding, proposed ideas ranged from support with the cost of medications, all the way through to free medical services for people aged over 60 years. Ideas for specialist services included wards, or even hospitals, exclusively for older people with more suitable food, expertise in the management of stroke and heart disease, as well as higher nursing ratios. In the community, proposed services encompassed step-down hospitals post-discharge for those with sustained care needs, and accommodation including specialist homes for the elderly providing comprehensive support.

6.10 Discussion

6.10.1 Approach to discussion

Many possible approaches were considered for the structure of this discussion, such as exploring theme-by-theme in a granular manner, or going through the chronological phases of the patient journey. Ultimately, a framework based around the main aims of this mixed methods research was chosen. This structure meant that equal voice was not given to every theme, however it ensured that the focus was maintained on triangulating qualitative results with the quantitative data. Within the overall mixed methods study design, qualitative elements were incorporated to explore the experiences of service users and providers with the aim of deepening understanding of key relationships, as well as identifying barriers and facilitators to effective care. This discussion therefore begins by exploring Tanzanian conceptions of health in old age which are key to understanding what it meant to live with frailty in this specific cultural context, and what defined *"good"* or *"bad"* outcomes. The greatest barriers and facilitators to effective care identified by service users and providers interacting with the hospital system were then evaluated with reference to existing literature.

6.10.2 What defines a "good" or "bad" outcome for older people admitted to hospital in Tanzania?

In theme one, conceptions of health in old age were summarised with reference to their dimensions and determinants. A key component of the model that was identified in this theme was the idea of "*kuzeeka vibaya"/ "ageing badly"*. This concept bears many similarities to the various definitions of frailty. Physical elements of *kuzeeka vibaya*, fatigue and weakness, align well with the weakness and exhaustion defined in Fried's frailty phenotype (Fried et al., 2001). There are also parallels between Fried's characteristics of slowness and low physical activity, and the dependency described by interviewees in the present investigation (Fried et al., 2001). In their study based in the Hai District in Tanzania, Lewis et al. conducted a mixture of focus groups and semi-structed interviews with 97 community-dwelling adults to interrogate the extent to which Fried's phenotype translated cross-culturally in this setting. Themes identified included *"the strength is reduced"*, *"the body has become tired"* and *"the legs don't walk"*, all of which have strong parallels with the determinants of health presented here, and echo elements of Fried's phenotype (Lewis et al., 2021, Fried et al., 2001).

Yet, in the present study, the dimensions of health in old age extended beyond physical characteristics, to include their practical consequences and social implications. Fatigue, weakness and mobility problems were framed in terms of their impact on ability to work, to contribute to household tasks, and to support oneself financially. This replicates the findings of Lewis et al.'s rural community-based study, in which the tiring of the body was discussed in reference to manual tasks associated with subsistence farming, and reduced strength in relation to loss of ability to generate capital (Lewis et al., 2021). Moreover, Lewis et al. identified a tendency to view many of the physical changes associated with frailty as a natural part of the ageing process, with the exceptions being when this was accelerated by undernutrition, alcohol, or psychological stress as a result of a lack in social support (Lewis et al., 2021). These accelerants closely mirror the determinants identified in the subthemes *lifestyle of the individual* and *relationships with family* in the present investigation. This study therefore supports the view of Lewis et al. that frailty in the cultural context of Tanzania is fundamentally understood in social terms and that any congruence between "*udhaifu wa* *wazee"*/ *"weakness of the elderly"*, and *physical* frailty, is somewhat superficial (Lewis et al., 2021).

Both Fried's "Cycle of Frailty" and Rockwood's original deficit accumulation model focus on physical characteristics to the neglect of social factors (Fried et al., 2001, Rockwood et al., 2005). However, since the first emergence of frailty in the medical literature, there have been those who have argued for a broader definition encompassing sociocultural elements (Kaufman, 1994). A systematic review (limited to English language studies) by Lekan et al, synthesised conceptual and operational definitions of frailty from 25 qualitative studies and identified four themes: *1) Time, 2) Vulnerability, 3) Loss, and 4) Relationships* (Lekan et al., 2021). Despite including only studies from HICs, many of the features identified in these themes echo the components of "*kuzeeka vibaya"/ "ageing badly"*. Lekan et al. paint a picture of frailty as a complex system, in which physical age-related changes have consequences for psychological wellbeing and social identity. In their qualitative synthesis, they presented the line between *frail* and *non-frail* as fluctuating according to the stability or weakness of social support, with changing needs in turn impacting the lives of those responsible for providing care (Lekan et al., 2021). In the present study, service users and providers certainly shared the view that inadequate social support had the potential to accelerate poor health. Furthermore, in the subtheme *dimensions of health in old age,* several interviewees also described the broader social impact of the changing needs of older people in the period surrounding hospital admission, and how with time, good care could lead to improvements in capability. This shifting social world surrounding an older person, and its intersection with the physical home environment, has previously been referred to as the "*carescape"* by Brigit Orbrist, who derived this term while conducting ethnographic research exploring the care of older people in coastal Tanzania (Obrist, 2016).

Despite numerous areas of agreement with the present study, financial insecurity played only a small part in the narratives in Leckan et al.'s meta-synthesis (Lekan et al., 2021), whereas it was central to the experiences of participants of this study in a low-middle-income setting. Though their review did recognise that many risk factors for frailty are related to socioeconomic status, in the present investigation and Lewis et al.'s previous work in Tanzania, poverty and food insecurity were inextricably linked with conceptions of health in old age (Lewis et al., 2021).

It is perhaps unsurprising that so many of the elements of health in old age highlighted by service users and providers in this study were social and economic in nature. Tanzania has a strong collectivist tradition. *Ujamaa*, translated into English as *"familyhood"*, was the Swahili word used to describe the political philosophy popularised by Julius Nyerere, the first President of Tanzania. His socialist movement explicitly aimed to transform Tanzania into a communitarian society through state-enforced villagisation and collective agriculture (Coulson, 2013). Though no longer evident in municipal areas, the villages visited for interviews in this study have broadly retained the structures of local leadership (including the *Balozi*) instigated as part of these policies. The legacy of this collectivist worldview can perhaps be seen in the theme *"responsibility for the care of older people",* where everyone in society was seen as responsible on some level for reciprocating the care given to them by the *"founders"* of the nation. During hospital admission, families were expected to continue to play an extensive role in care alongside professionals. This was something that resulted in tension and conflict when it came up against a ward system where visiting hours were restricted to allow professionals to care for *the individual* who was sick. Though ultimately replaced by a more capitalistic policy, *ujamaa* still represents an important ideological chapter in Tanzania's history which has permeated the culture, and many of the structures and values it represented persist to the present day.

Strong relationships with family and community, cultivated over a lifetime, were seen as core requirements in attaining "*uzee mzuri*"/ *"good old age"*. Meanwhile, at the other end of the scale, those with poor health in old age were often seen as burdened by loneliness and isolation. Loneliness and isolation are indeed considered independent risk factors for the development of frailty in studies from HICs (Davies et al., 2021), but to understand the origin of this view of health in old age in the cultural context of Tanzania it is worth outlining *ubuntu*. *Ubuntu* is a word originating from Bantu languages, for which there is no direct English equivalent, but which is often described broadly as "humanity to others" (Lumumba-Kasongo, 2018). It is fundamentally a philosophy of solidarity, interdependence and communitarianism (Jecker et al., 2022). Its origins go back centuries within many Southern

African nations, but its ideas gained increasing prominence in Tanzania the late 20th century with independence, decolonisation, *ujamaa* and the growth of Pan-Africanism. *"A person is a person through other persons"* is amongst the main axiomatic statements that are often used to explain *ubuntu,* an expression that one's own subjective identity and individuality exist only when mirrored by others (Wiredu, 2002). Through the lens of *ubuntu*, it is easier to appreciate why family support, and the impact of isolation, featured so prominently in conversations about psychosocial wellbeing in old age in Tanzania.

There is a vast body of literature relating to the determinants of health in old age, the key frameworks of which are outlined in the introduction of this thesis. As in the present investigation, other literature from sub-Saharan Africa also tends to place greater emphasis on social and economic factors than global frameworks. For example, Mapoma et al. conducted a survey of 690 people aged 60 and over across multiple areas of Zambia, with elements constructed as proxies for the determinants of Active Ageing in the WHO policy framework (Mapoma, 2014, World Health Organization, 2002). In a Zambian context, the determinants deemed to have the greatest impact on health also included access to income, low family and peer interactions and loneliness (Mapoma, 2014). Interestingly, Mapoma et al. propose that the transition from extended to nuclear family structures poses threat to health in old age, a view that was shared by participants in the presents study and in Lewis et al.'s investigation where one's children moving away was mentioned repeatedly in this context (Lewis et al., 2021, Mapoma, 2014). Interestingly, HIV and gender were also deemed key determinants of active ageing in a Zambian context, but featured little in narratives of the present study (Mapoma, 2014).

As part of a mixed-methods study from Cameroon, Naah et al. conducted focus group discussions, also based around the WHO framework, with 100 people aged over 60 in the city of Bemenda. The health determinants identified included the extent of civic and social participation, and interviewees expressed dissatisfaction at the lack of non-strenuous employment for older people (Naah et al., 2020). There was certainly an appetite amongst some of the older participants in the present study for employment of some kind to reduce financial dependence and insecurity, but in a region where much of the population are subsistence farmers there were limited opportunities for light duties. There was also a perception that the norm of respect for older people in Cameroon was in rapid decline amongst younger generations (Naah et al., 2020). Whilst these cultural norms remained strong amongst interviewees in the present study for the most part, there were examples of older people feeling like thy lacked value and of negative attitudes towards older people.

When considering frailty, and what constitutes a "good" or "bad" health outcome in Tanzania, purely physical models (such as Fried's phenotype) are not adequate to reflect the economic, social and cultural dimensions specific to this context. By contrast, social frailty may be defined as "*a continuum of being at risk of losing, or having lost, resources that are important for fulfilling one or more basic social needs during the life span"* (Bunt et al., 2017). This was derived from a systematic review which included 42 studies relating to social frailty (Bunt et al., 2017). In this definition, the term *resources* refers not only to one's financial situation, but to the living environment, community structure and physical limitations. It is also understood to encompass *social resources* such as marital status, family ties and the size of one's social network. *Social needs* are feelings of cohesion, belonging, emotional support and strong relationships (Bunt et al., 2017). In these respects, this social conception of frailty represents a much closer fit with the communitarian picture – rooted in *ujamaa* and *ubuntu* – of health and frailty in old age described in this Tanzanian cohort.

With this better understanding of frailty in the Tanzanian context, and what constitutes good and bad outcomes, the key barriers and facilitators to effective care raised by participants are now explored.

6.10.3 Rising numbers of older people being admitted represents a vulnerability to effective care in the future

It was the perception of service providers in this study that the number of older people being admitted to hospital is increasing, and that their complex health needs represent a significant challenge for staff and resources. Furthermore, many service users held the view that older people required specialist hospital care. Four of the traditional "Geriatric Giants", (incontinence, immobility, delirium and pressure ulcers), were amongst the presentations described by service providers, as well as many of the expanded range of geriatric syndromes recognised today including sensory impairment, reduced immunity, feeding problems, social isolation, depression and multimorbidity (Inouye et al., 2007). As has been discussed at length in this thesis, there is a paucity of data regarding the prevalence of geriatric syndromes in LMICs, particularly sub-Saharan Africa, and the attitudes of service providers caring for older people. Interviewees comments serve to highlight the limited provision of specialist geriatric training and services, which has previously been identified in the literature (Dotchin et al., 2013, Cassim and Tipping, 2022), and represents a considerable vulnerability as the population in Tanzania ages.

The challenges of nursing acutely unwell older adults, discussed extensively in theme two, are a well-documented phenomenon. A review of nursing attitudes towards older people called attention to pervasive perceptions that weakness, immobility and poor cognition make care more difficult and time consuming (Rush et al., 2017). Caring for older people with incontinence, disordered sleep and pressure ulcers were specific factors that also added to these challenges (Rush et al., 2017). A systematic review examining the quality of nursing care for patients of all ages in hospitals in LMICs (7/ 31 studies being from Africa) demonstrated that clinical and technical tasks were prioritised over patients’ physical and psychological needs (Assaye et al., 2022). Other common reasons for missed nursing tasks include inadequate staffing, the burden of clerical duties and the prioritisation of clinical activities, such as giving medications (Assaye et al., 2022). Of the studies included, two from South Africa and Nigeria specifically raised bathing, patient education, spiritual support and family updates as tasks that were often not completed (Bekker et al., 2015, John et al., 2016). This list of missed tasks is especially concerning given the holistic care needs and the importance of family involvement emphasised by interviewees in the present investigation. It is an even greater concern for those patients who are abandoned in hospital and may be entirely reliant on nursing staff for all their needs without relatives to aid or advocate for them. Although service providers in the present study generally expressed positive attitudes towards older people, and provided many examples of good nursing care, several also commented that care quality suffered when the needs of older people outstripped the capacity of nursing staff. Greater nursing support staff and task-shifting are amongst the solutions sometimes utilised to tackle such missed nursing tasks (Assaye et al., 2022).

6.10.4 Prioritisation of older people as a facilitator to effective care

Modernisation and urbanisation are often blamed for a perceived decline in the respect for the wisdom and experience of older people in Tanzania (Mfungo et al., 2022). However, in the present investigation, both family caregivers and service providers described older people in highly respectful terms as advisors, arbiters of dispute and builders of the nation. Many service providers regarded them as a special group, and several of the participating hospitals actively prioritised older patients for emergency care. Similar prioritisation policies to reduce wait times for older people have been described in other regions of Tanzania (Gasto et al., 2017, Tungu et al., 2022). Such policies demonstrate the continued cultural value placed on older adults and their efficacy improving the care of older people in hospital warrants further investigation as a potential facilitator.

6.10.5 Economic barriers to effective care

The most frequently raised barriers to effective care, from the perspectives of both service users and providers, were economic. Older individuals with frailty often subsist on low incomes or are financially dependent upon others. Pensions and insurance are uncommon (only 8.1% of participants of the quantitative phase had a pension and just 32.5% had any form of insurance), and in their absence the costs incurred in the period surrounding hospital admission are considerable. It is not just the cost of admission, but the financial burden incurred by lost income, transport, medications and follow-up appointments. The impact is also felt by family who often contribute to out-of-pocket payments, take time off work and travel to and from the hospital. Furthermore, limited healthcare funding means service providers sometimes lacked necessary equipment and staff and were forced to make decisions subject to systemic and individual patient’s resource constraints.

Relative to average income, out-of-pocket payments globally for healthcare are regressive, with people in LMICs disproportionately incurring medical expenses amounting to greater than 10% of household resources (Reid et al., 2022). In Tanzania, out-of-pocket payments account for 26% of healthcare expenditure and in a national survey, such payments were inversely related to socioeconomic indicators (Brinda et al., 2014, Macha et al., 2012). Notably, the factors associated with health costs exceeding 40% of annual household income in the survey included increasing age, lack of formal education, and functional disability

(Brinda et al., 2014). All three of these factors were related to frailty status in the quantitative measures in the present investigation.

Amongst interviewees in the present study, fears of medical expenses deterred service users from presenting to hospital, and there was a perception amongst service providers that this led to poorer health outcomes. This relationship between the cost of care and delays in presentation to health services is a well-documented phenomenon across LMICs (Reid et al., 2022, Rick et al., 2021, Brand et al., 2019). More locally, a 2020 qualitative study by Snavely et al. interviewed relatives of inpatients who died with febrile illnesses in Kilimanjaro and Arusha. They considered cost of care and transport to be barriers to healthcare utilisation, and summed up their findings with a memorable quotation from one participant: *"If you have no money, you might die"* (Snavely et al., 2020). Another interesting aspect of this study was the identification of the theme of *"social capital"* as a facilitator. More socially connected individuals were able to wield greater financial resources because they had more people from whom they could borrow money for care (Snavely et al., 2020). Though seen as a positive in this context, other work has emphasised the *"cycles of indebtedness"* that can occur in the aftermath of such borrowing (Macha et al., 2012). Nonetheless, social capital could go some way towards explaining the mechanism underlying the view amongst participants of the present study that good relationships with family and strong social networks resulted in a healthier old age.

Health insurance status was one of the characteristics of interest that were identified from the quantitative strand that was used to guide the purposive sampling in this qualitative investigation. Despite a formal goal of universal healthcare, health insurance coverage in Tanzania remains low at around 32% (Wang and Rosemburg, 2018, Kitole et al., 2023). In the present investigation, service users that lacked health insurance almost universally cited cost of premiums as the main reason. Previous work examining factors influencing membership of the Community Health Fund also found that instability in income and the cost of premiums were amongst the main reasons for non-membership (Macha et al., 2014). Conversely, many participants of Macha et al.'s mixed-methods study also commented that Community Health Fund premiums were affordable, though quantitative measures demonstrated that members of the programme were more likely to be in a middle-income bracket (Macha et al., 2014).

Existing insurance schemes are often not utilised by the poorest members of the community, those who were the most likely to be frail. A nationwide survey of women of all ages throughout Tanzania found that lack of health insurance, as well as low socioeconomic status (measured by wealth, education and employment) were associated with problems in accessing healthcare (Bintabara et al., 2018). Furthermore, a large study from the Tobora Region found that of 1899 people aged over 60, those with health insurance were more than twice as likely to utilise outpatient services and more than three times as likely to access hospital care (Tungu et al., 2020). For older people with frailty in Tanzania, lack of insurance therefore represents a significant barrier to accessing hospital services.

Even interviewees who had insurance in the present study reported that not all services were covered and that they were still often required to make out-of-pocket payments. A large mixed-methods study across Tanzania, Ghana and South Africa, concluded that health benefits were distributed regressively, with the poorest paying the most out-of-pocket payments due to inadequate insurance coverage and ineffective waiver policies (Macha et al., 2012). In the present investigation, there was no comparison of experiences of the care received between hospital sites. However, previous work from Tanzania has highlighted a perception amongst patients that government facilities provide lower quality care, experience greater shortages of medicines and equipment, have longer wait times and are even less trustworthy than private facilities (Macha et al., 2014, Shayo et al., 2016, Macha et al., 2012). In some cases, this has even been proposed as a driver of low health insurance coverage, as the Community Health Fund only funds care at government facilities (Macha et al., 2014).

A nexus exists between insurance and exemption policies. It is government policy that exemption from user fees/ out-of-pocket payments should be available for people aged 60 and over admitted to government funded facilities. Despite this, previous work has demonstrated that 43% of all people eligible for exemption from user fees were still making out-of-pocket payments (Macha et al., 2012). Several service users in the present study were not aware of exemption policies at all, while others spoke of their inconsistent and excessively bureaucratic implementation. These bureaucratic processes, as well as shortages of essential medicines, were also identified as barriers to effective implementation of exemption policies for older people in Kigoma, western Tanzania (Ntahosanzwe and Rwegoshora, 2021). Furthermore, in-depth exploration of exemption policies in two districts in central Tanzania attributed variation in implementation to confusion about eligibility, officials being unclear on the rationale for a non-means-tested waiver, and inconsistencies in criteria applied when means-testing was attempted (Maluka, 2013). Hospital officials also reported that they simply could not afford to grant exemptions and drug shortages in government dispensaries again featured in the narratives, with the consequence that people often had to go and buy medications from private pharmacies (Maluka, 2013). These barriers, as well as a lack of statute and guidance from central government to entrench exemption policies, have been corroborated now by a number of other studies (Gasto et al., 2017, Tungu et al., 2022).

6.10.6 Mitigating out-of-pocket payments to facilitate effective care

Interviewees gave several examples of factors which mitigated the impacts of out-of-pocket payments. The role of large social networks has already been mentioned; the larger the social network (or greater the social capital) of the older person, the more people they have to support them with the financial costs associated with hospital admission. Similarly, health insurance, when it could be afforded, was seen as essential and lifesaving for those service users who possessed it, despite criticisms that it was expensive and did not cover all treatments. Multiple studies have shown that insurance has the potential to increase utilisation and access to hospital services in Tanzania, though little data is available currently to determine whether this affects outcomes for older people (Kagaigai et al., 2023, Bintabara et al., 2018, Macha et al., 2012). Huge regional variation in membership of health insurance schemes, particularly of the relatively affordable Community Health Fund, cannot be accounted for socioeconomic factors alone. Though the national average rate of enrolment in the scheme is 19.8%, in some districts it is as high as 28.1%, while in others it is as low as 0.4% (Maluka, 2013, Wang and Rosemburg, 2018). It has been suggested that variable quality in the Community Health Fund district-level organisation, and poor understanding amongst potential scheme members of the concept of risk-pooling have also contributed to low enrolment in some districts (Macha et al., 2014, Maluka, 2013). Previous qualitative work from Tanzania, Ghana and South Africa emphasised the principles of affordability, availability and acceptability in delivering insurance and avoiding a pro-rich distribution of healthcare benefits (Macha et al., 2012). Schemes that worked well were characterised by affordable premiums with adequate explanation of risk-pooling, locally available services, and service providers at public facilities who understood the coverage and provided acceptable standards of care within it (Macha et al., 2012).

Exemption from user fees, and related mechanisms that were used to cover costs for poor elderly people or those abandoned in hospital, were viewed as facilitators to effective care by service providers. The main problems interviews with service users highlighted were the lack of awareness of exemption and the variability and bureaucratic nature of obtaining exemption status. However, previous work from the Iramba District in Tanzania provides a positive example of how exemption policies can be implemented more effectively (Maluka, 2013). In Iramba, poorer members of the community were proactively identified at multiple levels, by village leadership, officials in local government, and the by health system as eligible for exemption. Furthermore, leaders were incentivised to facilitate the scheme, and when local hospitals struggled to manage financially with the proportion of exempted patients, a scheme was devised in which Community Health Fund membership was instead purchased for eligible individuals by the village government (Maluka, 2013). Though there were still considerable challenges and areas to improve upon, these experiences demonstrate how exemption can be used to broaden access to care for frail older people.

6.10.7 Variability in community services as a barrier

Interviews drew attention to deficiencies in community health services in terms of availability, staffing and equipment, as well as differences between provision of services in rural and urban areas. Though there is limited data available regarding older people, in the fields of maternal health and paediatrics there is evidence of health disparities between urban and rural populations in Tanzania, with significantly lower healthcare utilisation by the latter (Langa and Bhatta, 2020, Zhu et al., 2021). Despite 75% of the nation's population residing in rural areas, only 26% of doctors are based in rural facilities and this proportion has been falling in recent years (Sirili et al., 2018). In qualitative interviews with doctors working in rural districts, poor prospects for career progression, underequipped facilities, poor satisfaction with their work, and feelings of underappreciation were amongst the main reasons given for why doctors leave (Sirili et al., 2018). As a consequence, most districts are understaffed and face structural challenges in retaining doctors.

Transport to hospital was one of the major barriers to accessing care for acutely unwell older people described by service users living in rural areas. It was also a problem for aftercare and routine appointments. All the hospitals sites that took part in this study were within one hours drive of one another via tarmacked roads. Though there were very few ambulances, patients referred to other sites could usually be taken by relatives or by taxi. The present study lacks the perspectives of service providers from primary healthcare sites which are often off the main roads on dirt tracks. However, participants of Sirili et al.'s interviews with doctors working in primary healthcare described often having to manage critically unwell patients in underequipped facilities; even if they gave the patient a referral to hospital, often transport was unreliable or expensive (Sirili et al., 2018). Transport issues go beyond access to healthcare and represent major problem for older people across sub-Saharan Africa in their daily lives. In Naah et al.'s mixed-methods examination of the determinants of active healthy ageing in Cameroon, despite this study taking place in urban centre, narrow and bad roads were amongst the challenges older people raised as a barrier to their health and wellbeing (Naah et al., 2020). Similarly, in a qualitative study which utilised novel methods to recruit peers as co-investigators in Tanzania, intra-village movement to gather water, firewood or to buy food was identified as a major problem for older people with reduced mobility (Porter et al., 2015).

Formal referrals from one hospital to another were common in the accounts given in this study, often because of the need for investigations unavailable at the primary site. There were also examples of older patients bypassing their nearest facility entirely because of perceptions that they were underequipped or that they would require transfer at a later date. This phenomenon was also described by Snavely et al. in their investigation of patients presenting with febrile illness in the Kilimanjaro and Arusha regions with the conclusion that greater investment in lower level health facilities could improve care seeking and develop more formal referral pathways (Snavely et al., 2020). While Tanzania's complex mixed health economy poses many challenges for the development of integrated care pathways, implementation is possible. Integrated models of care for people living with HIV have been very successful and recent pilots have even sought to combine care for HIV and comorbid non-communicable diseases in one-stop clinics with resulting high levels of satisfaction amongst service users and providers (Shayo et al., 2022). Such examples highlight the potential for integrated care pathways in other areas.

6.10.8 The complex role of the family in the period surrounding hospital admission: a facilitator and vulnerability

The caregivers interviewed in this study were all relatives of the older participant. This was because paid caregivers did not meet the definition of *"informant"* and were thus excluded from participating in interview. Nonetheless, the quantitative work of this and other studies has demonstrated that the vast majority of care of older people in Tanzania is still provided by first-degree relatives (Manyama, 2017). Reciprocity of care was an element of multiple themes in this investigation and, in keeping with traditional caregiving practices, most interviewees viewed close family as those with the greatest responsibility for the care of older people. However, it is commonly said of sub-Saharan Africa that urbanisation and globalisation are driving a shift from extended family structures, in which there is a large and multigenerational network, towards smaller nuclear families consisting only of parents and their children (Omari, 1991). However, recent work has painted a far more complex picture. It is clear that the social institution of the family is changing, but there are a strong cultural, religious and political forces striving to maintain extended family structures, while resisting perceived imposed external *"western"* social norms (Manyama, 2017). The result is an evolving negotiation, in which most people still live within extended families, but a range of other family sizes and structures are emerging.

On the one hand, extended families can act as a significant facilitator to effective care for older people with frailty in Tanzania. As has been discussed, larger social networks can be utilised to pay for hospital care and disperse the costs, but an added benefit for well-connected individuals is that these same networks also represent a large pool of potential caregivers. Most extended families in Tanzania still practice intergenerational care, in which children look after their parents (Rutagumirwa et al., 2020). Rutagumirwa et al. conducted focus group discussions with 120 adults aged over 60 living in Pwani on the coast of Tanzania, finding that the act of caring for one’s parent was associated with motivational rewards including blessings and the development of a close bond, whilst neglect of this obligation was punished with shame and even disinheritance (Rutagumirwa et al., 2020). While it may be seen as encouraging that elements of traditional norms of intergenerational care remain strong, findings from the present study also highlight the vulnerability of younger adults caring for both parents and children, with caregiver stress emerging as a significant concern.

During an older person with frailty’s hospital stay, in this study the family played an integral role that varied in scope depending on the norms of the ward. Many of the communication challenges highlighted in theme two were mitigated by the use of relatives to aid interactions between service providers and the older person. There is relatively little data regarding the impact of family members assisting in care during the admission of an older relative. A 2018 systematic review of studies from HICs demonstrated that when family assisted with interventions for patients with delirium, patient anxiety and length of stay were reduced, though authors commented on the poor quality of the evidence (McKenzie and Joy, 2020). In the present investigation, there was a perception amongst service providers that inpatient falls were uncommon (though unfortunately no quantitative corroboration). Few studies have examined the impact of relatives at the bedside on the frequency of inpatient falls, but counterintuitively one prospective observational study of inpatients in Taiwan found that falls taking place in the presence of a family member were associated with greater risk of serious injury than those that occurred when the older person was unaccompanied (Tzeng and Yin, 2009). They hypothesised that this might be because family caregivers assisting older people with walking and transfers were not trained in safe manual handling techniques, and that older people were more cautious and moved less when there was no one in the room to help them (Tzeng and Yin, 2009).

In a study from Malawi, researchers conducted questionnaires and interviews with family members, healthcare professionals and administrators involved in providing care to patients of all ages on a variety of speciality wards (Hoffman et al., 2012). The vast majority of family members, whom they referred to as “*hospital guardians*”, were female and all were relatives of the patients to whom they were assisting. As in the present study, guardians' key roles were advocating for the patient, monitoring their condition and ensuring basic needs were met, especially with regard to feeding, toileting and personal hygiene. One healthcare professional described them as *"like eyes for the nurses"* (Hoffman et al., 2012). Effective care for older people with frailty in hospital requires these basics to be done well; nutritional status is closely related to clinical outcomes, while good toileting and personal hygiene practices are essential to safeguarding dignity (Ligthart-Melis et al., 2020, Stephen Ekpenyong et al., 2021). The family member assisting in care as a hospital guardian might have a positive role to play in promoting these aspects of health and dignity during hospital admission.

On the other hand, the role of relatives on the wards in Tanzania was also a cause of conflict due to perceived overcrowding and disagreements over visiting hours. Not to mention the personal and financial tole experienced by those who provided care, who were sometimes elderly themselves. These factors also were emphasised in Hoffman et al.'s previously cited study from Malawi which went on to comment on healthcare providers' concerns regarding infection control and poor communication with lack of clarity over roles and responsibilities (Hoffman et al., 2012). Similarly, Hoffman's hospital guardians felt their absence placed stress on the family back at home, while they struggled to attend to their own needs on hospital grounds that lacked a space for them to cook, wash and sleep (Hoffman et al., 2012). In both Malawi and Tanzania, family were motivated to stay to care for their hospitalised relative in-part because of a sense that nurses would be unable to keep up with care if they left (Hoffman et al., 2012). This advocacy also has the potential to increase inequities for socially isolated older people, as those without relatives to advocate on their behalf may be unable to draw attention to their needs and find themselves neglected as a result.

As has been described, the extended family system and the practice of intergenerational care has the potential to act as a strong form of social protection for older people in Tanzania. However, even within these structures older people can find themselves lacking support and in caregiving roles for grandchildren (Rutagumirwa et al., 2020). This burden of informal care disproportionately falls on women (Msechu, 2014). Furthermore, the increasing numbers of people who live outside of traditional family structures are left in a vulnerable position. It is increasingly becoming normalised for spouses to provide care for one another, but intragenerational care can be a precarious position, particularly if the older person in the caregiving role is also in ill health (van Eeuwijk, 2016). While educated adults are often able to pay for caregivers for elderly parents whilst pursuing work in urban centres, interviewees in the present investigation highlighted the social isolation that can occur for poorer members of the community who lack family and social support. In periods of acute illness, isolated older people were reliant on neighbours and Good Samaritans to take them to hospital where they were *"abandoned"*. This led to challenges for funding hospital treatment and for post-discharge care in the community, something that fell to the Social Welfare Officers. Government policy promotes the role of the extended family in supporting older people, with institutional care only as a last resort (Ministry of Labour Youth Development and Sports, 2003). With only one residential home, the Kilimanjaro Region has very few options for older people who find themselves in this position.

6.10.9 Healthcare providers role in education and health promotion as a facilitator to effective care

It was encouraging to see the extent to which service providers interviewed in the present study saw health education and promotion as key components of their role. The importance of lifestyle was strongly emphasised and advice about diet, exercise and medication concordance all featured strongly in the narratives in relation to diabetes, hypertension and heart disease.

Health literacy in Tanzania is generally low and lower levels of formal educational attainment are one of the factors which have been linked to late presentations of cardiovascular disease and malignancy, even when controlling for other socioeconomic factors (Rick et al., 2021, Hertz et al., 2019). A qualitative study from Ghana, which interviewed a total of 60 participants (including older people with low incomes, their caregivers and healthcare providers) called attention to the fact that healthcare providers were viewed as the most reliable source of health information, but that most older people only sought advice when concurrently attending for management of a specific symptom (Agyemang-Duah et al., 2020). For older people living in areas underserved by community-based health services, or lacking the finances or insurance to pay for more routine medical care, an acute emergency requiring hospital admission may be one of the only times they interact with the healthcare system. The acute admission of an older person with non-communicable disease in this context represents a potential opportunity for health education, as well as primary and secondary disease prevention.

6.10.10 Challenges around end-of-life care

Healthcare providers gave a range of physical and behavioural features that they associated with death and dying. However, the identification of older people with frailty in hospital who were approaching end-of-life was considered very challenging. In data from HICs, community-dwelling adults with severe frailty were almost five times more likely to die in 12 months than those without (Clegg et al., 2016). Nonetheless, the highly variable trajectory of frailty, particularly in the absence of other pathology, can make healthcare professionals the world over reluctant to identify end-of-life (British Geriatrics Society, 2020). Guidelines from the British Geriatric Society therefore emphasise the need to combine multiple indicators, from objective signs such as 5-10% weight loss in 6 months, to important subjective features such as rising levels of distress amongst the older person and their caregivers, or requests to withdraw active treatment (British Geriatrics Society, 2020). There is a cultural specificity to such subjective or behavioural signs which is under-researched in the context of sub-Saharan Africa, and is likely to vary considerably across the region due to the enormous diversity of cultural traditions and faiths (Ekore and Lanre-Abass, 2016). Behavioural factors identified by service providers in the present investigation included expressions of premonition and discussions of deceased relatives. Future work examining the validity of such culturally specific factors in predicting end-of-life may prove useful in increasing the confidence of healthcare providers in its identification in a Tanzanian context.

As in many other cultures, death and dying are considered taboo subjects in Tanzania and are rarely discussed even in healthcare contexts (Lewis et al., 2018b, Gafaar et al., 2020). The findings of the present investigation corroborate those of existing studies in which healthcare providers expressed that such conversations were avoided due to a lack of confidence in breaking bad news, fear of causing harm, or even accelerating the dying process (Lewis et al., 2018b, Gafaar et al., 2020). One aspect in which data from the present study goes further than existing literature was the identification of euphemistic language (exemplified by phrases such as “God knows”) sometimes employed by service providers to discuss death and express prognostic uncertainty in softer terms. Unfortunately, this research is lacking perspectives of service users at the receiving end of these conversations, so it is unclear how such phrases are understood. However, this is an area that warrants further exploration as a possible framework through which death, dying and prognostic uncertainty can be discussed in a culturally acceptable manner.

Not all service providers interviewed avoided discussions of death, in fact some felt it was very important to tell patients and families everything to spare them unnecessary expenses and allow them to prepare. These participants emphasised the psychological, social and spiritual needs of patients and caregivers to at the end-of-life. The concept of a “good death” was the primary topic of Gafaar et al.’s in-depth exploration with 122 healthcare providers across 13 focus groups conducted in northern Tanzania (Gafaar et al., 2020). Emotional, spiritual and family wellness made up three of the four elements of the resulting grounded theory framework for a good death, with the other being enough time to prepare (Gafaar et al., 2020). The other three elements of the framework relate to elements of medical care, namely a minimal burden of suffering, and good quality of care from formal and informal caregivers (Gafaar et al., 2020). Due to challenges with the acceptability of discussions around death in Tanzania, existing qualitative studies (the present investigation included) have focussed on healthcare providers views of “good death” and are lacking the service user perspectives.

Consideration of advanced care planning and the appropriateness of CPR are important components of the CGA for hospitalised older people with frailty (Ellis et al., 2017). In a meta-analysis summarising data from the UK, Australia and Canada, compared with non-frail older adults, those with a CFS ≥5 had a three times greater chance of dying during hospitalisation after inpatient cardiac arrest (Mowbray et al., 2021). Similar data are not available for sub-Saharan Africa, however in a study exploring nursing views of CPR in Ghana, frequent exposure to unsuccessful resuscitation efforts led to a perception that that the likelihood of a positive outcome in older people was low, and consequently minimal effort was applied (Amoako-Mensah et al., 2023). Service providers interviewed in this study indicated that most of the time CPR was initiated, though occasionally it was not attempted or ceased rapidly if clinicians felt that it was likely to be futile. Despite this, cultural barriers around the discussion of death prevented the consideration of CPR and other aspects of planning future medical care in advance. Though advanced care directives have been criticised when applied to an African context because of their built-in individualism, effective care of older people with frailty in hospital in Tanzania requires an alternative which can be raised in a culturally-sensitive way and which respects communitarian values (Ekore and Lanre-Abass, 2016).

6.10.11 Limitations

There were several limitations to the qualitative phase of this mixed methods research. The first concerned the timing of the interviews within the overall study design. Interviews were conducted after the initial analysis of quantitative data, in order to explore the context and meaning of these findings. Service users interviewed for the qualitative phase were recruited from the original sample of older inpatients, approximately one year after their participation in the baseline study. Although the topic guides were designed to elicit general reflections on experiences of hospitalisation in later life – rather than focussing specifically on the most recent admission – it is likely that for many participants, a significant amount of time had passed since their hospital stay. In addition to the potential for recall bias, participants had aged further and many (including a disproportionate number of those living with frailty) had died in the interim. These factors may have influenced the nature and accuracy of participants' recollections and also meant that the perspective of some of the frailest individuals and their caregivers could not be captured. If interviews had been conducted in parallel with baseline quantitative data collection, during the initial hospital admission, they would have yielded a more contemporaneous perspective.

In the recruitment of service providers, Tanzanian colleagues employed at each hospital site recommended service providers for interview. This is role functioned effectively as that of a gatekeeper (Williams et al., 2020). Although Tanzanian colleagues were asked to recruit people with a range of backgrounds and experiences, there was a risk that participants were selected because they were perceived to be good interviewees, or even because they would reflect positively on the hospital. Furthermore, since the service providers interviewed were employed at participating hospitals, and their clinical leaders were involved in supporting the study, they may have had a vested interest in portraying hospital services in a favourable light. This potential source of social desirability bias may have been compounded by the presence of the author (SD) and other UK-based members of the research team during interviews, whose outsider status may have further inhibited service provider's responses. This raises the possibility that interviewees accounts could have been coloured by the fact that they had vested interests in providing a good account of hospital services.

Although interviews covered a range of topics relevant to hospital admission, on reflection, there were aspects of the experiences of older people in hospital that were omitted from topic guides, and as a result are absent from this thesis. Of course it is not possible to cover everything. However, subjects such as elder abuse and depression are important parts of older people's experiences in other parts of the world, and little is known about them in a Tanzanian context. Such topics warrant investigation in future to deepen understanding of the challenges faced by older people in Tanzanian hospitals.

Another limitation relates to the influence of power dynamics and economic disparity, particularly between service users and UK research team members. These factors are explored in the reflexive passage in section 4.10, but are worth considering again in reference to theme five: Impacts of resource scarcity. Given the visible markers of wealth and privilege associated with foreign researchers, there is a possibility that some participants emphasised economic hardship in the hope of receiving material assistance. While financial challenges were frequently and plausibly cited as barriers to care, the potential for exaggeration, conscious or otherwise, cannot be discounted. This dynamic may have shaped participants' responses and led to an overrepresentation of economic concerns in the data relative to other aspects of the hospital experience. Although every effort was made to explain the purpose of the study, and clarify that no material support would be provided, the presence of white researchers may nonetheless have influenced what participants chose to share.

Perhaps the greatest limitation of this qualitative phase was the use of translation. The process was conducted with the aim of preserving the original meaning of interviews, with translators regarded as members of the research team rather than mere technicians, and it is hoped that this thesis described the process transparently. However, translation is an interpretive act, and it is inevitable that some of the original nuance, cultural context and meaning were lost in the process (van Nes et al., 2010). For logistical reasons – chiefly the challenging geography of the region and the fact that many service users were unable to read – member checking was not instigated. Nonetheless, this is one method which could have been used to better ensure the accuracy of the original Swahili transcripts. A more robust approach for the overall analysis (and one currently being explored with members of the team) would have involved Tanzanian research colleagues analysing transcripts in the original Swahili. This method could have more effectively preserved the original meaning and helped mitigate concerns around interpretive marginalisation.

6.10.12 Summary

This chapter has reported the thematic results of qualitative interviews with service users, their caregivers, and service providers. The six themes identified shed light on their experiences, and the factors that shape care in the period surrounding the hospital admission.

In this northern Tanzanian setting, health in old age was conceptualised not only in terms of physical function, but also through the practical consequences and wider social implications of its decline, with *"ageing badly"* often being related to feelings of loss of independence and social value. Upon hospital admission, older people were reported to have substantially greater care needs than younger adults, placing significant demands on service providers, family caregivers, and the older people themselves who struggled to communicate their needs. Communication between service users and providers was specifically challenging at the end-of-life, and while some healthcare providers felt able to speak openly, cultural sensitivities meant that others were more comfortable using euphemistic language to discuss death and dying.

The overall context of economic and resource constraints, both individual and systemwide, affected every part of the patient journey from community, to hospital and back again. While cultural norms of respect for older people remained present, in practical terms responsibility for the care of older people was described as fragmented and under pressure from social and demographic change. Nonetheless, family caregivers still played a central role during the admission of an older person, providing emotional support and oftentimes personal care. However, these roles varied and were not without their complications, both in terms of caregiver stress and disruption to the functioning of the ward.

From these themes, several barriers and facilitators to effective care were identified. Barriers included the pressures caused by rising numbers of older people, systemwide economic constraints, variability in community care, and cultural challenges around discussions at the end of life. Facilitators to effective care included cultural norms of respect for older people, policies which prioritised older people, admission as an opportunity for health education and insurance and exemption policies (when implemented effectively). The role of the extended family was both a facilitator and a vulnerability.

In the final chapter, these findings are discussed alongside quantitative results and this study’s overall contribution to existing knowledge is considered. The methodological strengths and weaknesses of this mixed methods research are explored, along with implications for clinical practice and future research.

Chapter 7. Discussion

7.1 Chapter introduction

The aim of this doctoral research was to establish the extent of frailty amongst older adults admitted to hospital in northern Tanzania, and the experiences and implications of admission in this context. A mixed methods approach was used. Firstly, a cross-sectional study was conducted in which consecutive older people, admitted to four hospital sites, were assessed and followed up to establish the prevalence and characteristics of frailty in this setting, with a follow-up phase to assess their outcomes. Secondly, based upon these results, semi-structured interviews were conducted with a purposive sample of older people, their caregivers and healthcare providers to explore the experiences, attitudes and needs of older people with frailty admitted to hospital. These qualitative data, grounded in the findings of the preceding quantitative study, were then summarised with reference to barriers and facilitators to effective care. These findings have been discussed in the context of existing literature in the previous chapters. This final chapter provides an integrated summary of the key findings, along with discussion of the implications for current practice and future research, and of the main strengths and weaknesses.

7.2 Local dissemination

In 2023, the results of quantitative elements of this research, as well as early qualitative findings, were presented to clinical staff, and discussed with clinical leaders, at each of the participating hospital sites (see Figure 41). These events led to questions and discussions that later helped to shape thinking when considering the implications of this study for clinical practice and future research. Meanwhile, presentations and publications will remain the key methods for disseminating the findings more broadly.

Figure 41. Dissemination at participating hospital sites

Presentation of findings at clinical meetings at Hai District Hospital (top left), Mawenzi Regional Referral Hospital (bottom left) and Machame Lutheran Hospital (right). Photos were not available from the presentation at Kilimanjaro Christian Medical Centre.

7.3 Summary of key findings

7.3.1 What is the extent of frailty amongst older people admitted to hospital in northern Tanzania?

This study has demonstrated that it is possible to use existing instruments to assess frailty amongst older people admitted to hospital in northern Tanzania. The prevalence of frailty in this population was high when compared with hospital inpatient populations in other LMICs, as well as in high-income settings (Davidson et al., 2025, Doody et al., 2022). The older people in this study were predominantly admitted with non-communicable disease and exhibited high rates of multimorbidity and disability, which overlapped considerably with frailty. Moreover, qualitative interviews highlighted the complexity of the health problems faced by the older inpatient population in Tanzania and those caring for them: multiple conditions, poor mobility, cognitive impairment, incontinence, pressure injuries and more. These health challenges will be familiar to those working in geriatric inpatient services in high-income settings such as the UK. However, hospital services in Tanzania, like many countries in sub-Saharan Africa, are still orientated to the needs of younger people and lack specialist geriatric care (African Union, 2022, Dotchin et al., 2013). Frailty, and the broader complexity of caring for older hospital inpatients, represent a present and urgent clinical need.

Furthermore, this study also had important implications for how we think about frailty in inpatient settings in Tanzania, and what it means to older people, their caregivers and healthcare providers in this context. Practically, the frailty phenotype proved challenging to operationalise in this setting. But more than that, purely physical models of frailty are too narrow to capture the important social dimensions and determinants of frailty in this setting. Although the concept of "*kuzeeka vibaya"/ "ageing badly"*, bears a strong resemblance to frailty, this study – which replicates findings from the community in the Hai District (Lewis et al., 2021) – demonstrates that health in old age is understood to be determined as much by economic and social factors as it is by physical health and lifestyle.

7.3.2 What were the implications of hospital admission for older people with frailty, their caregivers and service providers in northern Tanzania?

Amongst older people admitted to hospital in this study, frailty was not only prevalent, but consequential. For those older people affected, results indicated that frailty conferred a twofold greater risk of mortality in the year following an acute admission. These findings mirror those seen in high-income settings, however this is only the second time a relationship between frailty and mortality has been demonstrated in inpatients in sub-Saharan Africa (Adebusoye et al., 2019a). Interestingly, amongst those that were alive at follow-up, results indicated that there was perhaps some potential improvement in functioning amongst older adults with frailty with respect to ADLs and IADLs. Moreover, this study also gives a unique insight into the personal implications of frailty in this setting. With most older people lacking insurance coverage, and few attaining exemptions from user fees, hospital admission had a huge financial implications for individuals, a factor which was perceived as a deterrent to attendance. While some older people were able to draw on social support networks to meet the cost of out-of-pocket payments, others were effectively *abandoned* with no way of paying for their care.

In addition to these marked effects on the older individuals, this study has also demonstrated the wider implications of frailty during hospital admission. Though the degree of involvement can vary, the extended family often play a major role in care during an older person's inpatient stay. On the one hand, this was often perceived to be a benefit to the older person's psychological wellbeing, nutrition and personal care. On the other hand, this active involvement in care placed significant stress on family members, who had to balance the responsibilities of working to earn money to pay out-of-pocket fees, while also caring for their own children. In some respects, the extended family involvement in care alleviated the workload of healthcare providers, but it also caused overcrowding, infection control concerns and was a source of tension in relationships. Overall, there remained a perception that growing numbers of older adults, with complex health needs, placed increasing pressure on hospital services. Nursing staff in particular were affected and there were instances when demand exceeded capacity and the quality of care was compromised. Thus, the complexity of health problems experienced by older people admitted to hospital in Tanzania, including frailty, not only have implications for the individual, but also place considerable strain on their extended families, service providers and the wider hospital system.

7.2.3 What is the experience of hospital admission for older people with frailty, their caregivers and service providers northern Tanzania?

The lived experience of "*kuzeeka vibaya"*/ *"ageing badly"*, which bears a resemblance to frailty in many respects, was described in very negative terms by the older people affected. Weakness, fatigue, loneliness and isolation were key aspects of this experience, which for many led to distress at their inability to work, and a sense of guilt about their dependence on others. Hospital admission served to amplify these feelings, as older people were admitted to unfamiliar environments, where access to their family support was sometimes restricted. Communicating their needs could be challenging and the fear of death loomed as they witnessed other patients passing away.

This study collected different perspectives on these admission journeys which shed light on the strengths of current services, as well as the challenges health planners and policymakers in Tanzania must overcome if they are to meet goals to create accessible and integrated health services for older people (African Union, 2022). On the one hand, service users and service providers expressed many positive aspects to their admission experiences. For older people, their family caregivers provided significant psychological support and played key roles in advocating for their care and aiding communication with ward staff. This mediation role was also valued by service providers, who also treated admissions as an opportunity for health education for older people and their caregivers. Even though the management of multiple patients with high needs undoubtably caused them stress, service providers described their experiences of caring for an older generation as a virtue and source of professional satisfaction.

On the other hand, negative experiences in the period surrounding admission were largely driven by systemwide economic and resource constraints. These limitations influenced the decisions regarding when to seek care, the journey to hospital, the availability of investigations and treatments, and care post-discharge. While insurance, charitable funds and exemption policies mitigated some of these challenges, their impact was limited as few individuals held insurance and exemptions were applied infrequently. Ultimately, the experience of frailty amongst older people admitted to hospital in Tanzania is one of personal vulnerability, which is heightened in the context of limited family support and a lack of economic resources. These experiences offer valuable insights which should be considered when identifying areas for future research and intervention.

7.4 Implications for current practice and future interventions

7.4.1 Frailty screening for hospital inpatients aged ≥60 years in northern Tanzania

The value of including frailty in the assessment of older hospital inpatients lies in its ability to predict which individuals are at the greatest risk of functional decline and mortality (Cunha et al., 2019). If those with the greatest vulnerability can be identified through screening or clinical assessment, and effective targeted interventions are put in place, then adverse outcomes can be prevented and quality of life can be improved (Ellis et al., 2017). This study has demonstrated that frailty tools (the CFS and B-FIT2) can be applied to assess frailty in inpatient environments in northern Tanzania and follow-up data suggest that these tools can identify those with the greatest risk of mortality in the 10-12 months following admission. This is an important first step, but until it has been demonstrated that intervention can modify these trajectories, frailty screening should remain a tool for research rather than clinical practice in this setting.

However, if there were an effective intervention, which of the frailty instruments evaluated would be the most useful for use as a screening tool in current clinical practice? One of the weaknesses of this study was the limited evaluation (both quantitative and qualitative) of the feasibility and acceptability of each frailty instrument. Nonetheless, the experience of conducting this research, as well as discussions with clinical leaders regarding its results, can provide some guidance on this matter. For use within current resource constraints, any tool for the screening of frailty at the time of hospital admission must:

1) Reflect local cultural understandings of health in old age, in particular social and economic dimensions and determinants.
2) Identify those at the greatest risk with some specificity, to allow targeting of resources to those most likely to benefit.
3) Require minimal specialist equipment which may be expensive, or a challenge to maintain.
4) Be suitable for administration – for now at least – by clinicians without specialist geriatric training.
5) Be quick to administer, easy to use and not add to the burden of already busy clinical staff.

It may have been possible to improve the application of the frailty phenotype in this study by limiting its use to participants who were mobile. However, this would have excluded a significant proportion of the older inpatient population and limited its real-world applicability. One of the few other studies that has applied the phenotype without such exclusions also found that those who were unable to complete items were older, had poorer cognition and greater disability (Bieniek et al., 2016). In addition to potentially missing individuals with the greatest frailty, the frailty phenotype also requires specialised equipment (a dynamometer), and neglects social and economic dimensions that are important to health in old age in this setting. Therefore, based on this research, further evaluation of the frailty phenotype in inpatient settings in Tanzania is not recommended.

Both the B-FIT and the CFS were operationalised successfully in this setting and demonstrated promise with respect to these criteria. On the one hand, the CFS holds several advantages. First, its straightforward design made it easy to apply to all participants in this study, a feature that has led to its widespread adoption in other acute settings (Church et al., 2020). Although in this study participants were dichotomised into frail and non-frail groups, in reality frailty is not a binary state. In this study, the CFS produced a continuum in which greater scores broadly indicated a greater risk of mortality. This feature of the CFS could allow older people with different scores to be treated as further subgroups on the continuum, which could be targeted with more tailored interventions based on their specific needs and risks. Furthermore, the CFS does not require specialist equipment, only initial printing costs, after which it could be laminated and reused.

On the other hand, there are potential limitations to the use of the CFS in hospitals in Tanzania that must be considered. It is true that the CFS reflects a broad range of domains including exercise, chronic disease, activities of daily living, dependency, and cognition in updated versions. However, it does not reflect the broader themes of social and economic vulnerability that were seen as important determinants of health in old age by the participants of this study. Furthermore, in this research the clinical judgement underpinning CFS scores was conducted by trained personnel, at the end of a multidimensional assessment, structured around the domains of the CGA. If it were to be used in current clinical practice, by non-specialists, following a less thorough assessment, there is a danger that it may be less accurate. Specific pitfalls could include the scoring of the CFS based on clinical appearance at the time of admission rather than usual baseline. Additionally, obtaining a detailed history of baseline function from the patient and family may be challenging and place extra burden on clinical staff.

By contrast, the B-FIT2 requires minimal clinical judgement, experience and training. The only equipment required is a tape measure, and even though it is brief, it does attempt to capture some of the social dimensions of frailty through the question regarding ability to join community activities, which is given a heavy weighting. However, it too had significant drawbacks in this study. Firstly, when a cut-off of ≥8 was used to define frailty, the B-FIT2 demonstrated lower specificity in its prediction of mortality compared to the CFS, and in an acute setting the use of the IDEA-Cog raised concerns that an individual's frailty may be overestimated due to delirium. The accuracy in mortality prediction could be improved by increasing the cut-off used to define frailty to ≥12, which would also prevent the classification of participants as frail solely based on a maximal score for the Barthel Index component. However, the B-FIT2's weighted, non-linear, scoring structure would still limit potential to group older people beyond binary *'frail'* and *'non-frail'* categories.

In summary, of the three instruments evaluated in this study, it is the author's view that the CFS currently holds the greatest potential for use in the screening of older adults in inpatient settings in Tanzania. Its chief advantage over the B-FIT2 was its potential for a more continuous view of the frailty spectrum, while it performed comparably in other respects. Although the CFS may overlook some factors contributing to health in older adults in the Tanzanian context, it is an adequate starting point for evaluation in initial screening, while later clinical assessment can evaluate the individual context of an older person's wellbeing. It is true that future research (including further evaluation of this dataset) could explore the potential for further adaption the B-FIT2 to better account for other local risk factors, such as lack of formal education or culturally specific IADLs. While many have advocated for the tailoring of frailty screening tools for different settings, others argue that the proliferation of bespoke frailty tools represents an unhelpful fragmentation of the frailty construct, which limits comparability of studies, and the generalisability of their findings (Hoogendijk et al., 2019, Dzando et al., 2024, Lewis et al., 2020b).

Concern about the use of the CFS by non-specialists must be addressed, and future research must validate the CFS for use in screening by non-specialist medical and nursing staff, by comparing their score allocations with those of a geriatrician following CGA. That being said, there is good reason to suspect the CFS will perform favourably, as it has already been extensively applied in exactly these circumstances. A scoping review of 183 studies demonstrated that the CFS has been used by non-specialists across various settings including emergency departments, intensive care, internal medicine, cardiology, orthopaedics and others. In the majority of cases, increasing CFS frailty maintained its association with dependency and mortality (Church et al., 2020). Given the pressing need to develop effective interventions, and the fact the CFS in its current form can identify those at greatest risk of adverse outcomes, it stands that this would provide a reasonable starting point for further evaluation, or adaptation.

7.4.2 Potential targets for future intervention

The high prevalence of frailty amongst older adults admitted to general and medical wards in northern Tanzania, and the apparent association with mortality, present an urgent clinical challenge. Beyond the immediate health risks, frailty and the associated complex health problems affecting older people, also appeared to be having a profound effect on the quality of life of affected individuals and their caregivers, as well as the functioning of hospital services struggling to meet their needs. This study examined the prevalence of frailty on general and medical wards, and it is likely that in other settings, such as surgical, or sub-speciality wards, the prevalence of frailty may differ. Furthermore, Tanzania is a diverse country, marked by considerable regional demographic variations in age, income, ethnic make-up and urbanisation. As a result, it seems likely that the prevalence of frailty amongst older hospital inpatients may vary between regions. Nonetheless, if frailty is anywhere near as prevalent amongst older people in hospitals in other parts of Tanzania, and effective interventions can be produced to improve outcomes, there is significant potential to positively impact large numbers of older adults and their caregivers. This study provides valuable insights that can be used to inform the development of targeted interventions, including to help define who should be prioritised, at what stage and how their outcomes should be effectively assessed.

Amongst the participants of this study with complete follow-up data, the optimal cut-off score for the prediction of mortality on the CFS was 5.5, which falls between *"Mildly frail"* and *"Moderately frail"*. Based on these findings, a score of *"5 – Mildly frail"*, or above, is recommended as the threshold for future evaluation. This aligns with existing literature, where a cut-point of five or above is commonly used for risk stratification, and to identify those most likely to benefit from interventions for frailty (Church et al., 2020). However, it is crucial that future interventions are tailored to meet the specific needs of older individuals which may vary across the frailty spectrum. For example, in this study 44.7% of older people classified as "*Mildly frail"*, to *"Severely frail"* (CFS scores 5-7) at baseline were alive at follow-up, while only 21.9% of those classified as *"Very severely frail"*, or *"Terminally ill"* (CFS scores

8-9) survived. The needs of these different groups, and even the outcomes that are considered important, may differ considerably. This underscores the necessity to design interventions that can assess individuals with frailty holistically, and account for variations in individuals' needs.

In addition to these outcomes, it is vital that any future intervention takes account of the dimensions of a good outcome that are considered important by older people in Tanzania, highlighted by the interviews in this study as perceptions of their own health, financial security, functional independence and social engagement. There are existing assessments which could be adapted to measure older people's perceptions of their own health ranging from the simple Self Related Health measure which asks *"In general, would you say your health is excellent/ very good/ good/ fair/ poor?"*, to more complex questionnaires such as the 36-item Short Form Survey (Ware and Sherbourne, 1992, Idler and Benyamini, 1997). However, other outcomes contain elements that are relatively specific to Tanzania which may be better captured through social vulnerability indices, or qualitative interviews (Cooper et al., 2022).

This thesis has focussed on the period surrounding an older person's acute admission to hospital, but the development of frailty is a dynamic process which occurs over a lifetime (Clegg et al., 2013). Although this study has implications for hospital-based practice, it also highlights broader areas for exploration and interventions aimed at improving the health of older people in northern Tanzania. In a narrative review, Hoogendijk et al. (2019) discuss opportunities for intervention across the frailty care trajectory, highlighting primary, secondary and tertiary prevention strategies. The passages below explore the opportunities identified by this study within this framework.

Primary prevention refers to efforts aimed at preventing frailty before it occurs, primarily through the avoidance of unhealthy lifestyle behaviours and deficit accumulation (Hoogendijk et al., 2019). Quantitative elements of the present study demonstrated a relationship between frailty and the lack of a formal education. Meanwhile, in qualitative interviews, participants highlighted many other potential contributors to poor health in old age in Tanzania including poverty, life stressors (many economic), undernutrition, the physical toll of manual labour, lack of family or community support, and lifestyle behaviours such as smoking and alcohol consumption. These findings represent numerous opportunities for further exploration and intervention. However, addressing such a range of factors across the life course would be a complex public health task, requiring interventions in multiple areas, and buy-in from the Tanzanian government and its collaborators.

Fortunately, substantial efforts have already been invested in the development of community interventions aimed at the promotion of healthy ageing, as well as the prevention of dependency and frailty (Bevilacqua et al., 2022). These are largely focussed around preserving intrinsic capacity, a concept promoted by the WHO which is defined in the introduction of this thesis (World Health Organization, 2015c). An influential project study in this area is the 10/66 study, a large scale, longitudinal, population-based study that followed over 17,000 people, aged 65 years and older, from India, China and South America. While its main focus was on understanding dementia in LMICs, the study also revealed evidence of progressive declines in intrinsic capacity with increasing age, and an increase in the risk of dependency and mortality once frailty was reached (Prince et al., 2021). These findings support the case for community interventions, targeted primarily at those with early decline, before frailty and dependency are reached (Prince et al., 2021). Such interventions often involve supporting older people to set personal goals and have included programmes targeted at preserving cognitive functioning, activity levels, physical strength and psychosocial wellbeing, with varying degrees of success (Bevilacqua et al., 2022).

One of the most comprehensive primary prevention frameworks is the WHO’s Integrated Care for Older People (ICOPE) programme. This is a toolkit of interventions which begins with screening for loss of intrinsic capacity, followed by in-depth assessment of specific areas of vulnerability and personalised care planning (World Health Organization, 2024). Care pathways follow domains very similar to those of the CGA, including cognitive function, mobility, nutrition, sensory impairments, depressive symptoms, social support, incontinence and support for carers (World Health Organization, 2024). Considering the implementation of a programme of this kind in Tanzania is a daunting prospect, especially given the disjointed healthcare landscape highlighted by the participants of this study and the lack of both primary and specialist geriatric care infrastructure. Nonetheless, a recent randomised controlled trial of the ICOPE care approach in China – the first of its kind in an LMIC – provides a compelling example of its potential. This trial utilised primary care providers, rather than specialist geriatricians, demonstrating not only that the ICOPE approach was feasible, but also that it was effective in improving function across several domains of intrinsic capacity when compared with standard care (Yan Wang et al., 2024). This outcome is promising and demonstrates the potential for evaluation of the ICOPE in other LMICs, with tailored adjustments to suit local resource limitations.

Secondary prevention and tertiary prevention are considered together, as they are closely interlinked. While secondary prevention focuses on the early detection of frailty and intervention to prevent further progression, tertiary prevention seeks to manage and minimise the impact of frailty, in particular complications such as hospitalisations, functional decline and death (Hoogendijk et al., 2019).

The feasibility of screening for the early detection of frailty in the community in Tanzania has already been demonstrated (Lewis et al., 2018a). Although no interventions for the treatment of frailty in this setting have yet been trialled, multicomponent interventions – often involving nutritional and physical activity elements – have been conducted elsewhere, yielding mixed results in terms of frailty progression, functional decline and dependence (Crocker et al., 2024, Macdonald et al., 2020). However, the focus of this research was the hospital environment. The results demonstrate that the admission of an older person to hospital in Tanzania represents an opportunity for frailty screening, that such screening is likely to be feasible, and suggest the CFS and B-FIT2 may be useful in identifying those with the greatest mortality risk. Nonetheless, the results also carry important implications for any future interventions at this stage, highlighting several significant challenges.

Firstly, of the older people with frailty admitted to hospital in this study, more than half died within the first 30 days of admission. The results did not provide a cause of death and thus it is hard to determine whether any of these deaths were preventable. The timing of these deaths, occurring so soon after admission, raises significant concerns about the severity of illness upon arrival to hospital, and the narrow window of opportunity available for intervention. Furthermore, qualitative data highlighted several reasons why the older people included in this study may have delayed admission, as well as suggesting that many others remained at home altogether.

Previous research from Tanzania has sought to characterise the reasons for delays in Emergency Department attendances using the *"Three Delays"* model, which was originally developed in relation to maternal mortality in West Africa (Hosaka et al., 2023, Thaddeus and Maine, 1994). These delays are characterised as: 1) delay in the decision to seek care; 2) delay in arrival to hospital; and 3) delays to treatment once in hospital (Thaddeus and Maine, 1994). In a qualitative study conducted by Hosaka et al., also in collaboration with KCMC, 24 emergency care stakeholders were interviewed, including fire service personnel, hospital staff and community health workers (Hosaka et al., 2023). Shared findings between their study and the present investigation include the fact that delays in the decision to seek care occurred due to financial concerns, lack of insurance and fear of hospital environments. Challenging geography, limited public transport, and long distances to hospital delayed patient's arrival after the decision to seek care was made. Once in hospital, there were examples in which the time taken to receive appropriate care was influenced by the high volume of patients, limited supply of medicines and equipment, the older person's ability to pay and staffing shortages. Moreover, surveys of adults in the Kilimanjaro region also highlight limited understanding regarding what constitutes an emergency health condition (Shayo et al., 2025). Taken together, these findings suggest that those seeking to improve outcomes amongst older people with frailty need to address factors that delay presentation and restrict access to hospital services, as well as considering interventions once an older person is admitted.

Any intervention for older people with frailty in Tanzania must take account of existing limitations in resources, staffing and geriatric expertise, whilst also seeking to preserve aspects of care that are already working well. This research identified several potential facilitators to effective care during admission. Firstly, policies which prioritised older people for assessment in the Emergency Department were well regarded and warrant further investigation as a potential mechanism to ensure timely access to definitive treatment. Secondly, service providers recognised admission as an opportunity for health promotion and education around chronic disease management, key aspects of care in any intervention for frailty. Thirdly, while family involvement in care was a complex issue, in qualitative interviews many older people expressed that there were clear benefits. It would be valuable to quantitatively evaluate family caregivers' effect on an older person's nutritional status, as well as the incidence of inpatient falls and delirium during admission. However, any efforts to capitalise on family caregivers' roles should include an explicit division of responsibilities and be sensitive to caregiver stress with flexible options to support those struggling to manage their other roles. Care must also be taken to ensure ward processes are not disrupted and that those without family support are not disadvantaged. Integrating these benefits into care strategies would align with the African Union's goals to make the most of traditional family structures and involvement in care (African Union, 2022).

The gold standard intervention for frailty amongst older adults admitted to hospital is the CGA (Ellis et al., 2017, Veronese et al., 2022). However, what might this look like in a resource-limited environment, without specialist geriatricians? Despite the existence of numerous assessment tools based on the CGA developed for use in LMICs, hospital interventions involving CGA have rarely been evaluated in these settings (Ntsama Essomba et al., 2024, Pizarro-Mena et al., 2024). The only study to-date, of interventional design, that has evaluated the efficacy of interventions for frailty in sub-Saharan Africa comes from Ethiopia (Kasa et al., 2024b). This involved the delivery of a nurse-led educational intervention to 66 older adults with frailty in the community over a period of six months and seemed to show some benefits in terms of their physical and psychosocial functioning, albeit in the absence of a control group for comparison (Kasa et al., 2024b). Meanwhile, efforts to implement CGA interventions led by non-geriatric services in hospitals in the UK have previously been unsuccessful, citing competing priorities, increased workload and continued reliance on specialist geriatricians as reasons for failure (Kocman et al., 2019).

While implementing interventions based on the full CGA represents a complex prospect, there are simpler care pathways that may be better suited for a low-resource setting. One such example is the *"Eat Walk Engage"* initiative, which originated in Australia and was designed for use on acute medical wards (Mudge et al., 2022). This programme sought to reduce hospital associated complications experienced by older people through setting simple goals, such as increasing the proportion of patients who receive feeding assistance, increasing the time older people spent mobilising and supporting functional orientation. This led to ward-specific interventions including revising allocation of nursing tasks, improving a patient lounge as a walking destination and orientation boards. In a randomised controlled trial, the intervention proved effective at preventing delirium, though unfortunately not mortality (Mudge et al., 2022). With thoughtful implementation, tailored to the specific environment of each ward, and the involvement of family caregivers to minimise the burden on clinical staff, it is possible to imagine the development or adaptation of programmes of this kind for a Tanzanian hospital context. Although such interventions may be feasible within current resource constraints, they are not without their drawbacks. Such protocol-driven approaches are far from holistic and hold less scope to personalise care for each older person and their extended family. While they may have a role, they should be considered as adjuncts to in-depth clinical assessment.

In the aftermath of admission, this study found that many older people were unable to pay for prescribed medications, unable to travel to follow-up appointments and lacked access to healthcare in the community. With these limitations, it is easy to see how older people with frailty might deteriorate in the period following discharge. Although the evidence surrounding transitional care interventions for older adults with frailty is mixed (Lee et al., 2022), improving these fundamentals – such as ensuring access to medications and appointments following discharge – represent actionable targets for potential intervention.

7.4.3 Immediate interventions

While this research has highlighted many potential targets for future interventions, through the experiences of conducting this study there are a number of simple recommendations that could be implemented rapidly to begin to improve care now. These are outlined briefly in the bullets below.

Nutrition and hydration

- *Clean water and/ or flasks of hot water in waiting areas in the Emergency Department.* At KCMC, older people were offered tea when in the Emergency and Outpatients Departments to prevent dehydration. A stocked self-service station in the other sites could do some way towards preventing dehydration whilst waiting for assessment.

- *Increasing the amount of protein in hospital meals, or giving family caregivers information on sources of protein to include when bringing in meals for their older relative.* Current meals provided to older people by hospital and by relatives typically contain carbohydrate but little protein. Hospital kitchens, or family caregivers, could add relatively cheap and readily available sources of protein such as beans, chickpeas, milk powder or peanut butter into the meals to increase protein content.
- *Identifying those who need a soft diet and providing Mtori.* Mtori (banana and meat soup) was highlighted as a suitable food for older people requiring a soft diet. Older people could be flagged by nursing staff early in their admission and, where possible, provided with Mtori as an alternative to ugali or rice. Where hospital kitchens lack resources to implement this, it could be recommended to family caregivers.

Mobility

- *Providing a chair by the bed for each older person.* For suitable older people this would provide the opportunity to sit out of bed regularly to reduce deconditioning.
- *Train all staff (including doctors, nurses, support workers, cleaners, etcetera) in basic manual handling techniques to safely assist older people to mobilise.* Encouraging all staff to assist older people to stand, transfer to sit out of bed, or to get to the toilet may help to reduce deconditioning and perhaps incontinence where this is due to immobility.
- *Stock mobility aids on the wards.* Having walking frames readily available, and placed within reach of those who capable of using them, may help a larger proportion of older people to mobilise independently during admission.

Cognition and communication

- *Display orientation boards in view of every admitted older person.* These should contain the date and location, this basic information should be accessible to most older people regardless of their educational level. Thick marker pen should be used so the information can be seen by older people with milder visual impairment. This may help to orientate older people when family caregivers are not present.

- *Display communication preferences at the end of the bed.* This may include the older person’s preferred name, dialect and any other communication needs (e.g. cognitive difficulties or hearing impairment). This may help to mitigate some of the communication challenges highlighted.
- *Staff should wear name badges.* At KCMC service providers wore name badges but at the other sites they did not. Staff should be encouraged to introduce themselves each time they approach, and wear a badge with their name in large font.

Family caregivers and abandoned patients

- *Explicitly define roles of family caregivers on admission.* Family caregivers should be involved from the start of admission, beginning with an agreement of ward visiting hours and an explicit division of responsibilities, preferably in written form. This would establish who is responsible for providing food and personal care from the outset, as well as help in identifying older people who are *“abandoned”* who will need all their care from hospital staff.
- *Signpost older people without relatives to Social Welfare Officers early.* This will allow Social Welfare Officers a head start on locating people to assist with an older person’s care on discharge, as well as to start the exemption process if needed, and prevent unnecessary extension to the admission.

7.4.4 Implications for future healthcare priorities

The high prevalence of frailty seen in this study, and its considerable effect on older people, their caregivers and the wider healthcare system, has significant implications for health service planners and policymakers in northern Tanzania. Hospital services are already struggling to meet the needs of high numbers of older patients with frailty, non-communicable disease, multimorbidity, disability and complex health needs. Tanzania’s National Ageing Policy, published in 2003, states that older people should have access to free basic health services (Ministry of Labour Youth Development and Sports, 2003). Unfortunately, two decades later, the healthcare journeys of older people in this study were still marked by a lack of community healthcare services and significant financial concerns at every stage, with these issues being amplified for those without family members to provide assistance and care. In the long-term, this study supports wider calls in Tanzania for prioritisation and investment in integrated health services for older people, more accessible insurance coverage and specialist geriatric services.

7.5 Strengths

It may seem obvious that the number of older people with age-related health issues, requiring hospital admission, will increase as populations age. However, this study demonstrates why it is important not to assume that the extent, experience and implications of demographic changes will be the same across all populations. This research was the first to consider frailty in hospital settings in Tanzania and was one of the first to explore this topic in sub-Saharan Africa. It has shown that frailty, multimorbidity, disability and non-communicable disease are *already* common amongst older people in this setting. However, it has also highlighted local understandings and circumstances which influence the experiences of key stakeholders in this specific context. This section considers some of the key strengths of this study that contributed to achieving the aims and advancing the wider body of existing knowledge.

Firstly, a systematic approach was used to summarise the existing literature related to the prevalence and outcomes of frailty in low- and middle-income settings. Systematic reviews have several advantages over traditional narrative approaches which serve to improve methodological rigour (Siddaway et al., 2019). The search strategy of the literature review in the present study cast a broad net, which sacrificed some specificity, to ensure that key references relevant to the review were not missed. The review was prospectively registered for transparency and to reduce the risk of other groups wasting energy duplicating the work. Screening and risk of bias assessment were both completed by two people, blinded to one another, to minimise selection bias and ensure quality control. Furthermore, the use of meta-analysis allowed statistical summary of the data to give pooled estimates for the prevalence of frailty and pre-frailty. This systematic approach provided a comprehensive overview of the existing literature, in a manner that is easily reproducible.

The quantitative elements of this study also had several strengths. Frailty was assessed in multiple ways, along with disability and multimorbidity, allowing interrogation of the characteristics associated with each construct. Inclusive criteria for participation helped to ensure that the sample of older adults was representative of real-world clinical practice, while recruitment from multiple hospital sites across different tiers of the healthcare system made the results more generalisable within Tanzania. Although follow-up response rates were lower than ideal, they still provided a valuable indication that there are likely to be stark differences in mortality between older people with, and without, frailty.

Probably the greatest strength of this study was the use of mixed methods. A frequent criticism levelled at mixed methods research is that integration is often insufficient (Halcomb, 2019). In this study, considerable thought (described explicitly in the methods section) was given to maximising the strengths of each method and to ensuring adequate integration in design and methods (Fetters et al., 2013). Qualitative elements drew upon the perspectives of multiple key stakeholders, while the sequential design helped to answer questions which arose from the analysis of the index quantitative assessment. This helped provide a deeper understanding of the context of frailty in this setting and helped to identify potential barriers and facilitators to effective care that would not have been apparent from quantitative data alone. Such insights were crucial when considering the implications for clinical practice and future research.

7.6 Limitations

Many of the limitations of this research have already been discussed in the preceding chapters. This section considers those which affect the study as a whole, and those which had the greatest impact on the data.

First, it is worth considering the literature review. Following a narrative introduction, a systematic approach was used to summarise existing literature relating to the prevalence and outcomes of frailty in low- and middle-income settings. This review had several specific limitations, chief amongst them being the heterogeneity of the data and the production of pooled estimates which combined various frailty constructs. Reflecting back, a quantitative systematic approach was selected largely because of the author’s own quantitative bias based on prior research experience. It would have been equally valid to explore frailty in LMICs from a qualitative perspective. Though the qualitative literature was explored as the research progressed, it is possible that the author’s understandings of frailty and the objectives for the research may have evolved differently had a qualitative approach been taken from the outset (Halcomb, 2019).

Second, there were several limitations to the quantitative assessments. Though many of these issues – including the lower-than-expected number of participants, the problems operationalising the phenotype and lack of a pre-frail category – have already been discussed, it is worth considering some of the potential sources of systematic bias and their impact on the data. The initial cross-sectional study may have overestimated the burden of frailty due to selection bias, as many eligible older people were discharged before they could be assessed. The design also limited the ability of this research to make causal inferences. While several factors were found to be associated with frailty, the study design cannot determine the direction of these relationships. It remains unclear, for example, whether frailty led to disability, whether disability contributed to the development of frailty, or whether both were consequences of other unknown factors. In addition, the reliance on retrospective recall during the index assessment – where older people with frailty and their informants were asked to rate their usual function prior to their acute illness – may have led to misclassification and information bias, with consequent overestimation of the burden of frailty and disability.

Furthermore, in the index phase there were also important elements which were omitted which could have provided valuable information. For example, a more comprehensive evaluation of each frailty assessment tool would have been beneficial – ideally this would have explored accuracy compared with CGA, as well as more detailed investigation of the reliability, ease of use, and cost-effectiveness of each tool. Moreover, the lack of a wider economic analysis represents another missed opportunity. It would have been valuable to assess whether there were differences in the cost of admission between frail and non-frail adults, especially considering the significant role that out-of-pocket payments played in the qualitative narratives. Had these elements been included, the findings would have provided a more complete understanding of the pros and cons of each frailty tool, as well as offering economic insights important to policymakers.

Thirdly, survival bias likely influenced the follow-up phase of the study. This definitely affected the disability transitions which were only assessed in 94 survivors who had lower rates of frailty and disability than the original sample population. With respect to mortality estimates, post-hoc analyses did not demonstrate any major differences between respondents and those lost to follow-up for many of the key demographic and clinical variables. However, there may have been other factors which were not considered in this analysis like mobile network coverage in rural areas, or dissatisfaction with hospital admission, that may have skewed the follow-up data towards certain groups.

Fourthly, the production of qualitative data was potentially limited by the author’s own outsider status, social desirability bias and the limitations imposed by translation. A common critique of thematic analytic methods is that final themes essentially follow from the interview questions, which in turn reflect the topic guides and the aims of the researcher (Rapley, 2011). After initial meetings with key stakeholders, the author held the greatest influence on the topics of discussion and agenda of each interview. Reflecting on the project as a whole, it is evident that the agenda was clinical and solutions-based. This is apparent in the aims (which included identifying barriers and facilitators to effective care), and the use of a systems-based model to guide the design of qualitative components and the topic guide questions. Though valuable, this focus on local and practical considerations, rather than broader themes around what it means to be frail in this context, may limit the transferability of the results to other settings.

Finally, this study could have been conducted in a more sustainable and equitable manner. One key improvement would have been to incorporate greater patient and public involvement in setting the research agenda at the outset, to ensure that the study’s goals aligned with those of older people in the community, not just clinical leaders. This research would have benefitted from more careful consideration of how to minimise hierarchical dynamics and maximise the input of Tanzanian research colleagues throughout the project, particularly in intellectual aspects such as design and data analysis. Structural barriers in timing of ethics applications, and the way funding was allocated, limited the meaningful involvement of local researchers in the creation of data collection tools, in data analysis and interpretation. Furthermore, beyond dissemination, this project would also have benefitted from more explicit consideration of how it could build capacity within the local clinical and research community.

Some measures have been taken to improve these factors retrospectively. For example, aspects of this PhD were used as part of a training presentation on frailty at a workshop for clinicians from several African countries in Addis Abiba. Furthermore, data have been shared with Joseph Kilasara for aspects of his own PhD, and there are plans to incorporate his analysis and interpretations in future publications, particularly with respect to the qualitative data. Nonetheless, these types of more meaningful involvement earlier in the process would have led to a more equitable and sustainable collaboration.

7.7 Recommendations for future research

This study provides several avenues for future exploration. The CFS represents a good starting point for future evaluation of frailty screening in hospital settings elsewhere, as well as other environments including outpatients, the Emergency Department, surgical wards and Intensive Care. Regardless of the environment, it is important to consider how to incorporate the wider context of frailty in Tanzania into clinical assessment, including social support, participation in the community and financial vulnerability. Moreover, it is crucial that frailty screening is evaluated in a real-world setting, with more rigorous assessment of acceptability and reliability when screened by usual clinical staff within routine care.

Given the burdens already placed upon clinical staff, another potential opportunity would be investigating frailty screening tools which could be completed by the older person themselves or their caregivers. There is precedent for this in the Pictorial Fit-Frail Scale, a visual scale in which an older person's function is rated against images in 14 domains such as mobility, social connections and bladder control (Theou et al., 2019). Although it was designed to facilitate conversations between service users and providers around an older person's needs, this tool has also been used to screen for frailty in hospital inpatients in Iran, where it compared favourably to a frailty index (Chehrehgosha et al., 2021a). In the context of sub-Saharan Africa, the domains and images would require significant cultural adaptation (e.g. for daytime tiredness, falling asleep in front of the television is much less applicable).

Nonetheless, opportunities for task-shifting frailty screening to the older person and their caregivers may warrant future consideration.

In addition to refining frailty screening tools for the Tanzanian hospital environment, there were several areas that were underexplored in the present study. Sarcopenia, nutrition and depression are all factors which can significantly impact the quality of life, functioning and independence of older people which were not extensively assessed. Additionally, this study also highlighted challenges in communicating around death and dying, as well as a gap in understanding around service users perspectives as to what constitutes a *"good death"* for older people with frailty in this context. Further investigation of these important aspects in the health of older people admitted to hospital would inform the development of interventions which respect cultural and individual preferences in a Tanzanian context.

This study identified several potential targets for future intervention and this discussion has provided some examples that could be adapted for Tanzania. If interventions are to be successfully and sustainably adopted, it is essential that the design of future research incorporates the principles of good implementation science, going beyond the assessment of efficacy, or effectiveness (Bauer and Kirchner, 2020). This means engaging clinical leaders, ward staff, older people with frailty and their caregivers to understand what a feasible and acceptable intervention might look like. Building upon the barriers and facilitators to effective care outlined in this study, the implementation of any future intervention will require an iterative process, with pilots and continuous feedback. Research should explore ways to preserve the benefits of family caregivers' involvement during admission, whilst also considering how to minimise caregiver stress, and not disadvantage those with limited social support. When assessing clinical outcomes, it will be important to consider not only mortality, readmissions and dependency, but also older people's perceptions of their own health, financial vulnerability and social engagement. Finally, the cost-effectiveness of any intervention must also be central to its evaluation if it is to be adopted in an environment where resources are limited.

Local leadership is essential for the sustainability and relevance of interventions for frailty in Tanzania and sub-Saharan Africa. While international collaborations can provide valuable support, in future it is important that leadership of the design, as well as interpretation of the data, are driven by Tanzanian researchers who have greater familiarity with the cultural, social, and economic context. Research designed and led primarily from within Tanzania would go some way towards ensuring greater epistemic fairness. Future research should seek to build capacity locally through the provision of geriatric training courses for local clinicians and by the inclusion of opportunities for local researchers, such as PhD programmes, within any grant proposals. This approach would represent a more sustainable model and align better with the African Union’s goal of a strong foundation for future research and interventions for older people in sub-Saharan Africa (African Union, 2022).

7.8 Conclusion

This mixed methods research incorporated a multi-centre cross-sectional study, as well as semi-structured interviews with service providers and service users, to understand the extent, experience and implications of frailty amongst older people admitted to general and medical wards in northern Tanzania.

The results demonstrate that frailty was prevalent in this population and, depending on the instrument used for assessment, associated with increasing age, female sex, lack of formal education, multimorbidity and dependency. Amongst the subset for whom follow-up data were available, this study found strong evidence that frailty was associated with mortality at 10-12 months, though its implications for other outcomes including length of stay, readmission and dependency were less clear cut.

For older people and their caregivers, the time surrounding admission to hospital was one of significant stress, compounded by systemwide resource constraints and the personal financial implications of hospital admission. Overall, the experience of acute admission to hospital in northern Tanzania was one of physical, emotional and financial vulnerability, which was amplified amongst older people with limited social support. Attitudes of service providers towards older people admitted to hospital were generally positive, reflecting cultural norms of respect for elders, the builders of the Tanzanian nation. However, growing numbers of older patients, with complex needs, provided significant challenges for service providers and for the functioning of the wards.

This research has highlighted many barriers and facilitators to effective care, and through local dissemination of these findings, and discussion of results with clinical leaders at participating hospitals, several potential avenues for future research and intervention have been identified. This research adds to a growing body of literature from LMICs which emphasise the urgent need for specialised health services for older people, with integrated community and hospital care, which take account of local dimensions and determinants of health in old age.

References

ADEBUSOYE, L. A., CADMUS, E. O., OWOLABI, M. O. & OGUNNIYI, A. 2019a. Frailty and mortality among older patients in a tertiary hospital in Nigeria. *Ghana Med J,* 53**,** 210-216.

ADEBUSOYE, L. A. & KALULA, S. Z. 2019. Mortality among older patients admitted to the medical wards of Groote Schuur Hospital, Cape Town, South Africa, 2010 - 2013. *S Afr Med J,* 109**,** 116-121.

ADEBUSOYE, L. A., OWOLABI, M. & OGUNNIYI, A. 2019b. Predictors of mortality among older patients in the medical wards of a tertiary hospital in Nigeria. *Aging Clinical and Experimental Research,* 31**,** 539-547.

AFRICAN UNION 2022. Draft policy framework and plan of action on ageing. Addis Ababa, Ethiopia: African Union.

AGGARWAL, A., KUMAR, A., SHARMA, R., GOEL, A., KAR, R., AVASTHI, R. & GUPTA, A. K. 2020. Physical Frailty Phenotype and Depression are Associated with More Severe Disease in Older Subjects Presenting with Acute Coronary Syndrome. *Nigerian journal of clinical practice,* 23**,** 1711-1720.

AGYEMANG-DUAH, W., ARTHUR-HOLMES, F., PEPRAH, C., ADEI, D. & PEPRAH, P. 2020. Dynamics of health information-seeking behaviour among older adults with very low incomes in Ghana: a qualitative study. *BMC Public Health,* 20**,** 928.

AIKAELI, J., MTUI, J. & TARP, F. 2021. Rural-urban migration, urbanisation and unemployment: The case of Tanzania Mainland. *African Journal of Economic Review,* 9**,** 87-108.

AJAYI, S. A., ADEBUSOYE, L. A., OLOWOOKERE, O. O., AKINYEMI, R. O., AFOLAYAN, K. O., AKINYEMI, J. O. & LABAEKA, E. O. 2021. Prevalence and Correlates of Frailty Syndrome among Older Adults Attending Chief Tony Anenih Geriatric Centre, University College Hospital, Ibadan. *West African journal of medicine,* 38**,** 255-267.

ALHARAHSHEH, H. H. & PIUS, A. 2020. A review of key paradigms: Positivism VS interpretivism. *Global Academic Journal of Humanities and Social Sciences,* 2**,** 39-43.

ALIBERTI, M. & AVELINO-SILVA, T. J. 2021. COVID-19 is not over and age is not enough: Using frailty forprognostication in hospitalized patients. *Journal of the American Geriatrics Society,* 69**,** S209-S210.

ALLISON, S. & JOANNA, S. 2017. Mixed methods research: expanding the evidence base. *Evidence Based Nursing,* 20**,** 74.

ALLMARK, P. & MACHACZEK, K. 2018. Realism and Pragmatism in a mixed methods study. *Journal of advanced nursing,* 74**,** 1301-1309.

ALTMAN, D. G. 1990. *Practical statistics for medical research*, Chapman and Hall/CRC.

AMBAGTSHEER, R. C. & MOUSSA, R. K. 2021. Association of frailty with health service utilisation and health care expenditure in sub-Saharan Africa: evidence from Cote d'Ivoire. *BMC Geriatr,* 21**,** 446.

AMBLÀS-NOVELLAS, J., TORNÉ, A., OLLER, R., MARTORI, J. C., ESPAULELLA, J. & ROMERO-ORTUNO, R. 2022. Transitions between degrees of multidimensional frailty among older people admitted to intermediate care: a multicentre prospective study. *BMC Geriatrics,* 22**,** 722.

AMOAKO-MENSAH, E., ACHEMPIM-ANSONG, G., GBORDZOE, N. I., ADOFO, C. E. & SARFO, J. O. 2023. Perceptions of nurses regarding quality of adult cardiopulmonary resuscitation in Ghana: a qualitative study. *BMC Nursing,* 22**,** 220.

AN, Z., XIAOWEI, S., JIAHUI, D., MITNITSKI, A., JIAN, L., ZHENHUI, G., ROCKWOOD, K., ZENG, A., SONG, X., DONG, J., LIU, J. & GUO, Z. 2015. Mortality in Relation to Frailty in Patients Admitted to a Specialized Geriatric Intensive Care Unit. *Journals of Gerontology Series A: Biological Sciences & Medical Sciences,* 70**,** 1586-1594.

ANDREW, M. K., MITNITSKI, A., KIRKLAND, S. A. & ROCKWOOD, K. 2012. The impact of social vulnerability on the survival of the fittest older adults. *Age and Ageing,* 41**,** 161-165.

ANDREW, M. K., MITNITSKI, A. B. & ROCKWOOD, K. 2008. Social Vulnerability, Frailty and Mortality in Elderly People. *PLOS ONE,* 3**,** e2232.

APRAHAMIAN, I., ARICO DE ALMEIDA, G. V., DE VASCONCELLOS ROMANIN, C. F., GOMES CALDAS, T., ANTUNES YOSHITAKE, N. T., BATAGLINI, L., MORI LIN, S., ALVES PEREIRA, A., NARA ALEGRINI LONGHI, L., MAMONI, R. L. & MARTINELLI, J. E. 2019. Frailty Could Predict Death in Older Adults after Admission at Emergency Department? A 6-month Prospective Study from a Middle-Income Country. *Journal of Nutrition, Health and Aging,* 23**,** 641-647.

ASSAYE, A. M., WIECHULA, R., SCHULTZ, T. J. & FEO, R. 2022. Missed nursing care, nurse staffing levels and patient safety outcomes in low-income country acute care settings: An observational study. *Int J Nurs Pract,* 28**,** e13031.

AT, J., BRYCE, R., PRINA, M., ACOSTA, D., FERRI, C. P., GUERRA, M., HUANG, Y., RODRIGUEZ, J. J. L., SALAS, A., SOSA, A. L., WILLIAMS, J. D., DEWEY, M. E., ACOSTA, I., LIU, Z., BEARD, J. & PRINCE, M. 2015. Frailty and the prediction of dependence and mortality in low- and middle-income countries: a 10/66 population-based cohort study. *BMC Medicine,* 13**,** 138.

AVELINO-SILVA, T. J., GIL, L. A., CURIATI, P. K., CABRAL, K. N., RANGEL, L. F., CORREA, F. G., DOMENICO, T. O. & GANEM, F. 2018. Using the frail scale and the identification of seniors at risk tool to predict delirium in hospitalized older adults: Results from a novel geriatric emergency department. *Journal of the American Geriatrics Society,* 66**,** S60-S61.

BARENDREGT, J. J., DOI, S. A., LEE, Y. Y., NORMAN, R. E. & VOS, T. 2013. Meta-analysis of prevalence. *J Epidemiol Community Health,* 67**,** 974-8.

BARKER, T. H., MIGLIAVACA, C. B., STEIN, C., COLPANI, V., FALAVIGNA, M., AROMATARIS, E. & MUNN, Z. 2021. Conducting proportional meta-analysis in different types of systematic reviews: a guide for synthesisers of evidence. *BMC Medical Research Methodology,* 21**,** 189.

BARTER, C. & RENOLD, E. 1999. The use of vignettes in qualitative research. *Social research update,* 25**,** 1-6.

BAUER, M. S. & KIRCHNER, J. 2020. Implementation science: What is it and why should I care? *Psychiatry Research,* 283**,** 112376.

BEKKER, M., COETZEE, S. K., KLOPPER, H. C. & ELLIS, S. M. 2015. Non-nursing tasks, nursing tasks left undone and job satisfaction among professional nurses in South African hospitals. *J Nurs Manag,* 23**,** 1115-25.

BEVILACQUA, R., SORACI, L., STARA, V., RICCARDI, G. R., CORSONELLO, A., PELLICCIONI, G., LATTANZIO, F., CASACCIA, S., MÖLLER, J., WIECHING, R., OGAWA, T., WATANABE, S., KOKOBUN, K., KONDO, I., TAKANO, E. & MARANESI, E. 2022. A systematic review of multidomain and lifestyle interventions to support the intrinsic capacity of the older population. *Front Med (Lausanne),* 9**,** 929261.

BHAKUNI, H. & ABIMBOLA, S. 2021. Epistemic injustice in academic global health. *The Lancet Global Health,* 9**,** e1465-e1470.

BHASKAR, R. 1979. *The Possibility of Naturalism: A Philosophical Critique of the Contemporary Human Sciences*, Routledge.

BHURCHANDI, S., KUMAR, S., AGRAWAL, S., ACHARYA, S., JAIN, S., TALWAR, D. & LOMTE, S. 2021. Correlation of Sarcopenia With Modified Frailty Index as a Predictor of Outcome in Critically Ill Elderly Patients: A Cross-Sectional Study. *Cureus,* 13**,** e19065.

BIENIEK, J., KRZYSZTOF, W. & AND SZEWIECZEK, J. 2016. Fried frailty phenotype assessment components as applied to geriatric inpatients. *Clinical Interventions in Aging,* 11**,** 453-459.

BINTABARA, D., NAKAMURA, K. & SEINO, K. 2018. Improving access to healthcare for women in Tanzania by addressing socioeconomic determinants and health insurance: a population-based cross-sectional survey. *BMJ Open,* 8**,** e023013.

BINYARUKA, P., MTEI, G., MAIBA, J., GOPINATHAN, U. & DALE, E. 2023. Developing the improved Community Health Fund in Tanzania: was it a fair process? *Health Policy and Planning,* 38**,** i83-i95.

BISHOP-WILLIAMS, K. E., BERRANG-FORD, L., SARGEANT, J. M., PEARL, D. L., LWASA, S., NAMANYA, D. B., EDGE, V. L., CUNSOLO, A., HUANG, Y., FORD, J., GARCIA, P. & HARPER, S. L. 2018. Understanding Weather and Hospital Admissions Patterns to Inform Climate Change Adaptation Strategies in the Healthcare Sector in Uganda. *Int J Environ Res Public Health,* 15.

BJÖRK BRÄMBERG, E. & DAHLBERG, K. 2012. Interpreters in Cross-Cultural Interviews: A Three-Way Coconstruction of Data. *Qualitative Health Research,* 23**,** 241-247.

BOUCHER, E. L., GAN, J. M., ROTHWELL, P. M., SHEPPERD, S. & PENDLEBURY, S. T. 2023. Prevalence and outcomes of frailty in unplanned hospital admissions: a systematic review and meta-analysis of hospital-wide and general (internal) medicine cohorts. *EClinicalMedicine,* 59**,** 101947.

BOUTAYEB, A. 2006. The double burden of communicable and non-communicable diseases in developing countries. *Transactions of The Royal Society of Tropical Medicine and Hygiene,* 100**,** 191-199.

BOZKURT, M. E., ERDOGAN, T., KILIC, C., OZALP, H., OZALP, G., ASCI, E., FETULLAHOGLU, Z., AYDIN, C. O., BAHAT, G. & KARAN, M. A. 2024. Comparison of two different frailty screening scales for predicting mortality due to all causes in older inpatients. *Rev Assoc Med Bras (1992),* 70**,** e20240250.

BRAND, N. R., QU, L. G., CHAO, A. & ILBAWI, A. M. 2019. Delays and Barriers to Cancer Care in Low- and Middle-Income Countries: A Systematic Review. *Oncologist,* 24**,** e1371-e1380.

BRAUN, V. & CLARKE, V. 2006. Using thematic analysis in psychology. *Qualitative Research in Psychology,* 3**,** 77-101.

BRAUN, V. & CLARKE, V. 2019. Reflecting on reflexive thematic analysis. *Qualitative Research in Sport, Exercise and Health,* 11**,** 589-597.

BRIGGS, R., MCDONOUGH, A., ELLIS, G., BENNETT, K., O'NEILL, D. & ROBINSON, D. 2022. Comprehensive Geriatric Assessment for community-dwelling, high-risk, frail, older people. *Cochrane Database of Systematic Reviews*.

BRINDA, E. M., ANDRÉS, R. A. & ENEMARK, U. 2014. Correlates of out-of-pocket and catastrophic health expenditures in Tanzania: results from a national household survey. *BMC International Health and Human Rights,* 14**,** 5.

BRITISH GERIATRICS SOCIETY 2015. Comprehensive Geriatric Assessment Toolkit for Primary Care Practicioners. *Improving healthcare for older people.* London.

BRITISH GERIATRICS SOCIETY 2020. End of Life Care in Frailty: Identification and prognostication. United Kingdom: British Geriatrics Society,.

BUGUZI, S. 2021. Covid-19: Counting the cost of denial in Tanzania. *BMJ,* 373**,** n1052.

BULTERIJS, S., HULL, R. S., BJÖRK, V. C. & ROY, A. G. 2015. It is time to classify biological aging as a disease. *Front Genet,* 6**,** 205.

BUNT, S., STEVERINK, N., OLTHOF, J., VAN DER SCHANS, C. P. & HOBBELEN, J. S. M. 2017. Social frailty in older adults: a scoping review. *Eur J Ageing,* 14**,** 323-334.

BURGHARDT, M. 2013. Common frailty, constructed oppression: tensions and debates on the subject of vulnerability. *Disability & Society,* 28**,** 556-568.

BYRNE, D. 2022. A worked example of Braun and Clarke's approach to reflexive thematic analysis. *Quality & Quantity,* 56**,** 1391-1412.

CASSIM, B. & TIPPING, B. 2022. Healthcare for older people in Africa. *Age Ageing,* 51.

CATIKKAS, N. M., TURKMEN, B. O., BOZKURT, M. E., KARAN, M. A. & BAHAT, G. 2022. Assessment of older acute hip fracture patients: from the view of geriatricians. *Journal of Clinical Densitometry,* 25**,** 275-276.

CESARI, M., GAMBASSI, G., ABELLAN VAN KAN, G. & VELLAS, B. 2013. The frailty phenotype and the frailty index: different instruments for different purposes. *Age and Ageing,* 43**,** 10-12.

CHAN, D.-C., TSOU, H.-H., CHEN, C.-Y. & CHEN, C.-Y. 2010. Validation of the Chinese-Canadian study of health and aging clinical frailty scale (CSHA-CFS) telephone version. *Archives of Gerontology and Geriatrics,* 50**,** e74-e80.

CHEHREHGOSHA, M., ALIZADEH-KHOEI, M., BEHNAMPOUR, N., SHARIFI, F., VATAN, R. F. & AMINALROAYA, R. 2021a. Diagnosis of frailty in geriatric patients: Is the pictorial fit frail scale an appropriate screening tool in hospital settings? *Caspian Journal of Internal Medicine,* 12**,** 307-314.

CHEHREHGOSHA, M., FADAYE VATAN, R., ALIZADEH-KHOEI, M., SHARIFI, F., AMINALROAYA, R., VAHABI, Z., ZENDEDEL, A. & HEKMAT, H. 2021b. Role of frailty in prediction of hospitalized older adult patient's outcomes: A prospective study. *Turkish Journal of Medical Sciences,* 51**,** 2324-2333.

CHEN, L. Y., CHEN, X. J., YAN, J. & CHEN, L. K. 2016. Frailty is associated with long-term adverse outcome among hospitalized older patients: A prospective cohort study in China. *European Geriatric Medicine,* 7**,** S117.

CHURCH, S., ROGERS, E., ROCKWOOD, K. & THEOU, O. 2020. A scoping review of the Clinical Frailty Scale. *BMC Geriatrics,* 20**,** 393.

CLACK, T. 2005. Re-Africanizing the African: Indigenising the Christianity on the slopes of Mount Kilimanjaro. *Indilinga: African Journal of Indigenous Knowledge Systems,* 4**,** 273-326.

CLARKSON, J., DEAN, J., WARD, J., KOMASHIE, A. & BASHFORD, T. 2018. A systems approach to healthcare: from thinking to -practice. *Future Healthc J,* 5**,** 151-155.

CLARKSON, P., BOGLE, D., DEAN, J., TOOLEY, M., TREWBY, J., VAUGHAN, L., ADAMS, E., DUDGEON, P., PLATT, N. & SHELTON, P. 2017. Engineering better care: a systems approach to health and care design and continuous improvement. *Royal Academy of Engineering***,** 1-92.

CLEGG, A., BATES, C., YOUNG, J., RYAN, R., NICHOLS, L., ANN TEALE, E., MOHAMMED, M. A., PARRY, J. & MARSHALL, T. 2016. Development and validation of an electronic frailty index using routine primary care electronic health record data. *Age Ageing,* 45**,** 353-60.

CLEGG, A., YOUNG, J., ILIFFE, S., RIKKERT, M. O. & ROCKWOOD, K. 2013. Frailty in elderly people. *Lancet,* 381**,** 752-62.

COELHO-JUNIOR, H. J., MARZETTI, E., PICCA, A., CALVANI, R., CESARI, M. & UCHIDA, M. C. 2020. Prevalence of Prefrailty and Frailty in South America: A Systematic Review of Observational Studies. *J Frailty Aging,* 9**,** 197-213.

COLLARD, R. M., BOTER, H., SCHOEVERS, R. A. & OUDE VOSHAAR, R. C. 2012. Prevalence of frailty in community-dwelling older persons: a systematic review. *J Am Geriatr Soc,* 60**,** 1487-92.

COLLIN, C., WADE, D. T., DAVIES, S. & HORNE, V. 1988. The Barthel ADL Index: a reliability study. *Int Disabil Stud,* 10**,** 61-3.

COLLINGWOOD, C., PADDICK, S. M., KISOLI, A., DOTCHIN, C. L., GRAY, W. K., MBOWE, G., MKENDA, S., URASA, S., MUSHI, D., CHAOTE, P. & WALKER, R. W. 2014. Development and community-based validation of the IDEA study Instrumental Activities of Daily Living (IDEA-IADL) questionnaire. *Glob Health Action,* 7**,** 25988.

CONNELLY, J. 2001. Critical realism and health promotion: effective practice needs an effective theory. *Health Education Research,* 16**,** 115-120.

CONTRERAS, M. F. & BARRAGAN BERLANGA, A. J. 2019. Osteosarcopenia prevalence and its association with comorbidity, frailty, and grip strength in patients with hip fracture. *European Geriatric Medicine,* 10**,** S246.

COOPER, F., LEWIS, E., URASA, S., WHITTON, L., COLLIN, H., COLES, S., WOOD, G., MOHAMMED, A., MDEGELLA, D., MKODO, J., ZERD, F., DOTCHIN, C., GRAY, W. & WALKER, R. 2022. Social Vulnerability, Frailty, and Their Association With Mortality in Older Adults Living in Rural Tanzania. *The Journals of Gerontology*.

COULSON, A. 2013. Ujamaa and Villagization. *Tanzania: A Political Economy.* Oxford University Press.

CRAIG, C. L., MARSHALL, A. L., SJÖSTRÖM, M., BAUMAN, A. E., BOOTH, M. L., AINSWORTH, B. E., PRATT, M., EKELUND, U., YNGVE, A. & SALLIS, J. F. 2003. International physical activity questionnaire: 12-country reliability and validity. *Medicine and science in sports and exercise,* 35**,** 1381-1395.

CROCKER, T. F., LAM, N., ENSOR, J., JORDÃO, M., BAJPAI, R., BOND, M., FORSTER, A., RILEY, R. D., ANDRE, D., BRUNDLE, C., ELLWOOD, A., GREEN, J., HALE, M., MORGAN, J., PATETSINI, E., PRESCOTT, M., RAMIZ, R., TODD, O., WALFORD, R., GLADMAN, J. & CLEGG, A. 2024. Community-based complex interventions to sustain independence in older people, stratified by frailty: a systematic review and network meta-analysis. *Health Technol Assess,* 28**,** 1-194.

CRUZ-JENTOFT, A. J., LANDI, F., TOPINKOVA, E. & MICHEL, J. P. 2010. Understanding sarcopenia as a geriatric syndrome. *Curr Opin Clin Nutr Metab Care,* 13**,** 1-7.

CUNHA, A. I. L., VERONESE, N., DE MELO BORGES, S. & RICCI, N. A. 2019. Frailty as a predictor of adverse outcomes in hospitalized older adults: A systematic review and meta-analysis. *Ageing Res Rev,* 56**,** 100960.

CUSCHIERI, S. 2019. The STROBE guidelines. *Saudi J Anaesth,* 13**,** S31-s34.

DANIEL, W. W. & CROSS, C. L. 2018. *Biostatistics: a foundation for analysis in the health sciences*, Wiley.

DAVIDSON, S. L., BICKERSTAFF, E., EMMENCE, L., MOTRAGHI-NOBES, S. M., RAYERS, G., LYIMO, G., KILASARA, J., MITCHELL, E., URASA, S., WALKER, R. W. & DOTCHIN, C. L. 2023a. The buden of multimorbidity amongst older hospitalised adults in northrn Tanzania: A multi-centre study [Conference abstract]. *Age and Ageing,* 52.

DAVIDSON, S. L., EMMENCE, L., MOTRAGHI-NOBES, S. M., BICKERSTAFF, E., RAYERS, G., LYIMO, G., KILASARA, J., CHUWA, M., KISHEO, F., KISARUNI, E., URASA, S., MITCHELL, E., DOTCHIN, C. L. & WALKER, R. W. 2024a. Assessing frailty amongst older people admitted to hospital in a low-income setting: a multicentre study in northern Tanzania. *BMC Geriatrics,* 24**,** 190.

DAVIDSON, S. L., EMMENCE, L., MOTRAGHI-NOBES, S. M., BICKERSTAFF, E., RAYERS, G., LYIMO, G., KILASARA, J., URASA, S., MITCHELL, E., DOTCHIN, C. L. & WALKER, R. W. 2023b. Measuring the prevalence of frailty amongst older hospitalised adults in northern Tanzania: A multicentre cross-sectional study [Conference abstract]. *13th International Conference on Frailty & Sarcopenia Research (ICFSR).* Toulouse, France: The Journal of Frailty & Aging.

DAVIDSON, S. L., HARDY, J., RANDALL, T., MURRAY, A., LYIMO, G., MSANGI, W., KILASARA, J., MARIKI, L., URASA, S., BRECKONS, M., DOTCHIN, C. L. & WALKER, R. W. 2024b. The experience of frailty in the Tanzanian hospital system: A qualitative exploration service user and provider perspectives [Conference abstract]. *Age and Ageing,* 53.

DAVIDSON, S. L., LEE, J., EMMENCE, L., BICKERSTAFF, E., RAYERS, G., DAVIDSON, E., RICHARDSON, J., ANDERSON, H., WALKER, R. & DOTCHIN, C. 2025. Systematic review and meta-analysis of the prevalence of frailty and pre-frailty amongst older hospital inpatients in low- and middle-income countries. *Age Ageing,* 54.

DAVIDSON, S. L., MSANGI, W., KILASARA, J., LYIMO, G., MARIKI, L., HARDY, J., RANDALL, T., MURRAY, A., URASA, S., BRECKONS, M., DOTCHIN, C. L. & WALKER, R. W. 2024c. "I need my children around me." The role of extended family during the hospital admissions of older people in northern Tanzania. [Oral presentation]. *Australian and New Zealand Society for Geriatric Medicine (ANZSGM) Annual Scientific Meeting.* Christchurch, New Zealand.

DAVIDSON, S. L., MURRAY, A., HARDY, J., RANDALL, T., LYIMO, G., KILASARA, J., URASA, S., WALKER, R. W. & DOTCHIN, C. L. 2024d. The long-term clinical outcomes of older adults with frailty following acute hospital admission in Tanzania [Conference abstract]. *Age and Ageing,* 53.

DAVIDSON, S. L., RAYERS, G., MOTRAGHI-NOBES, S. M., BICKERSTAFF, E., EMMENCE, L., KILASARA, J., LYIMO, G., URASA, S., MITCHELL, E., DOTCHIN, C. L. & WALKER, R. W. 2023c. Clinical outcomes of older hospitalised aults living with frailty in northern Tanzania: A prospective multicntre study [Conference abstract]. *Age and Ageing,* 52.

DAVIES, K., MAHARANI, A., CHANDOLA, T., TODD, C. & PENDLETON, N. 2021. The longitudinal relationship between loneliness, social isolation, and frailty in older adults in England: a prospective analysis. *Lancet Healthy Longev,* 2**,** e70-e77.

DE FÁTIMA SANTOS ANTUNES, J., PINTO OKUNO, M. F., BARBOSA TEIXEIRA LOPES, M. C., VANCINI CAMPANHARO, C. R. & ASSAYAG BATISTA, R. E. 2015. FRAILTY ASSESSMENT OF ELDERLY HOSPITALIZED AT AN EMERGENCY SERVICE OF A UNIVERSITY HOSPITAL. *Cogitare Enfermagem,* 20**,** 264-271.

DEFFUNE, P., DE LA CRUZ, D. & AVELINO-SILVA, T. J. 2020. Predictors of delirium occurrence in older in-patients with heart failure. *Journal of the American Geriatrics Society,* 68**,** S300.

DENT, E., KOWAL, P. & HOOGENDIJK, E. O. 2016. Frailty measurement in research and clinical practice: A review. *European Journal of Internal Medicine,* 31**,** 3-10.

DENT, E., MARTIN, F. C., BERGMAN, H., WOO, J., ROMERO-ORTUNO, R. & WALSTON, J. D. 2019. Management of frailty: opportunities, challenges, and future directions. *The Lancet,* 394**,** 1376-1386.

DETTORI, J. R., NORVELL, D. C. & CHAPMAN, J. R. 2022. Fixed-Effect vs Random-Effects Models for Meta-Analysis: 3 Points to Consider. *Global Spine J,* 12**,** 1624-1626.

DÍAZ, D. M., OCHOA, A., CORZO, M. A., SANABRIA, M. C. & FIGUEROA, C. L. 2020. Variables associated with frailty in a hospital population in Colombia. *Geriatrics, Gerontology and Aging,* 14**,** 114-119.

DIAZ-TORO, F., VERDEJO, H., ROSSEL, V., CASTRO, P., LARREA, R., CONCEPCIÓN, R. & SEPÚLVEDA, L. 2017. Frailty in patients admitted to hospital with acute decompensated heart failure. *Revista Medica de Chile,* 145**,** 164-171.

DOODY, P., ASAMANE, E. A., AUNGER, J. A., SWALES, B., LORD, J. M., GREIG, C. A. & WHITTAKER, A. C. 2022. The prevalence of frailty and pre-frailty among geriatric hospital inpatients and its association with economic prosperity and healthcare expenditure: A systematic review and meta-analysis of 467,779 geriatric hospital inpatients. *Ageing research reviews***,** 101666.

DOS SANTOS TAVARES, D. M., NADER, I. D., MAPELLI DE PAIVA, M., APARECIDA DIAS, F. & SOUSA PEGORARI, M. 2015. Association of socioeconomic and clinical variables with the state of frailty among older inpatients. *Revista Latino-Americana de Enfermagem (RLAE),* 23**,** 1121-1129.

DOTCHIN, C. L., AKINYEMI, R. O., GRAY, W. K. & WALKER, R. W. 2013. Geriatric medicine: services and training in Africa. *Age Ageing,* 42**,** 124-8.

DZANDO, G., WARD, P. R., ASANTE, D. & AMBAGTSHEER, R. C. 2024. Application of frailty screening instruments for older people in Sub-Saharan Africa: A scoping review. *Ageing Research Reviews,* 102**,** 102571.

DZIECHCIAŻ, M. & FILIP, R. 2014. Biological psychological and social determinants of old age: bio-psycho-social aspects of human aging. *Ann Agric Environ Med,* 21**,** 835-8.

EBEID, S., EL AKKAD, R., KAMEL, M., SHAFEEK, N. & ABOU ELEZZ, N. 2016. Frailty prevalence and correlates among free living elderly in an egyptian rural elderly. *IJRSR,* 2**,** 8902-7.

EKORE, R. I. & LANRE-ABASS, B. 2016. African Cultural Concept of Death and the Idea of Advance Care Directives. *Indian J Palliat Care,* 22**,** 369-372.

ELLIS, G., GARDNER, M., TSIACHRISTAS, A., LANGHORNE, P., BURKE, O., HARWOOD, R. H., CONROY, S. P., KIRCHER, T., SOMME, D., SALTVEDT, I., WALD, H., O'NEILL, D., ROBINSON, D. & SHEPPERD, S. 2017. Comprehensive geriatric assessment for older adults admitted to hospital. *Cochrane Database Syst Rev,* 9**,** CD006211.

EMILIE, S. K. B. 2022. How to identify epistemic injustice in global health research funding practices: a decolonial guide. *BMJ Global Health,* 7**,** e008950.

ESSAM BEHIRY, M., MOGAWER, S., YAMANY, A., RAKHA, M., AWAD, R., EMAD, N. & ABDELFATAH, Y. 2019. Ability of the Short Physical Performance Battery Frailty Index to Predict Mortality and Hospital Readmission in Patients with Liver Cirrhosis. *International Journal of Hepatology,* 2019**,** 8092865.

FETTERS, M. D., CURRY, L. A. & CRESWELL, J. W. 2013. Achieving integration in mixed methods designs-principles and practices. *Health Serv Res,* 48**,** 2134-56.

FLETCHER, A. J. 2017. Applying critical realism in qualitative research: methodology meets method. *International Journal of Social Research Methodology,* 20**,** 181-194.

FRICKER, M. 2007. *Epistemic Injustice: Power and the Ethics of Knowing*, Oxford University Press.

FRIED, L. P., TANGEN, C. M., WALSTON, J., NEWMAN, A. B., HIRSCH, C., GOTTDIENER, J., SEEMAN, T., TRACY, R., KOP, W. J., BURKE, G., MCBURNIE, M. A. & CARDIOVASCULAR HEALTH STUDY COLLABORATIVE RESEARCH, G. 2001. Frailty in older adults: evidence for a phenotype. *J Gerontol A Biol Sci Med Sci,* 56**,** M146-56.

FRYER, T. 2022. A critical realist approach to thematic analysis: producing causal explanations. *Journal of Critical Realism,* 21**,** 365-384.

FURUYA-KANAMORI, L., XU, C., HASAN, S. S. & DOI, S. A. 2021. Quality versus Risk-of-Bias assessment in clinical research. *J Clin Epidemiol,* 129**,** 172-175.

GAFAAR, T. O., PESAMBILI, M., HENKE, O., VISSOCI, J. R. N., MMBAGA, B. T. & STATON, C. 2020. Good death: An exploratory study on perceptions and attitudes of patients, relatives, and healthcare providers, in northern Tanzania. *PLoS One,* 15**,** e0233494.

GARCIA-DELGADO, A. J., ZAPATA-ALTAMIRANO, L. E., ANDRADE-MONTOYA, I. A., ACO-FLORES, A. Y., LOPEZ-RETAMOZA, A. K. & SARRIA, A. V. 2020. Prevalence and detection of frailty syndrome in the elderly at Hospital General de Mexico "Dr. Eduardo Liceaga". *Revista Medica del Hospital General de Mexico,* 83**,** 59-65.

GASTO, F., TUMAINI, N. & AMANI, A. 2017. Facilitators and Barriers to Health Care Access among the Elderly in Tanzania: A Health System Perspective from Managers and Service Providers. *Journal Of Aging Research And Healthcare,* 1**,** 1-10.

GBEASOR-KOMLANVI, F. A., TCHANKONI, M. K., BAKOUBAYI, A. W., LOKOSSOU, M. Y., SADIO, A., ZIDA-COMPAORE, W. I. C., DJIBRIL, M., BELO, M., AGBONON, A. & EKOUEVI, D. K. 2020. Predictors of three-month mortality among hospitalized older adults in Togo. *BMC Geriatrics,* 20**,** 507.

GILL, T. M., ALLORE, H. G., GAHBAUER, E. A. & MURPHY, T. E. 2010. Change in Disability After Hospitalization or Restricted Activity in Older Persons. *JAMA,* 304**,** 1919-1928.

GLOBAL BURDEN OF DISEASE STUDY, C. 2015. Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet,* 386**,** 743-800.

GORDON, E. H., PEEL, N. M., SAMANTA, M., THEOU, O., HOWLETT, S. E. & HUBBARD, R. E. 2017. Sex differences in frailty: A systematic review and meta-analysis. *Exp Gerontol,* 89**,** 30-40.

GOUDA, H. N., CHARLSON, F., SORSDAHL, K., AHMADZADA, S., FERRARI, A. J., ERSKINE, H., LEUNG, J., SANTAMAURO, D., LUND, C., AMINDE, L. N., MAYOSI, B. M., KENGNE, A. P., HARRIS, M., ACHOKI, T., WIYSONGE, C. S., STEIN, D. J. & WHITEFORD, H. 2019. Burden of non-communicable diseases in sub-Saharan Africa, 1990-2017: results from the Global Burden of Disease Study 2017. *Lancet Glob Health,* 7**,** e1375-e1387.

GRAY, W. K., OREGA, G., KISOLI, A., ROGATHI, J., PADDICK, S.-M., LONGDON, A. R., WALKER, R. W., DEWHURST, F., DEWHURST, M., CHAOTE, P. & DOTCHIN, C. 2017. Identifying Frailty and its Outcomes in Older People in Rural Tanzania. *Experimental Aging Research,* 43**,** 257-273.

GRAY, W. K., PADDICK, S. M., KISOLI, A., DOTCHIN, C. L., LONGDON, A. R., CHAOTE, P., SAMUEL, M., JUSABANI, A. M. & WALKER, R. W. 2014. Development and Validation of the Identification and Intervention for Dementia in Elderly Africans (IDEA) Study Dementia Screening Instrument. *J Geriatr Psychiatry Neurol,* 27**,** 110-8.

GRAY, W. K., RICHARDSON, J., MCGUIRE, J., DEWHURST, F., ELDER, V., WEEKS, J., WALKER, R. W. & DOTCHIN, C. L. 2016. Frailty Screening in Low- and Middle-Income Countries: A Systematic Review. *J Am Geriatr Soc,* 64**,** 806-23.

GU, J.-J., LIU, Q. & ZHENG, L.-J. 2021. A Frailty Assessment Tool to Predict In-Hospital Mortality in Patients with Acute Exacerbations of Chronic Obstructive Pulmonary Disease. *International journal of chronic obstructive pulmonary disease,* 16**,** 1093-1100.

GUERRA, M., FERRI, C., LLIBRE, J., PRINA, A. M. & PRINCE, M. 2015. Psychometric properties of EURO-D, a geriatric depression scale: a cross-cultural validation study. *BMC Psychiatry,* 15**,** 12.

HALCOMB, E. J. 2019. Mixed methods research: The issues beyond combining methods. *Journal of Advanced Nursing,* 75**,** 499-501.

HAMMAMI, S., GHZAIEL, I., HAMMOUDA, S., SAKLY, N., HAMMAMI, M. & ZARROUK, A. 2020. Evaluation of pro-inflammatory cytokines in frail Tunisian older adults. *PLoS ONE,* 15**,** e0242152.

HAN, B., LI, Q. & CHEN, X. 2019. Frailty and postoperative complications in older Chinese adults undergoing major thoracic and abdominal surgery. *Clinical interventions in aging,* 14**,** 947-957.

HAO, Q., ZHOU, L., DONG, B., YANG, M., DONG, B. & WEIL, Y. 2019. The role of frailty in predicting mortality and readmission in older adults in acute care wards: a prospective study. *Sci Rep,* 9**,** 1207.

HARTLEY, P., ADAMSON, J., CUNNINGHAM, C., EMBLETON, G. & ROMERO-ORTUNO, R. 2017. Clinical frailty and functional trajectories in hospitalized older adults: A retrospective observational study. *Geriatrics & Gerontology International,* 17**,** 1063-1068.

HASMUK, K., SAEDON, N. I., ONG, T., KAMARUZZAMAN, S. B., KHOR, H. M., TAN, K. M., TAN, M. P., CHIN, A. V., LIM, W. C., LOH, S. P., THIAM, C. N., ABDULLAH, A., NG, C. C., MANG, G. P. H., KUKREJA, A., DEWI, J. S., JOHARI, B. M., ONG, H. C., BASRI, S., WONG, P. L., OMAR, S. F. S., SOHAIL, A., PONNAMPALAVANAR, S. & KAMARULZAMAN, A. 2020. Understanding COVid in the VulnERable (UNCOVER)a- Experience from a tertiary centre in Malaysia. *European Geriatric Medicine,* 11**,** S23-S27.

HAYAJNEH, A. A. & RABABA, M. 2021. The Association of Frailty with Poverty in Older Adults: A Systematic Review. *Dementia and Geriatric Cognitive Disorders,* 50**,** 407-413.

HENNINK, M. M. 2008. Language and Communication in Cross-Cultural Qualitative Research. *In:* LIAMPUTTONG, P. (ed.) *Doing Cross-Cultural Research: Ethical and Methodological Perspectives.* Dordrecht: Springer Netherlands.

HERTZ, J. T., SAKITA, F. M., KWEKA, G. L., LORING, Z., THIELMAN, N. M., TEMU, G. & BARTLETT, J. A. 2019. Healthcare-seeking behaviour, barriers to care and predictors of symptom improvement among patients with cardiovascular disease in northern Tanzania. *International Health,* 14**,** 373-380.

HIGGINS, J. P., THOMPSON, S. G., DEEKS, J. J. & ALTMAN, D. G. 2003. Measuring inconsistency in meta-analyses. *Bmj,* 327**,** 557-60.

HOFFMAN, M., MOFOLO, I., SALIMA, C., HOFFMAN, I., ZADROZNY, S., MARTINSON, F. & VAN DER HORST, C. 2012. Utilization of family members to provide hospital care in Malawi: the role of Hospital Guardians. *Malawi Med J,* 24**,** 74-8.

HONG, X., YAN, J., XU, L., SHEN, S., ZENG, X. & CHEN, L. 2019. Relationship between nutritional status and frailty in hospitalized older patients. *Clinical interventions in aging***,** 105-111.

HOOGENDIJK, E. O., AFILALO, J., ENSRUD, K. E., KOWAL, P., ONDER, G. & FRIED, L. P. 2019. Frailty: implications for clinical practice and public health. *The Lancet,* 394**,** 1365-1375.

HOOGENDIJK, E. O., VAN HOUT, H. P. J., HEYMANS, M. W., VAN DER HORST, H. E., FRIJTERS, D. H. M., BROESE VAN GROENOU, M. I., DEEG, D. J. H. & HUISMAN, M. 2014. Explaining the association between educational level and frailty in older adults: results from a 13-year longitudinal study in the Netherlands. *Annals of Epidemiology,* 24**,** 538-544.e2.

HOSAKA, L., TUPETZ, A., SAKITA, F. M., SHAYO, F., STATON, C., MMBAGA, B. T. & JOINER, A. P. 2023. A qualitative assessment of stakeholder perspectives on barriers and facilitators to emergency care delays in Northern Tanzania through the Three Delays. *African Journal of Emergency Medicine,* 13**,** 191-198.

HOWARTH-MADDISON, M., GAMASSA, E., SAFIC, S., ANDREA, D., URASA, S., WALKER, R. W., GRAY, W. K., HAULE, I., DOTCHIN, C. L. & PADDICK, S. M. 2022. Development of a brief screening method for identification of depression in older adults in Sub-Saharan Africa. *Aging Ment Health,* 26**,** 40-47.

HOWE, K. R. 1988. Against the Quantitative-Qualitative Incompatibility Thesis or Dogmas Die Hard. *Educational Researcher,* 17**,** 10-16.

HOWORTH, K., PADDICK, S. M., ROGATHI, J., WALKER, R., GRAY, W., OATES, L. L., ANDREA, D., SAFIC, S., URASA, S., HAULE, I. & DOTCHIN, C. 2019. Conceptualization of depression amongst older adults in rural Tanzania: a qualitative study. *Int Psychogeriatr,* 31**,** 1473-1481.

IBRAHIM, K., HOWSON, F. F. A., CULLIFORD, D. J., SAYER, A. A. & ROBERTS, H. C. 2019. The feasibility of assessing frailty and sarcopenia in hospitalised older people: a comparison of commonly used tools. *BMC Geriatrics,* 19**,** 42.

IDLER, E. L. & BENYAMINI, Y. 1997. Self-rated health and mortality: a review of twenty-seven community studies. *J Health Soc Behav,* 38**,** 21-37.

INOUYE, S. K., STUDENSKI, S., TINETTI, M. E. & KUCHEL, G. A. 2007. Geriatric syndromes: clinical, research, and policy implications of a core geriatric concept. *J Am Geriatr Soc,* 55**,** 780-91.

INOUYE, S. K., VAN DYCK, C. H., ALESSI, C. A., BALKIN, S., SIEGAL, A. P. & HORWITZ, R. I. 1990. Clarifying confusion: the confusion assessment method: a new method for detection of delirium. *Annals of internal medicine,* 113**,** 941-948.

INTERNATIONAL TRADE ADMINISTRATION. 2021. *Tanzania - Country Commercial Guide* [Online]. Washington DC: International Trade Administration, U.S. Department of Commerce. Available: https://www.trade.gov/country-commercial-guides/tanzania-healthcare [Accessed 23/06/22].

JACKSON, J. L., KURIYAMA, A., ANTON, A., CHOI, A., FOURNIER, J.-P., GEIER, A.-K., JACQUERIOZ, F., KOGAN, D., SCHOLCOFF, C. & SUN, R. 2019. The Accuracy of Google Translate for Abstracting Data From Non–English-Language Trials for Systematic Reviews. *Annals of Internal Medicine,* 171**,** 677-679.

JECKER, N. S., ATUIRE, C. A. & KENWORTHY, N. 2022. Realizing Ubuntu in Global Health: An African Approach to Global Health Justice. *Public Health Ethics*.

JI, L., ZHU, B., WANG, J., DING, M., GAO, Y., QIAO, X., JIN, Y., SI, H. & WANG, C. 2022. Executive function and attentional bias as serial mediators in the relationship between frailty and depressive symptoms among older inpatients: A cross-sectional study. *Journal of Clinical Nursing*.

JIAO, J., WANG, Y., ZHU, C., LI, F., ZHU, M., WEN, X., JIN, J., WANG, H., LV, D. & ZHAO, S. 2020. Prevalence and associated factors for frailty among elder patients in China: a multicentre cross-sectional study. *BMC geriatrics,* 20**,** 1-10.

JL, C., MAHMOUD, D., INA ISMIARTI, S., TEANG SOON, C., KHOR HUI, M. I. N. & LOH PUI, S. A. N. 2021. Comparing the Association of Different Frailty Screening Tools with Postoperative Delirium...Malaysian Society of Anaesthesiologists & College of Anaesthesiologists, AMM, Annual Scientific Congress August 6-8, 2021 (Virtual). *Medicine & Health (Universiti Kebangsaan Malaysia),* 16**,** 53-54.

JOHN, M. E., MGBEKEM, M. A., NSEMO, A. D. & MAXWELL, G. I. 2016. Missed nursing care, patient outcomes and care outcomes in selected hospitals in Southern Nigeria. *nursing,* 152**,** 81-87.

JOHNSON, R. B. & ONWUEGBUZIE, A. J. 2004. Mixed Methods Research: A Research Paradigm Whose Time Has Come. *Educational Researcher,* 33**,** 14-26.

JONES, D. M., SONG, X. & ROCKWOOD, K. 2004. Operationalizing a frailty index from a standardized comprehensive geriatric assessment. *J Am Geriatr Soc,* 52**,** 1929-33.

KAGAIGAI, A., ANAELI, A., GREPPERUD, S. & MORI, A. T. 2023. Healthcare utilization and catastrophic health expenditure in rural Tanzania: does voluntary health insurance matter? *BMC Public Health,* 23**,** 1567.

KAISER, M. J., BAUER, J. M., RAMSCH, C., UTER, W., GUIGOZ, Y., CEDERHOLM, T., THOMAS, D. R., ANTHONY, P., CHARLTON, K. E., MAGGIO, M., TSAI, A. C., GRATHWOHL, D., VELLAS, B. & SIEBER, C. C. 2009. Validation of the Mini Nutritional Assessment short-form (MNA-SF): a practical tool for identification of nutritional status. *J Nutr Health Aging,* 13**,** 782-8.

KALLIO, H., PIETILÄ, A.-M., JOHNSON, M. & KANGASNIEMI, M. 2016. Systematic methodological review: developing a framework for a qualitative semi-structured interview guide. *Journal of Advanced Nursing,* 72**,** 2954-2965.

KANG, L., ZHANG, S. Y., ZHU, W. L., PANG, H. Y., ZHANG, L., ZHU, M. L., LIU, X. H. & LIU, Y. T. 2015. Is frailty associated with short-term outcomes for elderly patients with acute coronary syndrome? *J Geriatr Cardiol,* 12**,** 662-7.

KASA, A. S., LEE, S.-C. & CHANG, H.-C. 2024a. Frailty in older people living in Africa: A systematic review of prevalence and associated factors. *Archives of Gerontology and Geriatrics Plus,* 1**,** 100078.

KASA, A. S., TRAYNOR, V. & DRURY, P. 2024b. Measuring the effects of nurse-led frailty intervention on community-dwelling older people in Ethiopia: a quasi-experimental study. *BMC Geriatrics,* 24**,** 384.

KAUFMAN, S. R. 1994. The social construction of frailty: An anthropological perspective. *Journal of Aging Studies,* 8**,** 45-58.

KHANDELWAL, D., GOEL, A., KUMAR, U., GULATI, V., NARANG, R. & DEY, A. B. 2012. Frailty is associated with longer hospital stay and increased mortality in hospitalized older patients. *J Nutr Health Aging,* 16**,** 732-5.

KIMAMBO, I. N., MADDOX, G. H. & NYANTO, S. S. 2017a. The Early Years of Independence up to 1967. *A New History of Tanzania.* Mkuki na Nyota Publishers.

KIMAMBO, I. N., MADDOX, G. H. & NYANTO, S. S. 2017b. Economic Liberalisation and Multiparty Politics. *A New History of Tanzania.* Mkuki na Nyota Publishers.

KIMAMBO, I. N., MADDOX, G. H. & NYANTO, S. S. 2017c. The Expansion of European Influence to 1890. *A New History of Tanzania.* Mkuki na Nyota Publishers.

KIMAMBO, I. N., MADDOX, G. H. & NYANTO, S. S. 2017d. [PART ONE Introduction]. *A New History of Tanzania.* Mkuki na Nyota Publishers.

KITOLE, F. A., LIHAWA, R. M. & MKUNA, E. 2023. Equity in the public social healthcare protection in Tanzania: does it matter on household healthcare financing? *International Journal for Equity in Health,* 22**,** 50.

KIZILARSLANOGLU, M. C., CIVELEK, R., KILIC, M. K., SUMER, F., VARAN, H. D., KARA, O., ARIK, G., TURKOGLU, M., AYGENCEL, G. & ULGER, Z. 2017. Is frailty a prognostic factor for critically ill elderly patients? *Aging clinical and experimental research,* 29**,** 247-255.

KOCMAN, D., REGEN, E., PHELPS, K., MARTIN, G., PARKER, S., GILBERT, T. & CONROY, S. 2019. Can comprehensive geriatric assessment be delivered without the need for geriatricians? A formative evaluation in two perioperative surgical settings. *Age and Ageing,* 48**,** 644-649.

KOJIMA, G., ILIFFE, S. & WALTERS, K. 2018. Frailty index as a predictor of mortality: a systematic review and meta-analysis. *Age Ageing,* 47**,** 193-200.

KOJIMA, G., WALTERS, K., ILIFFE, S., TANIGUCHI, Y. & TAMIYA, N. 2020. Marital Status and Risk of Physical Frailty: A Systematic Review and Meta-analysis. *J Am Med Dir Assoc,* 21**,** 322-330.

KOWAL, P., CHATTERJI, S., NAIDOO, N., BIRITWUM, R., FAN, W., LOPEZ RIDAURA, R., MAXIMOVA, T., AROKIASAMY, P., PHASWANA-MAFUYA, N. & WILLIAMS, S. 2012. Data resource profile: the World Health Organization Study on global AGEing and adult health (SAGE). *International journal of epidemiology,* 41**,** 1639-1649.

KOWAL, P. & DOWD, J. E. 2001. Definition of an older person. Proposed working definition of an older person in Africa for the MDS Project. *World Health Organization, Geneva, doi,* 10**,** 5188.9286.

LANDI, F., ONDER, G., RUSSO, A., LIPEROTI, R., TOSATO, M., MARTONE, A. M., CAPOLUONGO, E. & BERNABEI, R. 2014. Calf circumference, frailty and physical performance among older adults living in the community. *Clinical Nutrition,* 33**,** 539-544.

LANGA, N. & BHATTA, T. 2020. The rural-urban divide in Tanzania: Residential context and socioeconomic inequalities in maternal health care utilization. *PLoS One,* 15**,** e0241746.

LARKAN, F., UDUMA, O., LAWAL, S. A. & VAN BAVEL, B. 2016. Developing a framework for successful research partnerships in global health. *Globalization and Health,* 12**,** 17.

LEE, J. Y., YANG, Y. S. & CHO, E. 2022. Transitional care from hospital to home for frail older adults: A systematic review and meta-analysis. *Geriatric Nursing,* 43**,** 64-76.

LEKAN, D. A., COLLINS, S. K. & HAYAJNEH, A. A. 2021. Definitions of Frailty in Qualitative Research: A Qualitative Systematic Review. *J Aging Res,* 2021**,** 6285058.

LEWIS, E., PADDICK, S.-M., BANKS, J., DUINMAIJER, A., TUCKER, L., KISOLI, A., CLETUS, J., LISSU, C., DOTCHIN, C., GRAY, W., WALKER, R. & URASA, S. 2016. Prevalence of Delirium in Older Medical Inpatients in Tanzania. *Journal of the American Geriatrics Society,* 64**,** e28-e29.

LEWIS, E. G., BRECKONS, M., LEE, R. P., DOTCHIN, C. & WALKER, R. 2020a. Rationing care by frailty during the COVID-19 pandemic. *Age and Ageing,* 50**,** 7-10.

LEWIS, E. G., BURN, E., RICHARDSON, F., MDEGELLA, D., ZERD, F., GRAY, W., URASA, S., WALKER, R. & DOTCHIN, C. 2019. 69OUTCOMES OF FRAILTY IN RURAL TANZANIA...British Geriatrics Society Spring Meeting. 10-12 April 2019, Cardiff, Wales. *Age & Ageing,* 48**,** ii19-ii19.

LEWIS, E. G., COLES, S., HOWORTH, K., KISSIMA, J., GRAY, W., URASA, S., WALKER, R. & DOTCHIN, C. 2018a. The prevalence and characteristics of frailty by frailty phenotype in rural Tanzania. *BMC Geriatr,* 18**,** 283.

LEWIS, E. G., GRAY, W. K., WALKER, R., URASA, S., WITHAM, M. & DOTCHIN, C. 2022. Multimorbidity and its socio-economic associations in community-dwelling older adults in rural Tanzania; a cross-sectional study. *BMC public health,* 22**,** 1918.

LEWIS, E. G., OATES, L. L., ROGATHI, J., DUINMAIJER, A., SHAYO, A., MEGIROO, S., BAKARI, B., DEWHURST, F., WALKER, R. W., DEWHURST, M. & URASA, S. 2018b. "We never speak about death." Healthcare professionals' views on palliative care for inpatients in Tanzania: A qualitative study. *Palliat Support Care,* 16**,** 566-579.

LEWIS, E. G., ROGATHI, J., KISSIMA, J., BRECKONS, M., LEE, R. & URASA, S. 2021. A cross-cultural investigation of the conceptualisation of frailty in northern Tanzania. *Ageing and Society*, 1-34.

LEWIS, E. G., WHITTON, L. A., COLLIN, H., URASA, S., HOWORTH, K., WALKER, R. W., DOTCHIN, C., MULLIGAN, L., SHAH, B., MOHAMED, A., MDEGELLA, D., MKODO, J., ZERD, F. & GRAY, W. K. 2020b. A brief frailty screening tool in Tanzania: external validation and refinement of the B-FIT screen. *Aging Clin Exp Res,* 32**,** 1959-1967.

LEWIS, E. G., WOOD, G., HOWORTH, K., SHAH, B., MULLIGAN, L., KISSIMA, J., DOTCHIN, C., GRAY, W., URASA, S. & WALKER, R. 2018c. Prevalence of Frailty in Older Community-Dwelling Tanzanians According to Comprehensive Geriatric Assessment. *Journal of the American Geriatrics Society,* 66**,** 1484-1490.

LI, Q., CHEN, X. & HAN, B. 2021. Effect Modification by Sex of the Hemoglobin Concentration on Frailty Risk in Hospitalized Older Patients. *Clinical interventions in aging,* 16**,** 687-696.

LI, Q., HAN, B. & CHEN, X. 2020. The association between sociodemographic factors, frailty, and health-related quality of life in older inpatients: a cross-sectional study. *Quality of Life Research,* 29**,** 3233-3241.

LIANG, Y., WANG, H., FU, K., SUN, N., YAO, S., ZHENG, P., WAN, Y. & YANG, J. 2019a. Frailty assessment and short-term prognosis in elderly hospitalized patients with cardiovascular disease. *Circulation,* 140.

LIANG, Y.-D., ZHANG, Y.-N., LI, Y.-M., CHEN, Y.-H., XU, J.-Y., LIU, M., LI, J., MA, Z., QIAO, L.-L., WANG, Z., YANG, J.-F. & WANG, H. 2019b. Identification of Frailty and Its Risk Factors in Elderly Hospitalized Patients from Different Wards: A Cross-Sectional Study in China. *Clinical interventions in aging,* 14**,** 2249-2259.

LIGTHART-MELIS, G. C., LUIKING, Y. C., KAKOUROU, A., CEDERHOLM, T., MAIER, A. B. & DE VAN DER SCHUEREN, M. A. E. 2020. Frailty, Sarcopenia, and Malnutrition Frequently (Co-)occur in Hospitalized Older Adults: A Systematic Review and Meta-analysis. *Journal of the American Medical Directors Association,* 21**,** 1216-1228.

LIN, K., NING, Y., MUMTAZ, A. & LI, H. 2021. Exploring the Relationships Between Four Aging Ideals: A Bibliometric Study. *Front Public Health,* 9**,** 762591.

LIN, L., XU, C. & CHU, H. 2022. Empirical Comparisons of 12 Meta-analysis Methods for Synthesizing Proportions of Binary Outcomes. *J Gen Intern Med,* 37**,** 308-317.

LING, L., WANG, Y., ZHANG, Y. & XIONG, L. 2019. Correlation between frailty syndrome and muscle function in elderly patients. *Chinese Nursing Research,* 33.

LIPSCOMB, M. 2008. Mixed method nursing studies: a critical realist critique. *Nurs Philos,* 9**,** 32-45.

LOCAL GOVERNMENT KILIMANJARO REGION 2017. Kilimanjaro Region Investment Guide. Dar es Salaam.

LUMUMBA-KASONGO, T. 2018. Ubuntu and Pan-Africanism: The Dialectics of Learning About Africa. *In:* TAKYI-AMOAKO, E. J. & ASSIÉ-LUMUMBA, N. D. T. (eds.) *Re-Visioning Education in Africa: Ubuntu-Inspired Education for Humanity.* Cham: Springer International Publishing.

LUO, J., TANG, W., SUN, Y. & JIANG, C. 2020. Impact of frailty on 30-day and 1-year mortality in hospitalised elderly patients with community-acquired pneumonia: a prospective observational study. *BMJ open,* 10**,** e038370.

LV, C., SHI, W., PAN, T., LI, H., PENG, W., XU, J. & DENG, J. 2022a. Exploration of Aging-Care Parameters to Predict Mortality of Patients Aged 80-Years and Above with Community-Acquired Pneumonia. *Clinical interventions in aging,* 17**,** 1379-1391.

LV, J., LI, R., YUAN, L., YANG, X. L., WANG, Y., YE, Z. W. & HUANG, F. M. 2022b. Research on the frailty status and adverse outcomes of elderly patients with multimorbidity. *BMC geriatrics,* 22**,** 560.

LYNCH, M. 2000. Against Reflexivity as an Academic Virtue and Source of Privileged Knowledge. *Theory, Culture & Society,* 17**,** 26-54.

MA, Y., HOU, L., HUANG, Z., YANG, X., ZHAO, N., HE, M., SHI, Y., KANG, Y., YUE, J. & WU, C. 2020. The association between frailty and severe disease among COVID-19 patients aged over 60 years in China: A prospective cohort study. *BMC Medicine,* 18**,** 274.

MACDONALD, S. H., TRAVERS, J., SHÉ É, N., BAILEY, J., ROMERO-ORTUNO, R., KEYES, M., O'SHEA, D. & COONEY, M. T. 2020. Primary care interventions to address physical frailty among community-dwelling adults aged 60 years or older: A meta-analysis. *PLoS One,* 15**,** e0228821.

MACHA, D. P. & MASSAWE, N. M. 2023. Financial Technology in Tanzania: Assessment of Growth Drivers.

MACHA, J., HARRIS, B., GARSHONG, B., ATAGUBA, J. E., AKAZILI, J., KUWAWENARUWA, A. & BORGHI, J. 2012. Factors influencing the burden of health care financing and the distribution of health care benefits in Ghana, Tanzania and South Africa. *Health Policy and Planning,* 27**,** i46-i54.

MACHA, J., KUWAWENARUWA, A., MAKAWIA, S., MTEI, G. & BORGHI, J. 2014. Determinants of community health fund membership in Tanzania: a mixed methods analysis. *BMC Health Services Research,* 14**,** 538.

MALTERUD, K., SIERSMA, V. D. & GUASSORA, A. D. 2016. Sample Size in Qualitative Interview Studies:Guided by Information Power. *Qualitative Health Research,* 26**,** 1753-1760.

MALUKA, S. O. 2013. Why are pro-poor exemption policies in Tanzania better implemented in some districts than in others? *Int J Equity Health,* 12**,** 80.

MANYAMA, W. 2017. Dynamics in family patterns in Tanzania: the case of Kijitonyama Ward, Kinondoni District, Dar es Salaam region, Tanzania. *Journal of Sociology and Social Work,* 5**,** 68-79.

MAPCHART.NET. 2024. *Custom World Map* [Online]. Mapchart.net. Available: https://www.mapchart.net/world.html [Accessed 10/06/24].

MAPOMA, C. C. 2014. Determinants of active ageing in Zambia. *African population studies,* 28**,** 1286-1296.

MBOERA, L. E. G., RUMISHA, S. F., LYIMO, E. P., CHIDUO, M. G., MANGU, C. D., MREMI, I. R., KUMALIJA, C. J., JOACHIM, C., KISHAMAWE, C., MASSAWE, I. S., MATEMBA, L. E., KIMARIO, E., BWANA, V. M. & MKWASHAPI, D. M. 2018. Cause-specific mortality patterns among hospital deaths in Tanzania, 2006-2015. *PLoS One,* 13**,** e0205833.

MBOGHOINA, T. & OSBERG, L. 2010. Social protection of the elderly in Tanzania: Current status and future possibilities. *Special Paper 10/5.* Dar Es Salaam: REPOA.

MCINTYRE, D. 2004. Health policy and older people in Africa. *Living longer: ageing, development and social protection.* London: Zed Books.

MCKENZIE, J. & JOY, A. 2020. Family intervention improves outcomes for patients with delirium: Systematic review and meta-analysis. *Australas J Ageing,* 39**,** 21-30.

MENG, H. Y., XI, J., LI, M. L., LIU, M. J. & WANG, L. 2021. Frailty in elderly inpatients with cardiovascular disease: an exploration of associated factors. *European Journal of Cardiovascular Nursing,* 20**,** 736-744.

MFINANGA, S. G., GATEI, W., TINUGA, F., MWENGEE, W. M. P., YOTI, Z., KAPOLOGWE, N., NAGU, T., SWAMINATHAN, M. & MAKUBI, A. 2023. Tanzania's COVID-19 vaccination strategy: lessons, learning, and execution. *The Lancet,* 401**,** 1649.

MFINANGA, S. G., MNYAMBWA, N. P., MINJA, D. T., NTINGINYA, N. E., NGADAYA, E. & MAKANI, J. 2021. Tanzania's position on the COVID-19 pandemic. *The Lancet,* 397**,** 1542.

MFUNGO, B. D., KAHIMBA, J. & LUPALA, F. 2022. Elderly Perceptions Regarding Changes in the Parent-Child Relationship in the Modern Era: A Case of Coast Region, Tanzania. *East African Journal of Education and Social Sciences (EAJESS),* 3**,** 63-75.

MICKLESFIELD, L. K., MUNTHALI, R., AGONGO, G., ASIKI, G., BOUA, P., CHOMA, S. S., CROWTHER, N. J., FABIAN, J., GÓMEZ-OLIVÉ, F. X., KABUDULA, C., MAIMELA, E., MOHAMED, S. F., NONTERAH, E. A., RAAL, F. J., SORGHO, H., TLUWAY, F. D., WADE, A. N., NORRIS, S. A. & RAMSAY, M. 2023. Identifying the prevalence and correlates of multimorbidity in middle-aged men and women: a cross-sectional population-based study in four African countries. *BMJ Open,* 13**,** e067788.

MICROSOFT BING. 2022. *Bing Maps - Africa* [Online]. Microsoft. Available: https://www.bing.com/maps?showmyplaces=true [Accessed 24/06/22].

MIGLIAVACA, C. B., STEIN, C., COLPANI, V., MUNN, Z. & FALAVIGNA, M. 2020. Quality assessment of prevalence studies: a systematic review. *J Clin Epidemiol,* 127**,** 59-68.

MINISTRY OF LABOUR YOUTH DEVELOPMENT AND SPORTS 2003. National Ageing Policy. Tanzania: United Republic of Tanzania.

MMBALI, S. & CHILLO, P. 2017. Applicability of structured telephone monitoring to follow up heart failure patients discharged from Muhimbili National Hospital, Tanzania. *Tanzania Journal of Health Research,* 19.

MOORE, D. T., DAVIDSON, S. L., MURRAY, A., RANDALL, T., HARDY, J., LYIMO, G., KILASARA, J., URASA, S., WALKER, R. W. & DOTCHIN, C. L. 2024. Cause of death amongst frail and non-frail older people post-hospital admission in northern Tanzania [Conference abstract]. *Age and Ageing,* 53.

MORENO-ARIÑO, M., TORRENTE JIMÉNEZ, I., CARTANYÀ GUTIÉRREZ, A., OLIVA MORERA, J. C. & COMET, R. 2020. Assessing the strengths and weaknesses of the Clinical Frailty Scale through correlation with a frailty index. *Aging Clinical and Experimental Research,* 32**,** 2225-2232.

MORLEY, J. E. 2017. The Importance of Geriatric Syndromes. *Mo Med,* 114**,** 99-100.

MOWBRAY, F. I., MANLONGAT, D., CORREIA, R. H., STRUM, R. P., FERNANDO, S. M., MCISAAC, D., DE WIT, K., WORSTER, A., COSTA, A. P., GRIFFITH, L. E., DOUMA, M., NOLAN, J. P., MUSCEDERE, J., COUBAN, R. & FOROUTAN, F. 2021. Prognostic association of frailty with post-arrest outcomes following cardiac arrest: A systematic review and meta-analysis. *Resuscitation,* 167**,** 242-250.

MSECHU, J. J. Intergenerational Relationships and Eldercare in Rural Tanzania: A Life Course Perspective on The Implications of Social Change on Families. 2014.

MUDGE, A. M., MCRAE, P., BANKS, M., BLACKBERRY, I., BARRIMORE, S., ENDACOTT, J., GRAVES, N., GREEN, T., HARVEY, G., HUBBARD, R., KURRLE, S., LIM, W. K., LEE-STEERE, K., MASEL, P., PANDY, S., YOUNG, A., BARNETT, A. & INOUYE, S. K. 2022. Effect of a Ward-Based Program on Hospital-Associated Complications and Length of Stay for Older Inpatients: The Cluster Randomized CHERISH Trial. *JAMA Intern Med,* 182**,** 274-282.

MUKUMBANG, F. C. 2023. Retroductive theorizing: a contribution of critical realism to mixed methods research. *Journal of Mixed Methods Research,* 17**,** 93-114.

MUNN, Z., MOOLA, S., LISY, K., RIITANO, D. & TUFANARU, C. 2015. Methodological guidance for systematic reviews of observational epidemiological studies reporting prevalence and cumulative incidence data. *JBI Evidence Implementation,* 13**,** 147-153.

MURPHY, J., HATFIELD, J., AFSANA, K. & NEUFELD, V. 2015a. Making a Commitment to Ethics in Global Health Research Partnerships: A Practical Tool to Support Ethical Practice. *Journal of Bioethical Inquiry,* 12**,** 137-146.

MURPHY, K., JORDAN, F., HUNTER, A., COONEY, A. & CASEY, D. 2015b. Articulating the strategies for maximising the inclusion of people with dementia in qualitative research studies. *Dementia (London),* 14**,** 800-24.

MWANYANGALA, M. A., MAYOMBANA, C., URASSA, H., CHARLES, J., MAHUTANGA, C., ABDULLAH, S. & NATHAN, R. 2010. Health status and quality of life among older adults in rural Tanzania. *Glob Health Action,* 3.

NAAH, F. L., NJONG, A. M. & KIMENGSI, J. N. 2020. Determinants of Active and Healthy Ageing in Sub-Saharan Africa: Evidence from Cameroon. *International Journal of Environmental Research and Public Health,* 17**,** 3038.

NAEEM, E. H., MOSTAFA, N. S. & EL-SAID, S. M. S. 2020. Prevalence of frailty among elderly patients attending primary health care centers in sixth of October city. *The Egyptian Journal of Geriatrics and Gerontology,* 7**,** 5-11.

NARH-BANA, S. A., CHIRWA, T. F., MWANYANGALA, M. A. & NATHAN, R. 2012. Adult deaths and the future: a cause-specific analysis of adult deaths from a longitudinal study in rural Tanzania 2003-2007. *Trop Med Int Health,* 17**,** 1396-404.

NATIONAL CENTER FOR BIOTECHNOLOGY INFORMATION (NCBI). 1869 - cited 02/07/24. *Bethesda (MD): National Library of Medicine (US), National Center for Biotechnology Information* [Online]. Available: https://www.ncbi.nlm.nih.gov/ [Accessed].

NATIONAL INSTITUTE FOR HEALTH AND CARE EXCELLENCE 2020. NICE guideline [NG159] COVID-19 rapid guideline: critical care in adults. *In:* HEALTH, D. O. (ed.). London: National Institute for Health and Care Excellence.

NG, N., KOWAL, P., KAHN, K., NAIDOO, N., ABDULLAH, S., BAWAH, A., BINKA, F., CHUC, N. T., DEBPUUR, C., EGONDI, T., XAVIER GÓMEZ-OLIVÉ, F., HAKIMI, M., HIRVE, S., HODGSON, A., JUVEKAR, S., KYOBUTUNGI, C., VAN MINH, H., MWANYANGALA, M. A., NATHAN, R., RAZZAQUE, A., SANKOH, O., KIM STREATFIELD, P., THOROGOOD, M., WALL, S., WILOPO, S., BYASS, P., TOLLMAN, S. M. & CHATTERJI, S. 2010. Health inequalities among older men and women in Africa and Asia: evidence from eight Health and Demographic Surveillance System sites in the INDEPTH WHO-SAGE Study. *Glob Health Action,* 3.

NGUYEN, A. T., NGUYEN, T. X., NGUYEN, T. N., NGUYEN, T. H. T., PHAM, T., CUMMING, R., HILMER, S. N. & VU, H. T. T. 2019a. The impact of frailty on prolonged hospitalization and mortality in elderly inpatients in Vietnam: a comparison between the frailty phenotype and the Reported Edmonton Frail Scale. *Clinical interventions in aging***,** 381-388.

NGUYEN, T. N., CUMMING, R. G. & HILMER, S. N. 2015. A Review of Frailty in Developing Countries. *J Nutr Health Aging,* 19**,** 941-6.

NGUYEN, T. V., LE, D., TRAN, K. D., BUI, K. X. & NGUYEN, T. N. 2019b. Frailty in older patients with acute coronary syndrome in Vietnam. *Clinical Interventions in Aging***,** 2213-2222.

NGUYEN, T. V., LY, T. T. & NGUYEN, T. N. 2020a. A Pilot Study of the Clinical Frailty Scale to Predict Frailty Transition and Readmission in Older Patients in Vietnam. *International journal of environmental research and public health,* 17.

NGUYEN, T. X., NGUYEN, A. T., NGUYEN, H. T. T., NGUYEN, T. T. H., NGUYEN, T. N., PHAM, T. & VU, H. T. T. 2020b. Polypharmacy at discharge in older hospitalised patients in Vietnam and its association with frailty. *Australasian journal on ageing,* 39**,** 230-236.

NÓBREGA, P. V., MACIEL, A. C., DE ALMEIDA HOLANDA, C. M., OLIVEIRA GUERRA, R. & ARAÚJO, J. F. 2014. Sleep and frailty syndrome in elderly residents of long-stay institutions: a cross-sectional study. *Geriatr Gerontol Int,* 14**,** 605-12.

NORRIS, A., JACKSON, A. & KHOSHNOOD, K. 2012. Exploring the Ethics of Observational Research: The Case of an HIV Study in Tanzania. *AJOB Primary Research,* 3**,** 30-39.

NOVEK, S. & WILKINSON, H. 2019. Safe and Inclusive Research Practices for Qualitative Research Involving People with Dementia: A Review of Key Issues and Strategies. *Dementia (London),* 18**,** 1042-1059.

NTAHOSANZWE, M. & RWEGOSHORA, H. 2021. Effectiveness of exemption measure in providing healthcare services among old people in Tanzania: The case of Kasulu District. *Huria: Journal of the Open University of Tanzania,* 28.

NTSAMA ESSOMBA, M.-J., ESSON MAPOKO, B. S., METOGO MBENGONO, J. A., SIMO-TABUE, N., KENGNE, A. P., CHOUKEM, S. P., SOBNGWI, E., ZE MINKANDE, J. & TABUE TEGUO, M. 2024. Pre-Therapeutic Assessment of Older People in Sub-Saharan Africa: Introduction to the Comprehensive Geriatric Assessment. *Journal of Clinical Medicine,* 13**,** 1801.

O'CAOIMH, R., SEZGIN, D., O'DONOVAN, M. R., MOLLOY, D. W., CLEGG, A., ROCKWOOD, K. & LIEW, A. 2021. Prevalence of frailty in 62 countries across the world: a systematic review and meta-analysis of population-level studies. *Age Ageing,* 50**,** 96-104.

O'CATHAIN, A. 2009. Mixed methods research in the health sciences: A quiet revolution. Sage Publications Sage CA: Los Angeles, CA.

OBIORA, U. 2020. In-Hospital Elderly Mortality in a Nigerian Tertiary Health Care Center. *Elderly Health Journal,* 6.

OBRIST, B. 2016. 95Place matters: the home as a key site of old-age care in coastal Tanzania. *In:* HOFFMAN, J. & PYPE, K. (eds.) *Ageing in Sub-Saharan Africa: Spaces and Practices of Care.* Policy Press.

OECD 2021. Pension Markets in Focus 2021. Paris.

OFORI-ASENSO, R., CHIN, K. L., MAZIDI, M., ZOMER, E., ILOMAKI, J., ZULLO, A. R., GASEVIC, D., ADEMI, Z., KORHONEN, M. J., LOGIUDICE, D., BELL, J. S. & LIEW, D. 2019. Global Incidence of Frailty and Prefrailty Among Community-Dwelling Older Adults: A Systematic Review and Meta-analysis. *JAMA Netw Open,* 2**,** e198398.

OLIVEIRA CROSSETTI, M. D. G., ANTUNES, M., FERREIRA WALDMAN, B., RUBIN UNICOVSKY, M. A., HENRIQUE DE ROSSO, L. & DALLA LANA, L. 2018. Factors that contribute to a NANDA nursing diagnosis of risk for frail elderly syndrome. *Revista Gaucha de Enfermagem,* 39**,** 1-17.

OLIVEIRA, D. R., BETTINELLI, L. A., PASQUALOTTI, A., CORSO, D., BROCK, F. & ERDMANN, A. L. 2013. Prevalence of frailty syndrome in old people in a hospital institution. *Rev Lat Am Enfermagem,* 21**,** 891-8.

OLIVER, D. 2021. David Oliver: What has the pandemic taught us about using frailty scales? *BMJ,* 374**,** n1683.

OLMOS-VEGA, F. M., STALMEIJER, R. E., VARPIO, L. & KAHLKE, R. 2023. A practical guide to reflexivity in qualitative research: AMEE Guide No. 149. *Medical Teacher,* 45**,** 241-251.

OMARI, C. K. 1991. THE FAMILY IN TANZANIA. *International Journal of Sociology of the Family,* 21**,** 55-71.

OPPONG, C. 2006. Familial Roles and Social Transformations:Older Men and Women in Sub-Saharan Africa. *Research on Aging,* 28**,** 654-668.

ORGANISATION FOR ECONOMIC COOPERATION AND DEVELOPMENT 2019. Life expectancy and healthy life expectancy at age 65. *Health at a Glance 2019: OECD Indicators.* Paris: OECD Publishing.

ORIMO, H., ITO, H., SUZUKI, T., ARAKI, A., HOSOI, T. & SAWABE, M. 2006. Reviewing the definition of “elderly”. *Geriatrics & gerontology international,* 6**,** 149-158.

ORME, J. G., REIS, J. & HERZ, E. J. 1986. Factorial and discriminant validity of the Center for Epidemiological Studies Depression (CES-D) scale. *Journal of clinical psychology,* 42**,** 28-33.

OSTIR, G. V., BERGES, I., KUO, Y.-F., GOODWIN, J. S., OTTENBACHER, K. J. & GURALNIK, J. M. 2012. Assessing gait speed in acutely ill older patients admitted to an acute care for elders hospital unit. *Archives of internal medicine,* 172**,** 353-358.

OUVRARD, C., AVILA-FUNES, J. A., DARTIGUES, J. F., AMIEVA, H. & TABUE-TEGUO, M. 2019. The Social Vulnerability Index: Assessing Replicability in Predicting Mortality Over 27 Years. *J Am Geriatr Soc,* 67**,** 1305-1306.

OUZZANI, M., HAMMADY, H., FEDOROWICZ, Z. & ELMAGARMID, A. 2016. Rayyan - a web and mobile app for systematic reviews. *Systematic Reviews,* 5.

OVIEDO-BRIONES, M., RODRÍGUEZ-LASO, Á., CARNICERO, J. A., GRYGLEWSKA, B., SINCLAIR, A. J., LANDI, F., VELLAS, B., RODRÍGUEZ ARTALEJO, F., CHECA-LÓPEZ, M. & RODRIGUEZ-MAÑAS, L. 2022. The ability of eight frailty instruments to identify adverse outcomes across different settings: the FRAILTOOLS project. *J Cachexia Sarcopenia Muscle,* 13**,** 1487-1501.

OXFORD BUSINESS GROUP. 2022. *An overview of Tanzania’s political history* [Online]. Oxford: Oxford Business Group. Available: https://oxfordbusinessgroup.com/overview/clearing-hurdles-country-stable-political-ground [Accessed 10/06/22].

OZOLINS, U., HALE, S., CHENG, X., HYATT, A. & SCHOFIELD, P. 2020. Translation and back-translation methodology in health research – a critique. *Expert Review of Pharmacoeconomics & Outcomes Research,* 20**,** 69-77.

ÖZTÜRK, Z. A., ÖZDEMIR, S., TÜRKBEYLER İ, H. & DEMIR, Z. 2017. Quality of life and fall risk in frail hospitalized elderly patients. *Turk J Med Sci,* 47**,** 1377-1383.

PADDICK, S.-M., GRAY, W. K., OGUNJIMI, L., LWEZUALA, B., OLAKEHINDE, O., KISOLI, A., KISSIMA, J., MBOWE, G., MKENDA, S., DOTCHIN, C. L., WALKER, R. W., MUSHI, D., COLLINGWOOD, C. & OGUNNIYI, A. 2015. Validation of the Identification and Intervention for Dementia in Elderly Africans (IDEA) cognitive screen in Nigeria and Tanzania. *BMC Geriatrics,* 15**,** 53.

PADDICK, S. M., LEWIS, E. G., DUINMAIJER, A., BANKS, J., URASA, S., TUCKER, L., KISOLI, A., CLETUS, J., LISSU, C., KISSIMA, J., DOTCHIN, C., GRAY, W. K., MUAKETOVA-LADINSKA, E., COSKER, G. & WALKER, R. W. 2018. Identification of delirium and dementia in older medical inpatients in Tanzania: A comparison of screening and diagnostic methods. *J Neurol Sci,* 385**,** 156-163.

PAGE, M. J., MCKENZIE, J. E., BOSSUYT, P. M., BOUTRON, I., HOFFMANN, T. C., MULROW, C. D., SHAMSEER, L., TETZLAFF, J. M., AKL, E. A., BRENNAN, S. E., CHOU, R., GLANVILLE, J., GRIMSHAW, J. M., HRÓBJARTSSON, A., LALU, M. M., LI, T., LODER, E. W., MAYO-WILSON, E., MCDONALD, S., MCGUINNESS, L. A., STEWART, L. A., THOMAS, J., TRICCO, A. C., WELCH, V. A., WHITING, P. & MOHER, D. 2021. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ,* 372**,** n71.

PARKER, M. & KINGORI, P. 2016. Good and Bad Research Collaborations: Researchers’ Views on Science and Ethics in Global Health Research. *PLOS ONE,* 11**,** e0163579.

PARKER, S. G., MCCUE, P., PHELPS, K., MCCLEOD, A., ARORA, S., NOCKELS, K., KENNEDY, S., ROBERTS, H. & CONROY, S. 2017. What is Comprehensive Geriatric Assessment (CGA)? An umbrella review. *Age and Ageing,* 47**,** 149-155.

PATTON, M. 1990. *Qualitative evaluation and research methods*, Sage Publications Inc.

PAYNE, C. F., WADE, A., KABUDULA, C. W., DAVIES, J. I., CHANG, A. Y., GOMEZ-OLIVE, F. X., KAHN, K., BERKMAN, L. F., TOLLMAN, S. M., SALOMON, J. A. & WITHAM, M. D. 2017. Prevalence and correlates of frailty in an older rural African population: findings from the HAALSI cohort study. *BMC Geriatr,* 17**,** 293.

PEIRCE, C. S. 1905. What Pragmatism is. *The Monist,* 15**,** 161-181.

PILOTTO, A., CELLA, A., PILOTTO, A., DARAGJATI, J., VERONESE, N., MUSACCHIO, C., MELLO, A. M., LOGROSCINO, G., PADOVANI, A., PRETE, C. & PANZA, F. 2017. Three Decades of Comprehensive Geriatric Assessment: Evidence Coming From Different Healthcare Settings and Specific Clinical Conditions. *Journal of the American Medical Directors Association,* 18**,** 192.e1-192.e11.

PINHEIRO, T. D. C. E., ALCÂNTARA, C. O., PEREIRA, F. M., ANDRADE, M. V. M. D., MORAES, E. N. D. & BICALHO, M. A. C. 2021. Clinical Frailty Scale in older adults admitted at Emergency Department: is baseline frailty a good predictor of Ninety-Day Mortality? *Revista Brasileira de Geriatria e Gerontologia,* 24**,** e210122.

PIZARRO-MENA, R., ROTAROU, E. S., CHAVARRO-CARVAJAL, D., WACHHOLZ, P. A., LÓPEZ, M. F., PERDOMO DELGADO, C., PARRA-SOTO, S., BARRIENTOS-CALVO, I., RETAMAL-WALTER, F. & RIVEROS-BASOALTO, G. 2024. Comprehensive Gerontological Assessment: An Update on the Concept and Its Evaluation Tools in Latin America and the Caribbean-A Literature Review. *Int J Environ Res Public Health,* 21.

POPESCU, A. 2020. The results of complex geriatric assessment in frail elderly patients from the Republic of Moldova. *European Geriatric Medicine,* 11**,** S212-S213.

PORTER, G., TEWODROS, A., BIFANDIMU, F., HESLOP, A. & GORMAN, M. 2015. Qualitative Methods for Investigating Transport and Mobility Issues among Commonly Socially Excluded Populations: A Case Study of Co-investigation with Older People in Rural Tanzania. *Transportation Research Procedia,* 11**,** 492-503.

PRANATA, R., HENRINA, J., LIM, M. A., LAWRENSIA, S., YONAS, E., VANIA, R., HUANG, I., LUKITO, A. A., SUASTIKA, K., KUSWARDHANI, R. A. T. & SETIATI, S. 2021. Clinical frailty scale and mortality in COVID-19: A systematic review and dose-response meta-analysis. *Arch Gerontol Geriatr,* 93**,** 104324.

PRINCE, M. J., ACOSTA, D., GUERRA, M., HUANG, Y., JACOB, K. S., JIMENEZ-VELAZQUEZ, I. Z., JOTHEESWARAN, A. T., LLIBRE RODRIGUEZ, J. J., SALAS, A., SOSA, A. L., ACOSTA, I., MAYSTON, R., LIU, Z., LLIBRE-GUERRA, J. J., PRINA, A. M. & VALHUERDI, A. 2021. Intrinsic capacity and its associations with incident dependence and mortality in 10/66 Dementia Research Group studies in Latin America, India, and China: A population-based cohort study. *PLoS Medicine,* 18**,** e1003097.

PRINCE, M. J., REISCHIES, F., BEEKMAN, A. T., FUHRER, R., JONKER, C., KIVELA, S. L., LAWLOR, B. A., LOBO, A., MAGNUSSON, H., FICHTER, M., VAN OYEN, H., ROELANDS, M., SKOOG, I., TURRINA, C. & COPELAND, J. R. 1999. Development of the EURO-D scale--a European, Union initiative to compare symptoms of depression in 14 European centres. *Br J Psychiatry,* 174**,** 330-8.

QIN, Y., HAO, X., LV, M., ZHAO, X., WU, S. & LI, K. 2023. A global perspective on risk factors for frailty in community-dwelling older adults: A systematic review and meta-analysis. *Archives of Gerontology and Geriatrics,* 105**,** 104844.

RAPLEY, T. 2011. Some pragmatics of qualitative data analysis. *Qualitative research,* 3**,** 273-290.

REID, E., GHOSHAL, A., KHALIL, A., JIANG, J., NORMAND, C., BRACKETT, A. & MAY, P. 2022. Out-of-pocket costs near end of life in low- and middle-income countries: A systematic review. *PLOS Glob Public Health,* 2**,** e0000005.

RENNERT-MAY, E., LEAL, J., THANH, N. X., LANG, E., DOWLING, S., MANNS, B., WASYLAK, T. & RONKSLEY, P. E. 2021. The impact of COVID-19 on hospital admissions and emergency department visits: A population-based study. *PLoS One,* 16**,** e0252441.

RICK, T. J., AAGARD, M., ERWIN, E., LEINTZ, C., DANIK, E., SERVENTI, F., HENKE, O. & YEATES, K. 2021. Barriers to Cancer Care in Northern Tanzania: Patient and Health-System Predictors for Delayed Presentation. *JCO Global Oncology***,** 1500-1508.

ROCKWOOD, K. & MITNITSKI, A. 2007. Frailty in Relation to the Accumulation of Deficits. *The Journals of Gerontology: Series A,* 62**,** 722-727.

ROCKWOOD, K. & MITNITSKI, A. 2012. How Might Deficit Accumulation Give Rise to Frailty? *J Frailty Aging,* 1**,** 8-12.

ROCKWOOD, K., SONG, X., MACKNIGHT, C., BERGMAN, H., HOGAN, D. B., MCDOWELL, I. & MITNITSKI, A. 2005. A global clinical measure of fitness and frailty in elderly people. *Cmaj,* 173**,** 489-95.

RODRIGUES, C., MENDONÇA, D. & MARTINS, M. M. 2020. Functional trajectories of older acute medical inpatients. *Enfermería Clínica (English Edition),* 30**,** 260-268.

RODRIGUES, M. K., NUNES RODRIGUES, I., VASCONCELOS GOMES DA SILVA, D. J., DE S. PINTO, J. M. & OLIVEIRA, M. F. 2021. Clinical Frailty Scale: Translation and Cultural Adaptation Into the Brazilian Portuguese Language. *The Journal of Frailty & Aging,* 10**,** 38-43.

ROLFSON, D. B., MAJUMDAR, S. R., TSUYUKI, R. T., TAHIR, A. & ROCKWOOD, K. 2006. Validity and reliability of the Edmonton Frail Scale. *Age Ageing,* 35**,** 526-9.

ROOPSAWANG, I., THOMPSON, H., ZASLAVSKY, O. & BELZA, B. 2020. The Reported Edmonton Frail Scale-Thai version: Development and Validation of a Culturally-Sensitive Instrument. *Nursing & Health Sciences,* 22**,** 685-693.

RUBENSTEIN, L. Z., HARKER, J. O., SALVÀ, A., GUIGOZ, Y. & VELLAS, B. 2001. Screening for Undernutrition in Geriatric Practice: Developing the Short-Form Mini-Nutritional Assessment (MNA-SF). *The Journals of Gerontology: Series A,* 56**,** M366-M372.

RUSH, K. L., HICKEY, S., EPP, S. & JANKE, R. 2017. Nurses' attitudes towards older people care: An integrative review. *J Clin Nurs,* 26**,** 4105-4116.

RUTAGUMIRWA, S. K., HUTTER, I. & BAILEY, A. 2020. “We Never Graduate from Care Giving Roles”; Cultural Schemas for Intergenerational Care Role Among Older Adults in Tanzania. *Journal of Cross-Cultural Gerontology,* 35**,** 409-431.

SADIQ, A. M., NJAU, R. E. & KILONZO, K. G. 2023. Disease patterns and clinical outcomes of medical admissions at a tertiary hospital in Northern Tanzania: A retrospective observational study. *Health Sci Rep,* 6**,** e983.

SCHNEIDER, C., AUBERT, C. E., DEL GIOVANE, C., DONZÉ, J. D., GASTENS, V., BAUER, D. C., BLUM, M. R., DALLEUR, O., HENRARD, S., KNOL, W., O’MAHONY, D., CURTIN, D., LEE, S. J., AUJESKY, D., RODONDI, N. & FELLER, M. 2022. Comparison of 6 Mortality Risk Scores for Prediction of 1-Year Mortality Risk in Older Adults With Multimorbidity. *JAMA Network Open,* 5**,** e2223911-e2223911.

SCHRAUF, R. W. 2017. Mixed Methods Designs for Making Cross-Cultural Comparisons. *Journal of Mixed Methods Research,* 12**,** 477-494.

SCHWARZER, G., CHEMAITELLY, H., ABU-RADDAD, L. J. & RÜCKER, G. 2019. Seriously misleading results using inverse of Freeman-Tukey double arcsine transformation in meta-analysis of single proportions. *Res Synth Methods,* 10**,** 476-483.

SEARLE, S. D., MITNITSKI, A., GAHBAUER, E. A., GILL, T. M. & ROCKWOOD, K. 2008. A standard procedure for creating a frailty index. *BMC Geriatr,* 8**,** 24.

SHAYO, E. H., KIVUYO, S., SEELEY, J., BUKENYA, D., KAROLI, P., MFINANGA, S. G., JAFFAR, S. & VAN HOUT, M.-C. 2022. The acceptability of integrated healthcare services for HIV and non-communicable diseases: experiences from patients and healthcare workers in Tanzania. *BMC Health Services Research,* 22**,** 655.

SHAYO, E. H., SENKORO, K. P., MOMBURI, R., OLSEN, Ø. E., BYSKOV, J., MAKUNDI, E. A., KAMUZORA, P. & MBOERA, L. E. G. 2016. Access and utilisation of healthcare services in rural Tanzania: A comparison of public and non-public facilities using quality, equity, and trust dimensions. *Global Public Health,* 11**,** 407-422.

SHAYO, F., ZACCHEUS, G. G., SAKITA, F., HERNANDES, T. R., VISSOCI, J. R. N., GORDEE, A., KUCHIBHATLA, M., KIREMEJI, M., MINJA, L., MMBAGA, B. T., STATON, C. A., KEATING, E. M. & JOINER, A. P. 2025. Emergency care knowledge, utilization, and barriers in Northern Tanzania: A community-based survey. *PLOS Glob Public Health,* 5**,** e0004032.

SHORTEN, A. & SMITH, J. 2017. Mixed methods research: expanding the evidence base. *Evid Based Nurs,* 20**,** 74-75.

SIDDAWAY, A. P., WOOD, A. M. & HEDGES, L. V. 2019. How to Do a Systematic Review: A Best Practice Guide for Conducting and Reporting Narrative Reviews, Meta-Analyses, and Meta-Syntheses. *Annu Rev Psychol,* 70**,** 747-770.

SIRILI, N., FRUMENCE, G., KIWARA, A., MWANGU, M., ANAELI, A., NYAMHANGA, T., GOICOLEA, I. & HURTIG, A.-K. 2018. Retention of medical doctors at the district level: a qualitative study of experiences from Tanzania. *BMC Health Services Research,* 18**,** 260.

SIRIWARDHANA, D. D., HARDOON, S., RAIT, G., WEERASINGHE, M. C. & WALTERS, K. R. 2018. Prevalence of frailty and prefrailty among community-dwelling older adults in low-income and middle-income countries: a systematic review and meta-analysis. *BMJ Open,* 8**,** e018195.

SNAVELY, M. E., OSHOSEN, M., MSOKA, E. F., KARIA, F. P., MAZE, M. J., BLUM, L. S., RUBACH, M. P., MMBAGA, B. T., MARO, V. P., CRUMP, J. A. & MUIRURI, C. 2020. "If You Have No Money, You Might Die": A Qualitative Study of Sociocultural and Health System Barriers to Care for Decedent Febrile Inpatients in Northern Tanzania. *Am J Trop Med Hyg,* 103**,** 494-500.

SORIC, G., LUPASCU-VOLENTIR, F., DESEATNICOVA, E., CHISLARI, L., NEGARA, A. & GROPPA, L. 2017. Frailty syndrome and fracture risk in elderly patients from the republic of Moldova. *Osteoporosis International,* 28**,** S615.

SOWA, A., TOBIASZ-ADAMCZYK, B., TOPOR-MADRY, R., POSCIA, A. & LA MILIA, D. I. 2016. Predictors of healthy ageing: public health policy targets. *BMC Health Serv Res,* 16 Suppl 5**,** 289.

STEPHEN EKPENYONG, M., NYASHANU, M., OSSEY-NWEZE, C. & SERRANT, L. 2021. Exploring the perceptions of dignity among patients and nurses in hospital and community settings: an integrative review. *Journal of Research in Nursing,* 26**,** 517-537.

STERNE, J. A. & DAVEY SMITH, G. 2001. Sifting the evidence-what's wrong with significance tests? *Bmj,* 322**,** 226-31.

STEVENSON, J. M., DAVIES, J. G. & MARTIN, F. C. 2019. Medication-related harm: a geriatric syndrome. *Age Ageing,* 49**,** 7-11.

STORTI, L., FABRÍCIO-WHEBE, S., KUSUMOTA, L., PARTEZANI-RODRIGUES, R. & MARQUES, S. 2013. Frailty of elderly patients admitted to the medical clinic of an emergency unit at a general tertiary hospital. 2013; 22 (2): 452-9.

SUKAMOLSON, S. 2007. Fundamentals of quantitative research. *Language Institute Chulalongkorn University,* 1**,** 1-20.

TANIGUCHI, L., SOUZA, I. A. O., SIQUEIRA, E. M. P. & RIBEIRO, P. C. 2018. Prevalence, nutrition risk evaluation and resource use of frail critically ill patients undergoing nutrition support therapy in a Brazilian tertiary hospital. *Intensive Care Medicine Experimental,* 6.

TANZANIAN NATIONAL BUREAU OF STATISTICS 2022. Basic Demographic and Socio-Economic Profile Kilimanjaro Region. Dar es Salaam: National Burea of Statistics.

TARIMO, C. S. & WU, J. 2020. The first confirmed case of COVID-19 in Tanzania: recommendations based on lesson learned from China. *Tropical Medicine and Health,* 48**,** 25.

TEDDLIE, C. & TASHAKKORI, A. 2010. SAGE Handbook of Mixed Methods in Social & Behavioral Research. 2 ed. Thousand Oaks

Thousand Oaks, California: SAGE Publications, Inc.

THADDEUS, S. & MAINE, D. 1994. Too far to walk: maternal mortality in context. *Soc Sci Med,* 38**,** 1091-110.

THE NATIONAL SECURITY FUND 2018. The Public Service Social Security Fund Act, 2018. The United Republic of Tanzania.

THE WORLD BANK 2020a. Data Catalog. *In:* BANK, T. W. (ed.).

THE WORLD BANK. 2020b. *Rural population (% of total population) - Tanzania: World Bank staff estimates based on the United Nations Population Division's World Urbanization Prospects* [Online]. The World Bank. Available: https://data.worldbank.org/indicator/SP.RUR.TOTL.ZS?end=2020&locations=TZ&start=1960&view=chart [Accessed 20/06/22].

THE WORLD BANK. 2022. *Life expectancy at birth, total (years) - Tanzania* [Online]. The World Bank Group. Available: https://data.worldbank.org/indicator/SP.DYN.LE00.IN?end=2020&locations=TZ&start=2000 [Accessed 12/08/2022 2022].

THEOU, O., ANDREW, M., AHIP, S. S., SQUIRES, E., MCGARRIGLE, L., BLODGETT, J. M., GOLDSTEIN, J., HOMINICK, K., GODIN, J., HOUGAN, G., ARMSTRONG, J. J., WALLACE, L., SAZLINA, S. G., MOORHOUSE, P., FAY, S., VISVANATHAN, R. & ROCKWOOD, K. 2019. The Pictorial Fit-Frail Scale: Developing a Visual Scale to Assess Frailty. *Canadian Geriatrics Journal,* 22**,** 64-74.

THEOU, O., CANN, L., BLODGETT, J., WALLACE, L. M., BROTHERS, T. D. & ROCKWOOD, K. 2015. Modifications to the frailty phenotype criteria: Systematic review of the current literature and investigation of 262 frailty phenotypes in the Survey of Health, Ageing, and Retirement in Europe. *Ageing Res Rev,* 21**,** 78-94.

THIAM, C. N., HASMUKHARAY, K., LIM, W. C., NG, C. C., PANG, G. H. M., ABDULLAH, A., SAEDON, N. I., KHOR, H. M. & ONG, T. 2021. COVID-19 Infection among Older People Admitted to Hospital: A Cross-Sectional Analysis. *Geriatrics (Basel, Switzerland),* 6.

THOROGOOD, A., MAKI-PETAJA-LEINONEN, A., BRODATY, H., DALPE, G., GASTMANS, C., GAUTHIER, S., GOVE, D., HARDING, R., KNOPPERS, B. M., ROSSOR, M., BOBROW, M., GLOBAL ALLIANCE FOR, G., HEALTH, A. & DEMENTIA TASK, T. 2018. Consent recommendations for research and international data sharing involving persons with dementia. *Alzheimers Dement,* 14**,** 1334-1343.

TIMANS, R., WOUTERS, P. & HEILBRON, J. 2019. Mixed methods research: what it is and what it could be. *Theory and Society,* 48**,** 193-216.

TINNETI, M., INIUYE, S. & GILL, T. 1995. Shared Risk Factors for Falls, Incontinence, and Functional Dependence

Unifying the Approach to Geriatric Syndromes. *JAMA,* 273**,** 1348-1353.

TUMAINI, B., MUNSERI, P. & PALLANGYO, K. 2019. Disease spectrum and outcomes among elderly patients in two tertiary hospitals in Dar es Salaam, Tanzania. *PLoS One,* 14**,** e0213131.

TUNGU, M., AMANI, P. J., HURTIG, A.-K., DENNIS KIWARA, A., MWANGU, M., LINDHOLM, L. & SAN SEBASTIÅN, M. 2020. Does health insurance contribute to improved utilization of health care services for the elderly in rural Tanzania? A cross-sectional study. *Global Health Action,* 13**,** 1841962.

TUNGU, M., SIRILI, N., FRUMENCE, G., KAGAIGAI, A., ANAELI, A., MWANGU, M. A. & KIWARA, A. D. 2022. Health care prioritization process for the elderly in rural Tanzania under decentralized system: prospects and challenges.

TZENG, H.-M. & YIN, C.-Y. 2009. Inpatient falls: the impact of family and personal caregivers. *Applied Nursing Research,* 22**,** 159-165.

UNITED KINGDOM GOVERNMENT. 2005. *Mental Capacity Act 2005* [Online]. United Kingdom. Available: https://www.legislation.gov.uk/ukpga/2005/9/contents [Accessed c. 9].

UNITED NATIONS 2015. Transforming our world: The 2030 agenda for sustainable development. New York.

UNITED NATIONS 2019. World Population Ageing 2019. *In:* DIVISION, D. O. E. A. S. A. P. (ed.). New York: United Nations.

UNITED NATIONS DEPARTMENT OF ECONOMIC AND SOCIAL AFFIARS POULATION DIVISION 2022. World Population Prospects. New York: United Nations.

UNITED NATIONS: DEPARTMENT OF ECONOMIC AND SOCIAL AFFAIRS 2015. Transforming our World: The 2030 Agenda for Sustainable Development. New York: United Nations.

UNITED REPUBLIC OF TANZANIA GOVERNMENT. 2008. *Mental Health Act* [Online]. Tanzania. Available: https://tanzlii.org [Accessed 04/08/25].

UNITED REPUBLIC OF TANZANIA MINISTRY OF HEALTH AND SOCIAL WELFARE 2015. Health Sector Strategic Plan July 2015 - June 2020 (HSSP IV). Dodoma, Tanzania.

USAID. 2022. *Tanzania: Democracy, Human Rights and Governance* [Online]. USAID. Available: https://www.usaid.gov/tanzania/democracy-human-rights-and-governance [Accessed 25/11/22].

USTÜN, T. B., CHATTERJI, S., KOSTANJSEK, N., REHM, J., KENNEDY, C., EPPING-JORDAN, J., SAXENA, S., VON KORFF, M. & PULL, C. 2010. Developing the World Health Organization Disability Assessment Schedule 2.0. *Bull World Health Organ,* 88**,** 815-23.

VAN EEUWIJK, P. 2016. Three: Older people providing care for older people in Tanzania: against conventions – but accepted

Ageing in Sub-Saharan Africa. Bristol, UK: Policy Press.

VAN NES, F., ABMA, T., JONSSON, H. & DEEG, D. 2010. Language differences in qualitative research: is meaning lost in translation? *Eur J Ageing,* 7**,** 313-316.

VAN NGUYEN, T., LY, T. T. & NGUYEN, T. N. 2020. A pilot study of the clinical frailty scale to predict frailty transition and readmission in older patients in Vietnam. *International Journal of Environmental Research and Public Health,* 17**,** 1582.

VASILEIOU, K., BARNETT, J., THORPE, S. & YOUNG, T. 2018. Characterising and justifying sample size sufficiency in interview-based studies: systematic analysis of qualitative health research over a 15-year period. *BMC Med Res Methodol,* 18**,** 148.

VERONESE, N., CUSTODERO, C., CELLA, A., DEMURTAS, J., ZORA, S., MAGGI, S., BARBAGALLO, M., SABBÀ, C., FERRUCCI, L. & PILOTTO, A. 2021. Prevalence of multidimensional frailty and pre-frailty in older people in different settings: A systematic review and meta-analysis. *Ageing Res Rev,* 72**,** 101498.

VERONESE, N., CUSTODERO, C., DEMURTAS, J., SMITH, L., BARBAGALLO, M., MAGGI, S., CELLA, A., VANACORE, N., APRILE, P. L., FERRUCCI, L., PILOTTO, A., SOCIETY, T. S. I. G. I. S. R. O. T. E. G. M., META-ANALYSES, T. S. I. G. I. & SOCIETY, C. G. A. O. T. E. G. M. 2022. Comprehensive geriatric assessment in older people: an umbrella review of health outcomes. *Age and Ageing,* 51.

VU, H. T. T., THANH XUAN, N., NGUYEN, T. N., ANH TRUNG, N., CUMMING, R., HILMER, S., THANG, P., NGUYEN, T. X., NGUYEN, A. T. & PHAM, T. 2017. Prevalence of frailty and its associated factors in older hospitalised patients in Vietnam. *BMC Geriatrics,* 17**,** 1-7.

WANG, H. & ROSEMBURG, N. 2018. Universal Health Coverage in Low-Income Countries: Tanzania’s Efforts to Overcome Barriers to Equitable Health Service Access. *Universal Health Coverage Study Series No. 39.* Washington DC.

WANG, J. & HULME, C. 2021. Frailty and Socioeconomic Status: A Systematic Review. *Journal of Public Health Research,* 10**,** jphr.2021.2036.

WANG, X., HU, J. & WU, D. 2022. Risk factors for frailty in older adults. *Medicine (Baltimore),* 101**,** e30169.

WARE, J. E., JR. & SHERBOURNE, C. D. 1992. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. *Med Care,* 30**,** 473-83.

WILKINSON, D. J. C. 2021. Frailty Triage: Is Rationing Intensive Medical Treatment on the Grounds of Frailty Ethical? *The American Journal of Bioethics,* 21**,** 48-63.

WILLIAMS, V., BOYLAN, A.-M. & NUNAN, D. 2020. Critical appraisal of qualitative research: necessity, partialities and the issue of bias. *BMJ Evidence-Based Medicine,* 25**,** 9-11.

WILTSHIRE, G. & RONKAINEN, N. 2021. A realist approach to thematic analysis: making sense of qualitative data through experiential, inferential and dispositional themes. *Journal of Critical Realism,* 20**,** 159-180.

WIREDU, K. 2002. The moral foundations of an African culture. *In:* COETZEE, P. H. & ROUX, A. P. J. (eds.) *Philosophy from Africa: a text with readings.* Oxford University Press.

WORLD BANK. 2022. *World Bank country classification by income level* [Online]. World Bank. Available: https://blogs.worldbank.org/en/opendata/new-world-bank-country-classifications-income-level-2022-2023 [Accessed 04/05/24 2022].

WORLD BANK. 2023. *Population, total - Tanzania* [Online]. World Bank. Available: https://data.worldbank.org/indicator/SP.POP.TOTL?locations=TZ [Accessed 02/07/24].

WORLD HEALTH ORGANIZATION 2002. Active ageing: a policy framework. Geneva.

WORLD HEALTH ORGANIZATION. 2015a. *Global health estimates 2013: deaths by cause, age, sex and regional grouping, 2000–2012* [Online]. Geneva: World Health Organization. Available: http://www.who.int/healthinfo/global_burden_disease/en [Accessed 16/05/22].

WORLD HEALTH ORGANIZATION. 2015b. *WHO World Health Survey: 2002–2004.* [Online]. Geneva: World Health Organization. Available: http://www.who.int/healthinfo/survey/en/ [Accessed 23/06/15].

WORLD HEALTH ORGANIZATION 2015c. *World report on ageing and health*, World Health Organization.

WORLD HEALTH ORGANIZATION. Multisectoral action for a life course approach to healthy ageing: draft global strategy and plan of action on ageing and health: report by the Secretariat. World Health Assembly, 69., 2016 Geneva. World Health Organization.

WORLD HEALTH ORGANIZATION. 2019a. *Global Health Observatory data repository: Life expectancy and Healthy life expectancy, data by WHO region* [Online]. World Health Organization. Available: https://apps.who.int/gho/data/view.main.SDG2016LEXREGv?lang=en [Accessed 16/05/22].

WORLD HEALTH ORGANIZATION 2019b. World Health Organization Global Health Expenditure database. Geneva.

WORLD HEALTH ORGANIZATION 2020. Decade of healthy ageing: baseline report. . Geneva.

WORLD HEALTH ORGANIZATION. 2023. *Unite Republic of Tanzania: The current COVID-19 situation* [Online]. World Health Organization. Available: https://www.who.int/countries/tza [Accessed 30/06/2024].

WORLD HEALTH ORGANIZATION 2024. Integrated care for older people (ICOPE): guidance for person-centred assessment and pathways in primary care. 2 ed. Geneva: World Health Organization.

XU, L., ZHANG, J., SHEN, S., HONG, X., ZENG, X., YANG, Y., LIU, Z., CHEN, L. & CHEN, X. 2020. Association Between Body Composition and Frailty in Elder Inpatients. *Clin Interv Aging,* 15**,** 313-320.

XU, L., ZHANG, J., SHEN, S., LIU, Z., ZENG, X., YANG, Y., HONG, X. & CHEN, X. 2021. Clinical frailty scale and biomarkers for assessing frailty in elder inpatients in China. *The Journal of nutrition, health and aging,* 25**,** 77-83.

YALINKILIC, M., KILICASLAN, K., UYSAL, H., BILGIN, S. & ENC, N. 2020. Determination of frailty in elderly individuals with heart failure. *Anatolian Journal of Cardiology,* 24**,** 75.

YAN WANG, N., LIU, X., KONG, X., SUMI, Y., CHHETRI, J. K., HU, L., ZHU, M., KANG, L., LIANG, Z., ELLIS, J. W. & SHI, L. 2024. Implementation and impact of the World Health Organization integrated care for older people (ICOPE) program in China: a randomised controlled trial. *Age and Ageing,* 53.

YANG, F. & CHEN, Q.-W. 2018. Evaluation of frailty and influencing factors in old people in hospital institution: Evidence for a phenotype of frailty. *Medicine,* 97**,** 1-7.

YIN, W., YANPEI, C., XIAOLI, Y., YAN, X., WEI, Y., CAO, Y., YANG, X. & XU, Y. 2018. Investigation on the frailty status of the elderly inpatients in Shanghai using the FRAIL (fatigue, resistance, ambulation, illness, and loss) questionnaire. *Medicine,* 97**,** 1-7.

YU, X., WANG, N., WANG, D., MA, Y., LIU, H., FU, J., XU, C., SUN, Y. & ZHANG, Y. 2022. Consistency in the prevalence and associated factors of frailty determined by two instruments among hospitalised older adults: A cross-sectional study. *Journal of Clinical Nursing*.

YUNUS, N. A., OLDE HARTMAN, T., LUCASSEN, P., BARTON, C., RUSSELL, G., ALTUN, A. & STURGISS, E. 2022. Reporting of the Translation Process in Qualitative Health Research: A Neglected Importance. *International Journal of Qualitative Methods,* 21**,** 16094069221145282.

ZHANG, X.-M., JIAO, J., XU, T. & WU, X.-J. 2022. The association between frailty of older stroke patients during hospitalization and one-year all-cause mortality: A multicenter survey in China. *International journal of nursing sciences,* 9**,** 162-168.

ZHANG, X.-M., YUAN, L., QUO, N., BO, H.-X., JIAO, J., WU, X. & XU, T. 2021. Cognitive frailty and falls in a national cohort of older Chinese inpatients. *The Journal of nutrition, health and aging,* 25**,** 993-998.

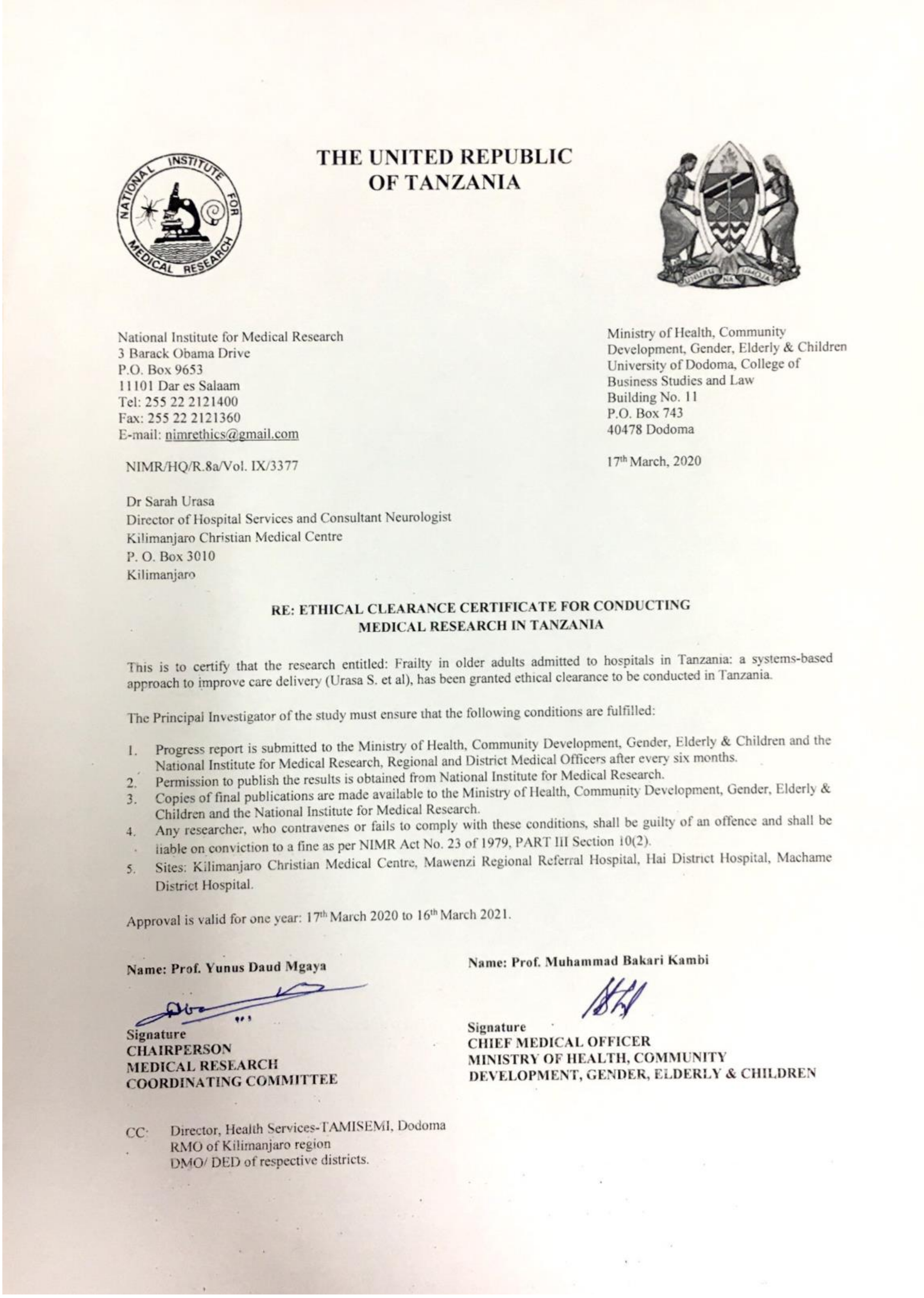
ZHENG, P.-P., YAO, S.-M., SHI, J., WAN, Y.-H., GUO, D., CUI, L.-L., SUN, N., WANG, H. & YANG, J.-F. 2020. Prevalence and Prognostic Significance of Frailty in Gerontal Inpatients With Pre-clinical Heart Failure: A Subgroup Analysis of a Prospective Observational Cohort Study in China. *Frontiers in cardiovascular medicine,* 7**,** 607439.

ZHU, W., ZHU, S., SUNGUYA, B. F. & HUANG, J. 2021. Urban–Rural Disparities in the Magnitude and Determinants of Stunting among Children under Five in Tanzania: Based on Tanzania Demographic and Health Surveys 1991–2016. *International Journal of Environmental Research and Public Health,* 18**,** 5184.

ZOU, C., CHEN, S., SHEN, J., ZHENG, X., WANG, L., GUAN, L., LIU, Q. & YANG, Y. 2018. Prevalence and associated factors of depressive symptoms among elderly inpatients of a Chinese tertiary hospital. *Clinical interventions in aging,* 13**,** 1755-1762.

ZRIBI, C., HAMMAMI, S., GHZAIEL, I., HAMMAMI, M. & ZARROUK, A. 2019. Frailty as a risk factors for falls in elderly. *European Geriatric Medicine,* 10**,** S88.

Appendix A. Ethical clearance certificate from the Tanzanian National Institute for Medical Research – 2020/21



THE UNITED REPUBLIC OF TANZANIA

National Institute for Medical Research
3 Barack Obama Drive
P.O. Box 9653
11101 Dar es Salaam
Tel: 255 22 2121400
Fax: 255 22 2121360
E-mail: nimrethics@gmail.com

Ministry of Health, Community Development, Gender, Elderly & Children
University of Dodoma, College of Business Studies and Law
Building No. 11
P.O. Box 743
40478 Dodoma

NIMR/HQ/R.8a/Vol. IX/3377

17th March, 2020

Dr Sarah Urasa
Director of Hospital Services and Consultant Neurologist
Kilimanjaro Christian Medical Centre
P. O. Box 3010
Kilimanjaro

RE: ETHICAL CLEARANCE CERTIFICATE FOR CONDUCTING MEDICAL RESEARCH IN TANZANIA

This is to certify that the research entitled: Frailty in older adults admitted to hospitals in Tanzania: a systems-based approach to improve care delivery (Urasa S. et al), has been granted ethical clearance to be conducted in Tanzania.

The Principal Investigator of the study must ensure that the following conditions are fulfilled:

1. Progress report is submitted to the Ministry of Health, Community Development, Gender, Elderly & Children and the National Institute for Medical Research, Regional and District Medical Officers after every six months.
2. Permission to publish the results is obtained from National Institute for Medical Research.
3. Copies of final publications are made available to the Ministry of Health, Community Development, Gender, Elderly & Children and the National Institute for Medical Research.
4. Any researcher, who contravenes or fails to comply with these conditions, shall be guilty of an offence and shall be liable on conviction to a fine as per NIMR Act No. 23 of 1979, PART III Section 10(2).
5. Sites: Kilimanjaro Christian Medical Centre, Mawenzi Regional Referral Hospital, Hai District Hospital, Machame District Hospital.

Approval is valid for one year: 17th March 2020 to 16th March 2021.

Name: Prof. Yunus Daud Mgaya

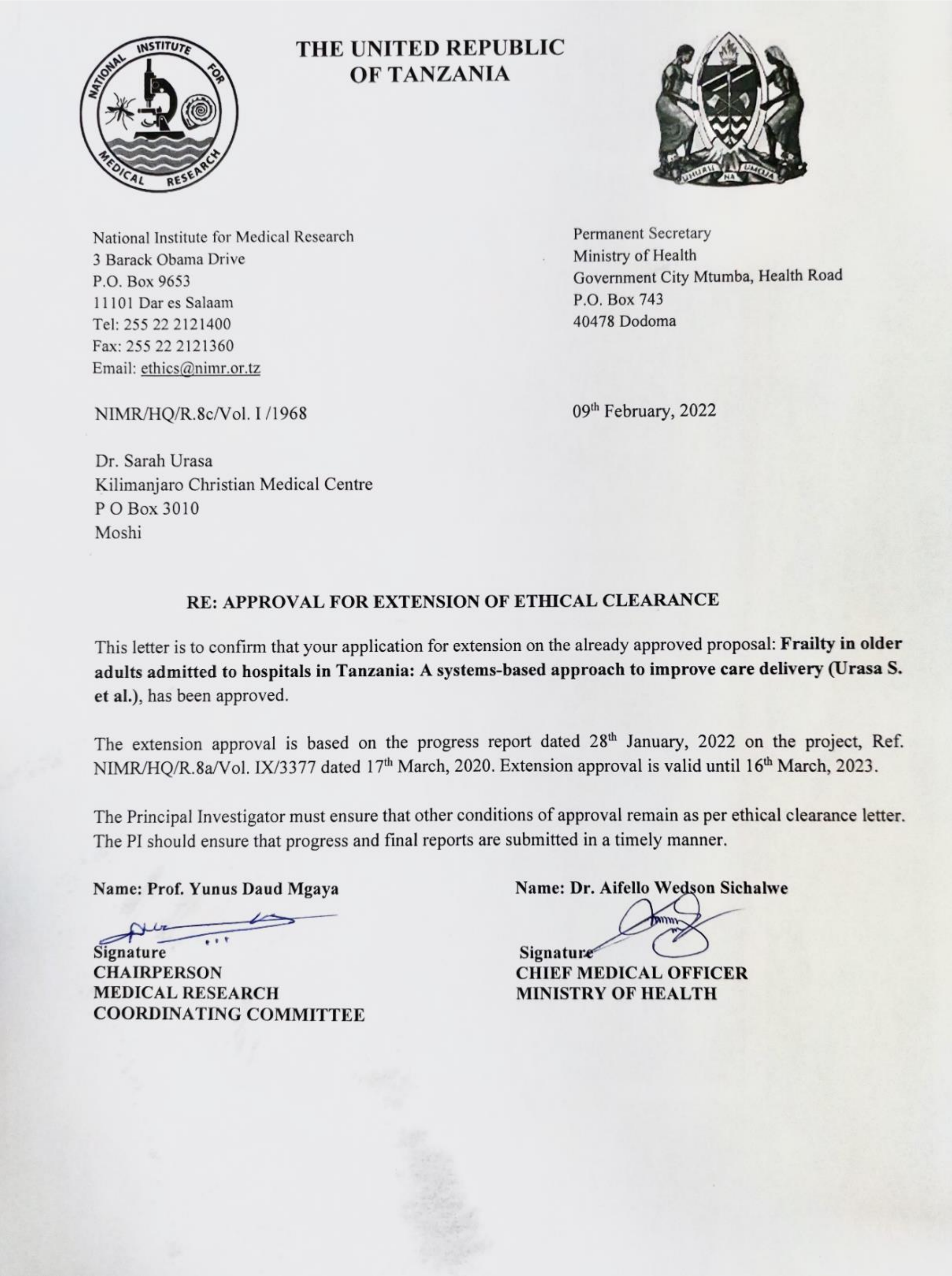
Signature
CHAIRPERSON
MEDICAL RESEARCH
COORDINATING COMMITTEE

Name: Prof. Muhammad Bakari Kambi

Signature
CHIEF MEDICAL OFFICER
MINISTRY OF HEALTH, COMMUNITY
DEVELOPMENT, GENDER, ELDERLY & CHILDREN

CC: Director, Health Services-TAMISEMI, Dodoma
RMO of Kilimanjaro region
DMO/ DED of respective districts.

Appendix B. Ethical clearance renewal certificate from the Tanzanian National Institute for Medical Research – 2022/23



**THE UNITED REPUBLIC
OF TANZANIA**

National Institute for Medical Research
3 Barack Obama Drive
P.O. Box 9653
11101 Dar es Salaam
Tel: 255 22 2121400
Fax: 255 22 2121360
Email: ethics@nimr.or.tz

Permanent Secretary
Ministry of Health
Government City Mtumba, Health Road
P.O. Box 743
40478 Dodoma

NIMR/HQ/R.8c/Vol. I /1968

09th February, 2022

Dr. Sarah Urasa
Kilimanjaro Christian Medical Centre
P O Box 3010
Moshi

RE: APPROVAL FOR EXTENSION OF ETHICAL CLEARANCE

This letter is to confirm that your application for extension on the already approved proposal: **Frailty in older adults admitted to hospitals in Tanzania: A systems-based approach to improve care delivery (Urasa S. et al.)**, has been approved.

The extension approval is based on the progress report dated 28th January, 2022 on the project, Ref. NIMR/HQ/R.8a/Vol. IX/3377 dated 17th March, 2020. Extension approval is valid until 16th March, 2023.

The Principal Investigator must ensure that other conditions of approval remain as per ethical clearance letter. The PI should ensure that progress and final reports are submitted in a timely manner.

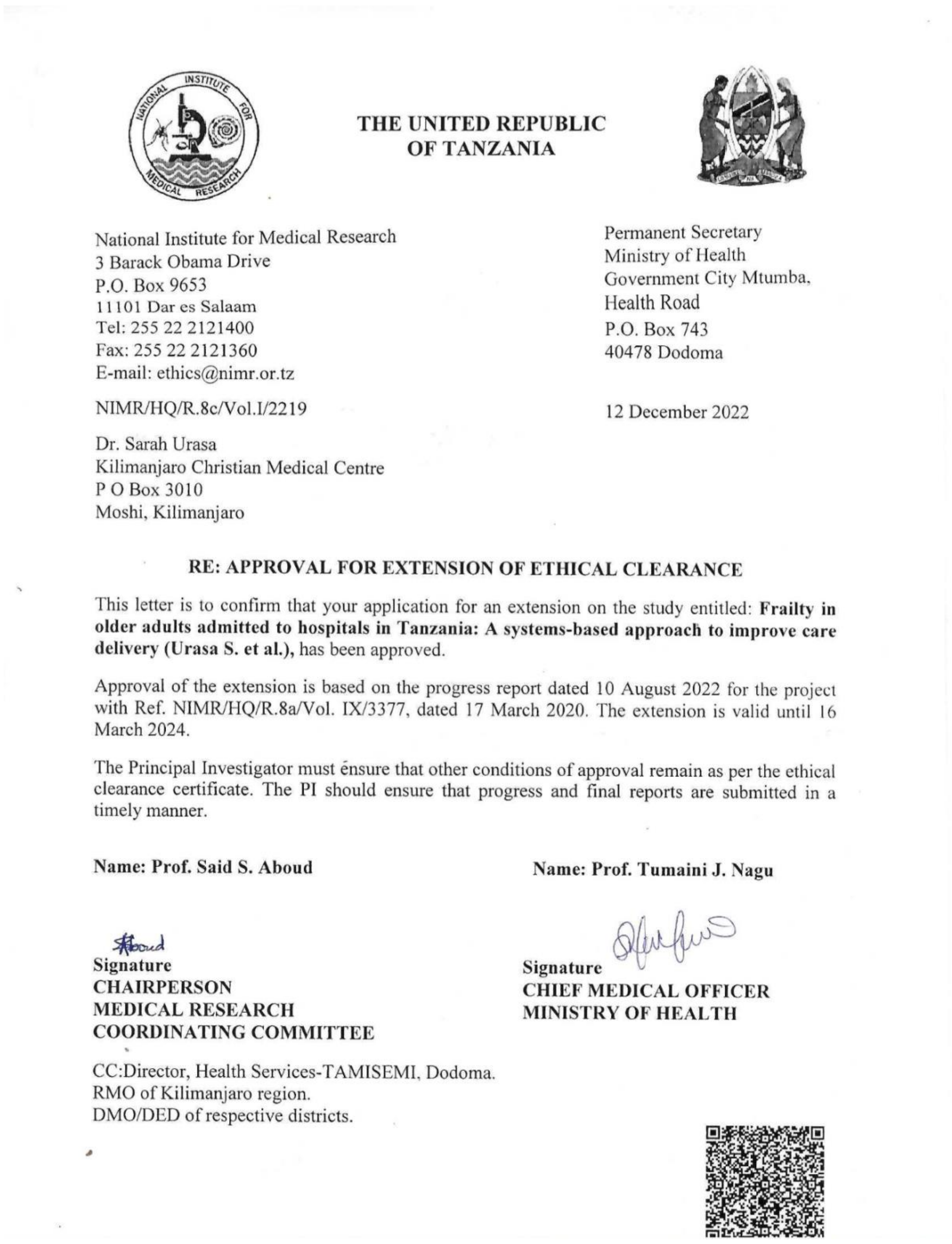
Name: Prof. Yunus Daud Mgaya

Signature
CHAIRPERSON
MEDICAL RESEARCH
COORDINATING COMMITTEE

Name: Dr. Aifello Wedson Sichalwe

Signature
CHIEF MEDICAL OFFICER
MINISTRY OF HEALTH

Appendix C. Ethical clearance renewal certificate from the Tanzanian National Institute for Medical Research – 2023/24



THE UNITED REPUBLIC
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40478 Dodoma

NIMR/HQ/R.8c/Vol.I/2219

12 December 2022

Dr. Sarah Urasa
Kilimanjaro Christian Medical Centre
P O Box 3010
Moshi, Kilimanjaro

RE: APPROVAL FOR EXTENSION OF ETHICAL CLEARANCE

This letter is to confirm that your application for an extension on the study entitled: **Frailty in older adults admitted to hospitals in Tanzania: A systems-based approach to improve care delivery (Urasa S. et al.),** has been approved.

Approval of the extension is based on the progress report dated 10 August 2022 for the project with Ref. NIMR/HQ/R.8a/Vol. IX/3377, dated 17 March 2020. The extension is valid until 16 March 2024.

The Principal Investigator must ensure that other conditions of approval remain as per the ethical clearance certificate. The PI should ensure that progress and final reports are submitted in a timely manner.

Name: Prof. Said S. Aboud

Aboud
Signature
CHAIRPERSON
MEDICAL RESEARCH
COORDINATING COMMITTEE

Name: Prof. Tumaini J. Nagu

Signature
CHIEF MEDICAL OFFICER
MINISTRY OF HEALTH

CC:Director, Health Services-TAMISEMI, Dodoma.
RMO of Kilimanjaro region.
DMO/DED of respective districts.

Appendix D. Ethical clearance certificate from Newcastle University

10 February 2020

Newcastle University

Faculty of Medical Sciences
Newcastle University
Medical School
Framlington Place
Newcastle upon Tyne
NE2 4HH

Emma Mitchell
Population Health Sciences Institute

FACULTY OF MEDICAL SCIENCES: ETHICS COMMITTEE

Dear Emma

Title: Frailty in Older Adults Admitted to Hospital in Tanzania: a systems-based approach to improve care delivery
Application No: 1836/17436/2019
Start date to end date: 01/10/2019 to 30/09/2022

On behalf of the Faculty of Medical Sciences Ethics Committee, I am writing to confirm that the ethical aspects of your proposal have been considered and your study has been given ethical approval.

The approval is limited to this project: **1836/17436/2019**. If you wish for a further approval to extend this project, please submit a re-application to the FMS Ethics Committee and this will be considered.

During the course of your research project you may find it necessary to revise your protocol. Substantial changes in methodology, or changes that impact on the interface between the researcher and the participants must be considered by the FMS Ethics Committee, prior to implementation.*

At the close of your research project, please report any adverse events that have occurred and the actions that were taken to the FMS Ethics Committee.*

Best wishes,

Yours sincerely

M. Holbrough

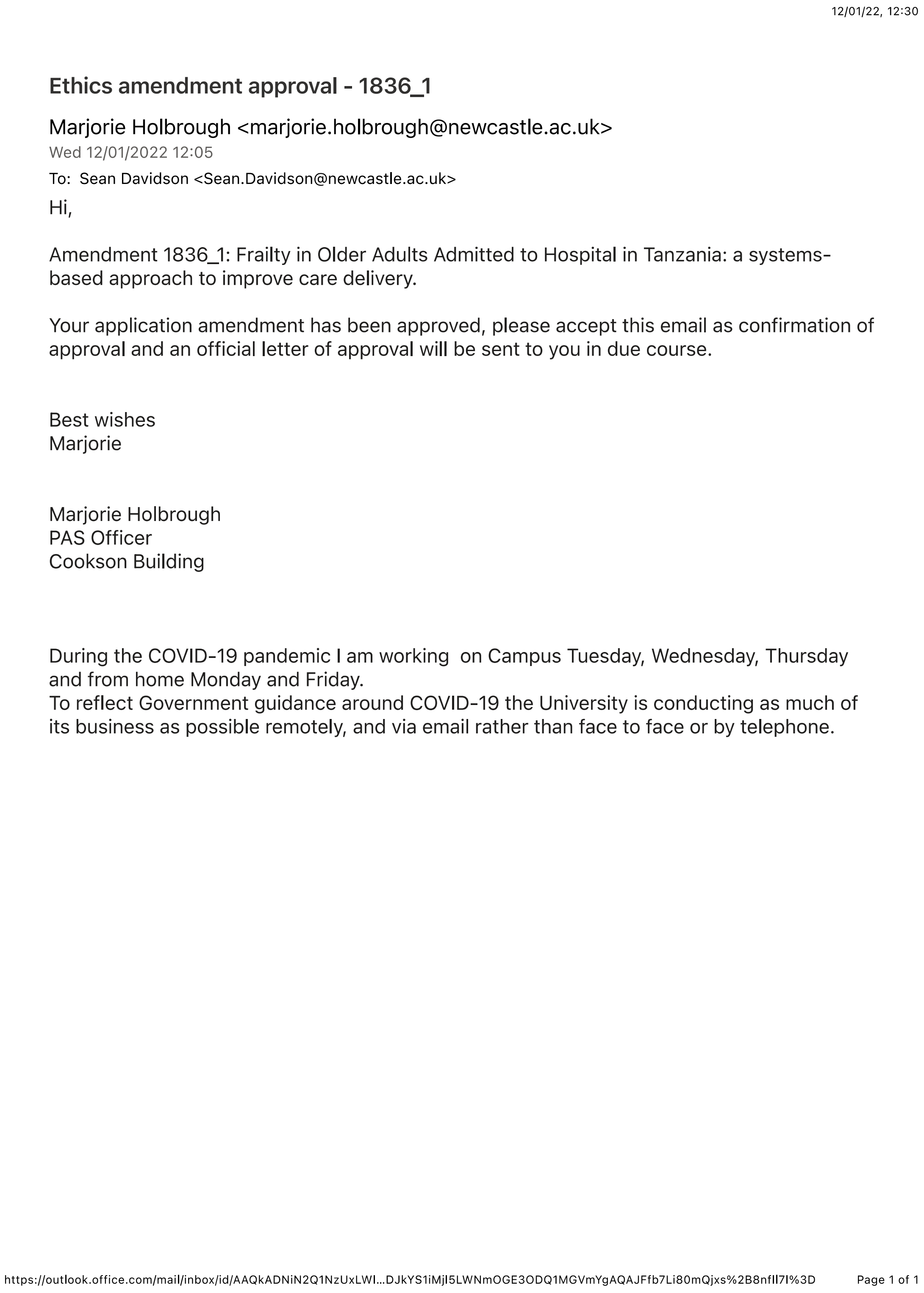
Marjorie Holbrough
On behalf of Faculty Ethics Committee

cc.
Professor Daniel Nettle, Chair of FMS Ethics Committee
Mrs Kay Howes, Research Manager

*Please refer to the latest guidance available on the internal Newcastle web-site.

This was the original ethical approval applied for by supervisors and Dr Emma Mitchell.

Appendix E. Approval of amendment to ethical clearance from Newcastle University



12/01/22, 12:30

Ethics amendment approval - 1836_1

Marjorie Holbrough <marjorie.holbrough@newcastle.ac.uk>
Wed 12/01/2022 12:05
To: Sean Davidson <Sean.Davidson@newcastle.ac.uk>

Hi,

Amendment 1836_1: Frailty in Older Adults Admitted to Hospital in Tanzania: a systems-based approach to improve care delivery.

Your application amendment has been approved, please accept this email as confirmation of approval and an official letter of approval will be sent to you in due course.

Best wishes
Marjorie

Marjorie Holbrough
PAS Officer
Cookson Building

During the COVID-19 pandemic I am working on Campus Tuesday, Wednesday, Thursday and from home Monday and Friday.
To reflect Government guidance around COVID-19 the University is conducting as much of its business as possible remotely, and via email rather than face to face or by telephone.

https://outlook.office.com/mail/inbox/id/AAQkADNiN2Q1NzUxLWI…DJkYS1iMjI5LWNmOGE3ODQ1MGVmYgAQAJFfb7Li80mQjxs%2B8nfIl7I%3D Page 1 of 1

This email provided confirmation of approval an extension, as well as an amendment allowing the author (SD) to take over as lead researcher.

Appendix F. British Geriatric Society specialist registrar start up grant award letter

British Geriatrics Society
Improving healthcare for older people

Marjory Warren House
31 St John's Square London EC1M 4DN

Telephone +44 (0)20 7608 1369
Email enquiries@bgs.org.uk
Website www.bgs.org.uk

6th July 2022

Dr Sean Davidson,
38 Princes Street
North Shields
Tyne and Wear
NE30 2HZ

Dear Sean,

BGS Specialist registrar start up grant- Grant no : StR 03/2022

Project: Frailty amongst older adults admitted to hospital in Tanzania: a cross cultural qualitative consultation.

I am delighted to inform you that your recent application for a BGS Specialist Registrar Research Start-up Grant for the above mentioned project has been successful for the amount of £9,953.00.

Please advise the details of payment as soon as possible (please note that payment cannot be made to individuals). Please send bank details and reference number to Joanna Gough (j.gough@bgs.org.uk).

Also attached is a copy of the Conditions of Award sent out to you with the original application form.

Please note that the spending of the grant should conform broadly to the original estimate (any remaining balance, where applicable, must be returned to the Society), and a condition of the grant is the provision by the applicant of six monthly grant report describing how you spent your grant and the benefits gained from it.

I wish you every success with your Study.

Yours sincerely,

Joanna Gough
Scientific Officer

Patron HRH The Prince of Wales
Limited company registered in England 1189776 Registered charity number 268762 Registered office Marjory Warren House 31 St John's Square London EC1M 4DN

Appendix G. Systematic review PROSPERO registration

NIHR | National Institute for Health and Care Research

PROSPERO
International prospective register of systematic reviews

The prevalence of frailty amongst hospitalised older adults in low- and middle-income countries: a systematic review

Sean L Davidson, Catherine Dotchin, Richard Walker, Emily Bickerstaff, Luke Emmence, Sara Motraghi-Nobes, George Rayers

Citation

Sean L Davidson, Catherine Dotchin, Richard Walker, Emily Bickerstaff, Luke Emmence, Sara Motraghi-Nobes, George Rayers. The prevalence of frailty amongst hospitalised older adults in low- and middle-income countries: a systematic review. PROSPERO 2024 Available from https://www.crd.york.ac.uk/PROSPERO/view/CRD42022340466

REVIEW TITLE AND BASIC DETAILS

Review title

The prevalence of frailty amongst hospitalised older adults in low- and middle-income countries: a systematic review

Review objectives

What is the prevalence of frailty amongst hospitalised older adults in low- and middle-income countries?

Keywords

Frailty, Geriatrics, Hospital inpatients, Low- and middle-income countries, Prevalence

Appendix H. Consent form (English)

Part A: Participant Information Sheet

For interviews as part of the project:

"Frailty in older adults admitted to hospital in Tanzania: a systems-based approach to improve care delivery."

We would like to invite you to take part in a research study. Before you decide, you need to understand why the research is being done and what it would involve for you. Please take time to read the following information carefully. Talk to others about the study if you wish.

You are welcome to ask us if anything is not clear or if you would like more information.

Please take time to decide whether you wish to take part.

Who is undertaking this research study?

This study is organised by researchers from Newcastle University, United Kingdom in collaboration with Kilimanjaro Christian Medical Centre (KCMC), Mawenzi Regional Referral Hospital (MRRH), Hai District Hospital and Machame District Hospital.

Principal Investigators: Dr Sarah Urasa, Dr Catherine Dotchin, Prof Richard Walker.
Lead Researcher: Dr Sean Davidson.

Contact details of the team are provided at the end of this information sheet.

What is the purpose of the study?

The purpose of this study is to help hospital staff understand more about the number of older people (those older than 60 years of age) visiting hospitals in and around the Kilmanjaro region and their needs. This study will help to identify areas which need to be addressed to improve the care of older people suffering from long-term and serious illnesses. It might also help the Tanzanian Ministry of Health when they are planning healthcare priorities for the future.

Why have I been invited?

You have been invited because you are 60 years of age or older and have been admitted to one of KCMC / MRRH / Hai District Hospital / Machame District Hospital ***(delete as appropriate)***.

Do I have to take part?

Participation is entirely voluntary. We will describe the study and go through this information sheet, which is yours to keep. We will ask you to sign a consent form (part B) to show that you have agreed to take part. You are free to withdraw at any time without giving a reason.

What happens if you decide to take part?

The researcher will identify a time and place which is as convenient as possible. You do not need to prepare anything in advance, and will not have to do anything in particular afterwards. We may also like to follow you up over the period of the study. This could include phone calls and visits to your home at a time of your convenience. You are free to accept or decline this as you wish.

What do I have to do?
You will be asked questions by a trained interviewer. You may also undergo tests, for example measuring your weight or checking your eyesight. There will be no injections or blood tests. We will also ask you general information about yourself, your household and your health. You can choose to decline to participate in any aspect of our encounter at any time. This will not forfeit your right to future participation.

What will happen to the information I give you?
The information will be used for academic research only. Your name will not be stored alongside your responses, and you will not be able to be identified from the answers you give us. Your details will not be released to anyone who is not involved in the research.

All data will be stored anonymously and securely on password-protected computers and will not be made available for any purposes other than the research study. All records will be kept for 5 years after the end of the study and then destroyed.

Expenses and payments
The researchers will be responsible for all associated costs involved with this project. There will be no costs to the participants.

Incentives
You will not be offered any extra incentives in cash. You will not receive any special treatment for taking part. You will not be disadvantaged if you refuse to take part.

What are the possible advantages and disadvantages of taking part?
Taking part in this study will not affect your usual treatment in any way. The researchers will make sure that the environment for the interview is as safe and as comfortable as possible. You may feel unhappy discussing more personal issues. Please do not feel under any pressure to volunteer information that makes you uncomfortable.

There are no direct benefits to you for taking part other than personal interest and an opportunity to help to provide the researchers with a good understanding of healthcare services for older people. This may provide opportunities for healthcare improvements across the region.

Interviews will take no longer than 1-hour and will not delay your usual treatment.

Will my taking part in the study be kept confidential?
Yes. All information collected about you will be kept strictly confidential. We will follow ethical and legal practice and ensure all information about you will be handled in confidence. All data will be identified only by a code, with any personal details kept in a locked file or secure computer with access only by the immediate research team.

Sharing of results
Your personal information will be used only for research. The results of the study may be published and presented at conferences. You will not be identifiable in these publications or presentations. The results will also inform the development of the protocol to develop this project further, and the application for ethical approval of this protocol.

Who is organising this research?

This research is being carried out by Newcastle University (Population Health Sciences Institute) in collaboration with Northumbria Healthcare NHS Foundation Trust and colleagues in Tanzania.

Ethical review of the study.

The project has received ethical review by the Research Ethics Committee at Newcastle University, Kilimanjaro Christian Research Ethics Review Committee (CRERC) at KCMC, and the National Institute of Medical Research (NIMR) based in Dar es Salaam.

Whom to contact

For any questions regarding the study, please contact:

Dr Sean Davidson Teaching Doctor and Research Fellow Northumbria Healthcare NHS Trust Newcastle, United Kingdom Tel: +255 764 381 961 Email: sean.davidson2@northumbria-healthcare.nhs.uk	**Dr Sarah Urasa** Director of Hospital Medical Services Kilimanjaro Christian Medical Centre, Tanzania Tel: +255 756519123 Email: dhssec@kcmc.ac.tz	**Kilimanjaro Christian Medical College Research Ethics and Review Committee (CRERC)** KCM College Opposite Tumaini Restaurant & New Admin Building Tel: 255 27 2754 377 Email: lightemba@yahoo.com

K.C.M.C Northumbria Healthcare NHS NHS Foundation Trust Newcastle University

Part B: Participant Consent Form **STUDY ID:**

“Frailty in older adults admitted to hospital in Tanzania: a systems-based approach to improve care delivery.”

This study is organised by researchers from Newcastle University, United Kingdom in collaboration with Kilimanjaro Christian Medical Centre (KCMC), Mawenzi Regional Referral Hospital (MRRH), Hai District Hospital and Machame District Hospital.

Principal Investigators: Dr Sarah Urasa, Dr Catherine Dotchin, Prof Richard Walker.
Lead Researchers: Dr Sean Davidson.

Participant’s statements	Initials
I confirm I have read and understand the information given in the Participant Information Sheet.	
The researcher has explained to me what the study involves and I have had the opportunity to ask any questions to my satisfaction.	
I understand that my participation is voluntary and that I am free to withdraw at any time, without any reason, without my legal rights being affected.	
I agree that my participation can be recorded: Using anonymised written records	
I understand that no benefit in cash or kind (in services) will be given as an incentive for taking part in the study and that I will not incur any additional costs for taking part in the study.	
I understand that the researchers are obliged to seek immediate guidance from the Clinical Lead for the study if I provide sensitive information considered an issue of safeguarding for myself or others.	
I give permission for the publication of the findings of the study at a later date in conferences or journals. I only give this permission with the understanding that no personal identifiable details will be published.	
I agree to take part in the above exercise.	

Name of participant (Please print) **Signature** **Date (DD/MM/YYYY)**

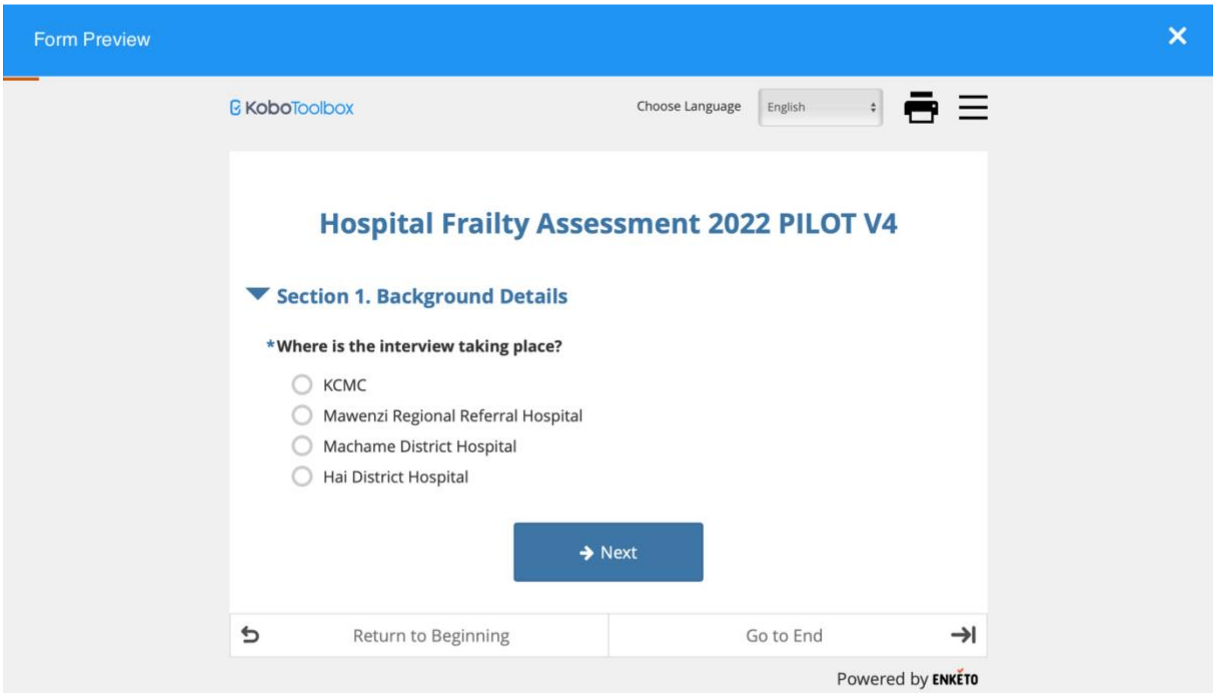
If the participant lacks capacity, an informant can consent on their behalf:

Name of informant (Please print) **Signature** **Date (DD/MM/YYYY)**

Affix thumbprint (of left thumb) for those who are unable to sign	

Name of researcher (please print) **Signature** **Date (DD/MM/YYYY)**

Appendix I. Kobo Toolbox proforma

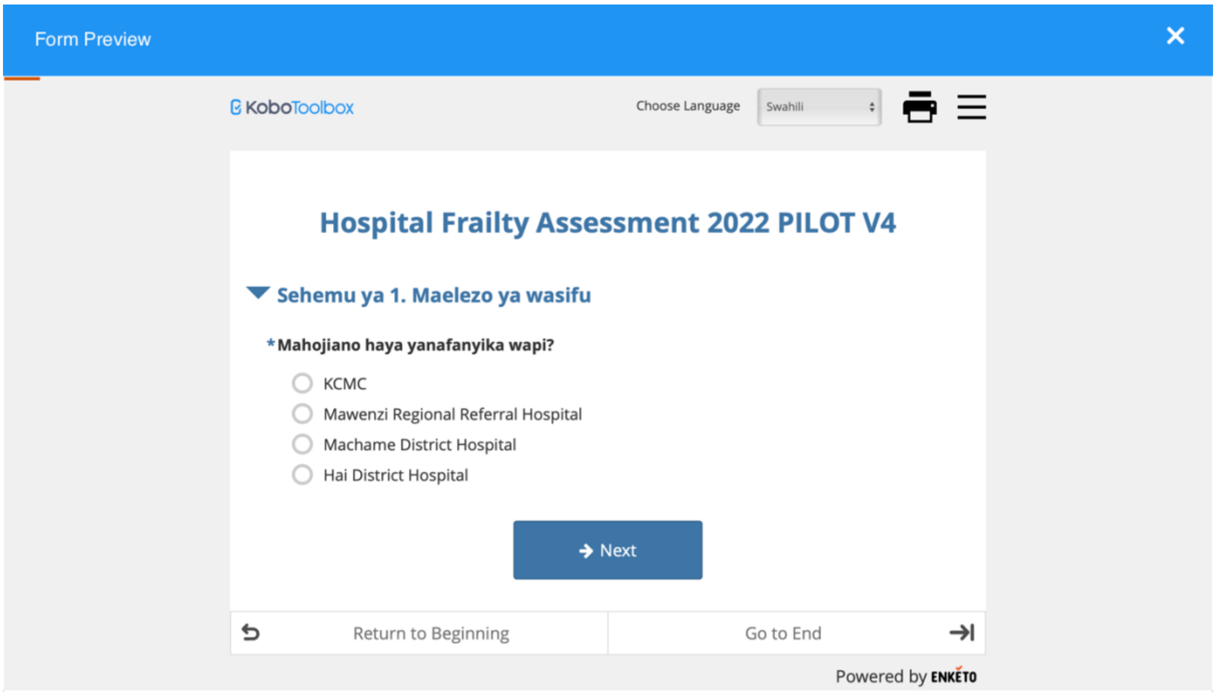


Hospital Frailty Assessment 2022 PILOT V4

Section 1. Background Details

*Where is the interview taking place?

○ KCMC
○ Mawenzi Regional Referral Hospital
○ Machame District Hospital
○ Hai District Hospital



Hospital Frailty Assessment 2022 PILOT V4

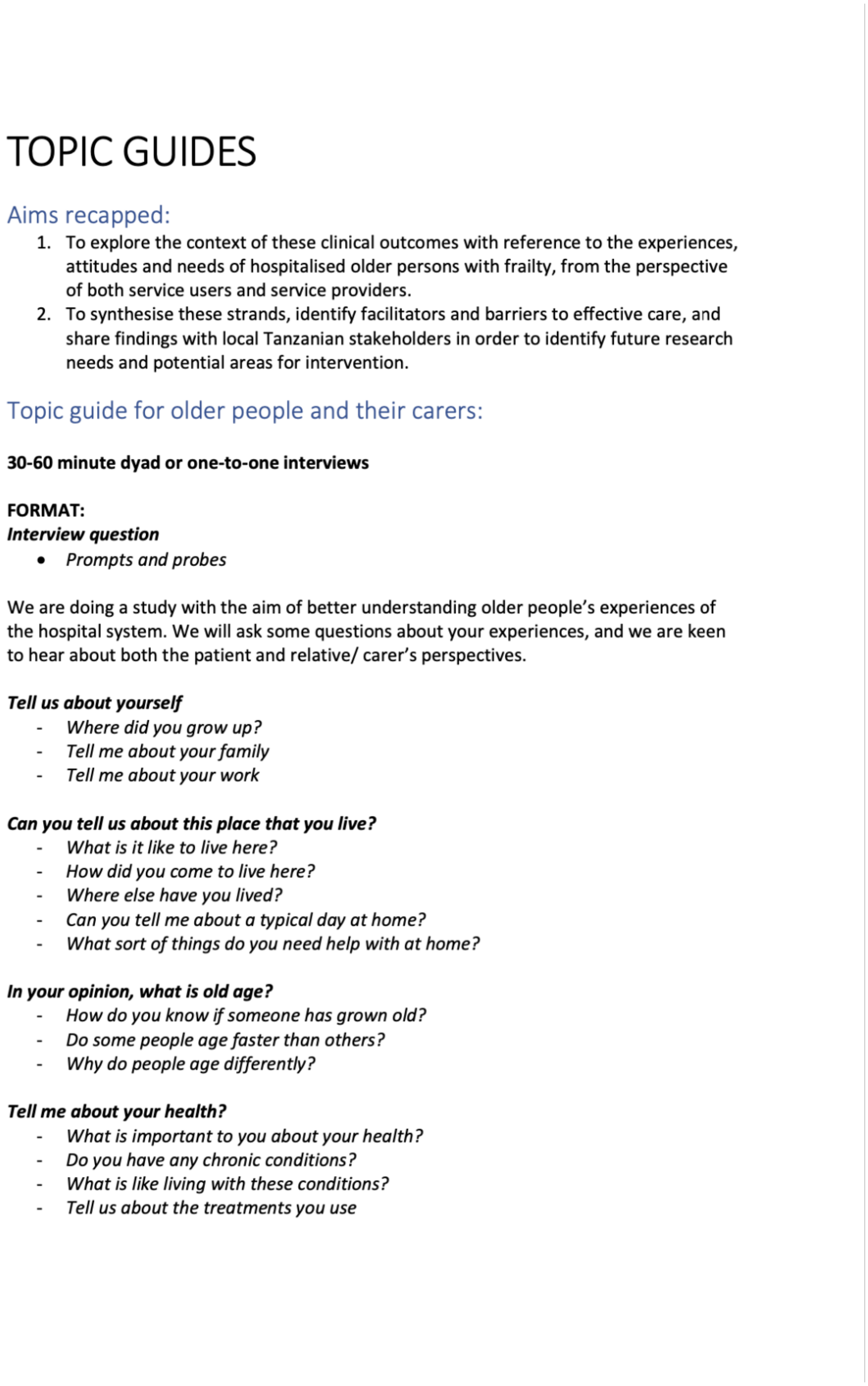
Sehemu ya 1. Maelezo ya wasifu

*Mahojiano haya yanafanyika wapi?

○ KCMC
○ Mawenzi Regional Referral Hospital
○ Machame District Hospital
○ Hai District Hospital

These screenshots demonstrate the Kobo Toolbox data collection tools used for quantitative elements of the study and how the questions could be toggled between English and Swahili. The full quantitative data collection tools run to 78 pages so are not included here for brevity but are available on request from the author.

Appendix J. Last iteration of the topic guides



TOPIC GUIDES

Aims recapped:

1. To explore the context of these clinical outcomes with reference to the experiences, attitudes and needs of hospitalised older persons with frailty, from the perspective of both service users and service providers.
2. To synthesise these strands, identify facilitators and barriers to effective care, and share findings with local Tanzanian stakeholders in order to identify future research needs and potential areas for intervention.

Topic guide for older people and their carers:

30-60 minute dyad or one-to-one interviews

FORMAT:
Interview question

- *Prompts and probes*

We are doing a study with the aim of better understanding older people's experiences of the hospital system. We will ask some questions about your experiences, and we are keen to hear about both the patient and relative/ carer's perspectives.

Tell us about yourself

- *Where did you grow up?*
- *Tell me about your family*
- *Tell me about your work*

Can you tell us about this place that you live?

- *What is it like to live here?*
- *How did you come to live here?*
- *Where else have you lived?*
- *Can you tell me about a typical day at home?*
- *What sort of things do you need help with at home?*

In your opinion, what is old age?

- *How do you know if someone has grown old?*
- *Do some people age faster than others?*
- *Why do people age differently?*

Tell me about your health?

- *What is important to you about your health?*
- *Do you have any chronic conditions?*
- *What is like living with these conditions?*
- *Tell us about the treatments you use*

What is it like being admitted to hospital as an older person?

- *In what ways is the experience different to younger people?*
- *What are the positives?*
- *What are the challenges?*
- *Should older people be treated differently to younger people?*

Tell us about your last admission.

- *Who did you see before admission (e.g. healer, pharmacist)?*
- *How did you decide to go to hospital?*
- *Tell us about the journey to hospital*
- *Tell us about the emergency department*
- *Tell us about a normal day on the ward*
- *Tell us about the staff on the ward (doctors, nurses, healthcares, physios etc)*

What is the role of visitors in hospital?

- *Who helped you while you were admitted (mobilising, toileting, personal care, feeding etc)?*
- *What is it like to care for an older relative in hospital?*
- *What were (carer's) experiences of the ward and hospital staff?*

After being admitted to hospital, what is it like going home?

- *What things were different?*
- *What things did you need help with?*
- *Who helped?*
- *What is the role of the family in caring for older people?*
- *What are your (older person's) feelings about being cared for by others?*

Who should have responsibility for caring for older people?

- *What is the role of insurance?*
- *What is the role of exemptions?*
- *Are there differences between older people who live in urban and rural areas?*
- *What happens when somebody has no relatives (abandonment)?*

****Use judgement and ask only if feel interviewees comfortable****
How do you feel about the future?

- *How do people where you are from usually think about the end of life?*
- *What do you think is important for someone who is nearing the end of life?*
- *Do older people where you are from discuss the end of life?*
- *Only if comfortable with non-personalised questions to enquire about what they personally will do if they become ill in future, personal wishes for the end of life and what is important to them*

If there was a hospital for older people, what would it be like?

- *What does good medical care look like?*
- *What are the biggest problems older people encounter in hospital?*
- *How could hospitals give the best care to older people?*

Topic guide for hospital staff

30-60 minute one-to-one interviews

We are doing a study with the aim of better understanding the experience of caring for older people in the hospital system. We will ask some questions about your experiences and observations of working with older people who are admitted to hospital. We are particularly interested in older people with frailty; to give you a better idea of what we mean, I will read you this case.

Case vignette:
Mrs Mushi is 75 years old and lives in Masama in the Hai District. She used to work nearby farming coffee but has been unable to work for several years. Her husband passed away four years ago and she lives with daughter, son and daughter-in-law. She has a background of hypertension and diabetes and for which she is on captopril. Her daughter is her main carer and looks after the household. For the last year or more, she has had reduced appetite and has lost some weight. She can walk about 30 meters with a stick and her daughter helping her, but she spends most of the day sitting because walking too far makes her feel exhausted. Her memory is not as good as it once was and she often forgets her grandchildren's names.

One morning, her daughter goes to help get her up and notices her left arm is weak and that her face is drooping on the same side. A friend drives them to the local hospital later that day where they are informed Mrs Mushi has had a stroke. She is admitted and started on treatment. She recovers some movement but three days later becomes more unwell, appearing drowsy and confused. She develops a cough and is started on antibiotics for pneumonia. After seven days she has completed this treatment and her vital signs have improved. She is now weak in her left arm, struggles to recall her daughter's name and can now only walk a few meters with two people helping her. She goes home later that day, but the family find it hard to manage her increased needs. Eight days later she is re-admitted with symptoms of a urinary tract infection.

Please tell us about the experiences of you and your colleague's in caring for older patients like Mrs Mushi?

- *What are the reasons older are people usually admitted?*
- *What are the best aspects of caring for older people?*
- *What is hard about caring for older people?*
- *How do you feel about caring for older people?*
- *What services does this hospital provide for older people?*
- *Why might an older person be transferred to another hospital?*
- *Are there older people who don't come to hospital?*

What are the differences between caring for older patients and younger patients?

- *Are old people treated the same as younger people?*
- *What things do older people need that younger people do not?*
- *What medical problems do older people have that younger people do not?*

- *Do older people fall in hospital?*
- *What is it like caring for older people who are often readmitted?*
- *What is the most important thing for older people's health?*
- *What determines how long an older person is admitted to hospital?*
- *What are the things that lead to an older person being readmitted after discharge?*

What is the role of the family when someone is admitted to hospital?

- *Who should have responsibility for caring for older people?*
- *Are there any policies around the presence of family on the wards?*
- *What parts of care are family members responsible for on the ward?*
- *What is it like having relatives on the ward?*
- *What are the challenges and stressors of caring for an older relative?*
- *What happens when somebody has no relatives?*

Not all older people have complex needs like Mrs Mushi, why do you think people age differently?

- *Why do patients like Mrs Mushi develop frailty and complex needs while others remain healthy?*
- *At what age do you consider someone elderly?*
- *What are the main features of ageing?*
- *What are the important factors in making this happen?*
- *What is important in an older person's recovery after hospital?*

What happens when an older person in hospital is dying?

- *How do you know when somebody is dying?*
- *What happens when this is recognised?*
- *What discussions are had within the team?*
- *What discussions are had with the patient and family?*
- *Are there any changes to treatment?*
- *Are there any discussions around resuscitation?*

Older people are being admitted to hospital more frequently and they often have more complex health problems than younger people. How should hospitals and the government manage this in future?

- *What aspects of care for older people in hospital are done well?*
- *What barriers are there to delivering the best care for older people in hospital?*
- *If there was a hospital for older people, what would it be like?*
- *Do you feel the current system of exemptions/ insurance is effective?*
- *What do you hope for in old age?*