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The impact of frailty on the outcome of hospitalised older people in Johannesburg, South Africa

A RESEARCH REPORT SUBMITTED TO THE UNIVERSITY OF WITWATERSRAND, JOHANNESBURG IN FULFILMENT OF THE DEGREE OF MASTERS OF MEDICINE 2020

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10 February 2020

1 Declaration

I, Susan Franci Coetzer declare that this research report is my own work. It is being submitted for the degree of MMed in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other University.

The 10th day of February 2020

2 Dedication

To my loving parents, Bennie and Irene Coetzer, for their support and encouragement and patience over many years.

3 Publications and presentations from this study

The abstract was submitted, accepted and presented as a poster presentation at the following events:

1. University of the Witwatersrand, Faculty of Health Sciences Research Day poster presentation on 6 September 2018.
2. 34th World Congress of Internal Medicine E-poster presentation on 18-21 October 2018.

4 Acknowledgements

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All the patients and their families that participated in the study

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7 List of abbreviations and definitions

BMI – body mass index

CHS index – Cardiovascular health study index

CI – confidence interval

DHEA-S – dehydroepiandrosterone sulphate

FU – followed up

HAALSI – Health and Aging in Africa: A Longitudinal Study of an INDEPTH Community in South Africa

HJH – Helen Joseph Hospital

LOS – Length of stay

LTFU = lost to follow-up

MNA® – Mini-nutritional assessment

Polypharmacy – The use of 5 or more medications

RR – relative risk

SD – standard deviation

SOF index – Study of Osteoporotic Fractures index

STOPP/START - Screening Tool of Older People's Prescriptions and Screening Tool to Alert to Right Treatment

UK – United Kingdom

USA – United States of America

WDGMC – University of Witwatersrand Donald Gordon Medical Centre

WHI – Women's health initiative

8 Abstract

8.1 Aim

To determine the impact of frailty measured clinically using the FRAIL scale in participants aged 65 years and older, hospitalised in the Johannesburg environment.

8.2 Methods

This is an observational prospective study of patients admitted to the medical wards of Helen Joseph hospital and Wits Donald Gordon Medical Centre. Participants were evaluated for frailty according to the FRAIL scale. Nutritional status was determined using the mini-nutritional assessment (MNA®). Functional status was determined using the modified Rankin score. Participants had telephonic follow-ups at 6 months to review their functional status and living environment.

8.3 Results

Of the 108 recruited participants, 78 (72%) were assessed as frail by the FRAIL scale on admission. Hospital survival overall was 93.5%. All participants who died were classified as frail. Frail participants were older (81.0 vs. 77.3 years, p=0.027), more likely to be malnourished (90.3% vs. 9.7%, p<0.001), more functionally disabled (93.5% vs. 46,7%, p<0.0001) and more likely to have required care assistance prior to admission (70.5% vs. 36.7%, p=0.0029). There were no significant differences between frail and robust participants in polypharmacy, hospital length of stay, cognitive impairment, and gender. Follow-up data were available for 94 participants. Frail participants had higher mortality (39.5% vs. 4.3%, p=0.0013, RR 9.1 (95% CI 1.3-63). Frail participants had more functional impairment at hospital discharge than non-frail participants (98.6% vs. 30%, p<0.0001). At 6 months follow-up there was no functional difference between frail and non-frail participants due to the increased mortality.

8.4 Conclusions

The FRAIL scale has utility in identifying older participants at risk of mortality and in-hospital functional decline.

9 Extended literature review

9.1 Introduction

"The sixth age shifts into the lean and slipper'd pantaloon, with spectacles on nose and pouch on side, his youthful hose well sav'd, a world too wide, for his shrunk shank…". Shakespeare – As you like it.

Even in the days of William Shakespeare some concepts of frailty were identified in older individuals when one sees how Shakespeare noted that people "shrunk" with age and therefore exhibited sarcopenia and weren't as robust as others.

Aging is controlled by different traits in mammals: instability of the genome, telomere attrition, changes in genetic expression, impaired proteostasis, deregulated nutrient-sensing, mitochondrial dysfunction, cellular senescence and altered intracellular communication and finally stem cell exhaustion. When these hallmarks become clinically evident, it may be seen as frailty (1).

Frailty has many definitions, but the most commonly accepted definition is by the American Geriatric Society in 2004 as "a state of increased vulnerability to stressors due to age-related declines in physiologic reserve across neuromuscular, metabolic and immune systems" (2). In 2013 a consensus group defined physical frailty as "a medical syndrome with multiple causes and contributors that is characterized by diminished strength, endurance and reduced physiological function that increases an individual's vulnerability for developing increased dependency and/or death" (3).

The condition of frailty is thus a clinical entity whereas homeostenosis (the theory that there are diminishing physiologic reserves available to meet challenges to homeostasis which therefore leads to this 'increased vulnerability' (4)), is its cellular counterpart. The opposite of homeostenosis is resilience and the clinical opposite of

frailty is a robust or resilient older person (5). A resilient older person has multiple systems that are working together to withstand stress (6).

Failure to thrive is a similar clinical syndrome of decline over several domains of an older person. The United States National Institute of Aging describes it as “a syndrome of weight loss, decreased appetite and poor nutrition, and inactivity, often accompanied by dehydration, depressive symptoms, impaired immune function and low cholesterol” (7).

Pre-frailty does not have a widely accepted definition, but a proposed definition suggests that it is: “a multi-dimensional concept, an early and reversible risk-state before frailty that can lead to negative healthcare outcomes”. (8)

Multimorbidity and disability are two terms that are distinct from frailty although they may overlap. Multimorbidity is defined as “any combination of chronic disease with at least one other disease (acute or chronic) or biopsychosocial factor (associated or not) or somatic risk factor” (9). It affects more than 50% of the elderly population (10). Co-morbidity exists when there are two or more concurrent illnesses with a primary or index condition (11). Disability is when there is difficulty or when help is required to carry out activities essential to living independently such as self-care or living alone (12). Both multimorbidity and frailty are independent predictors of disease outcome. In summary: with multimorbidity there is an accumulation of physiological damage that leads to disease and in frailty there is a loss of reserve across these physiological systems that predisposes to disease (6).

9.2 Demographics of aging and frailty

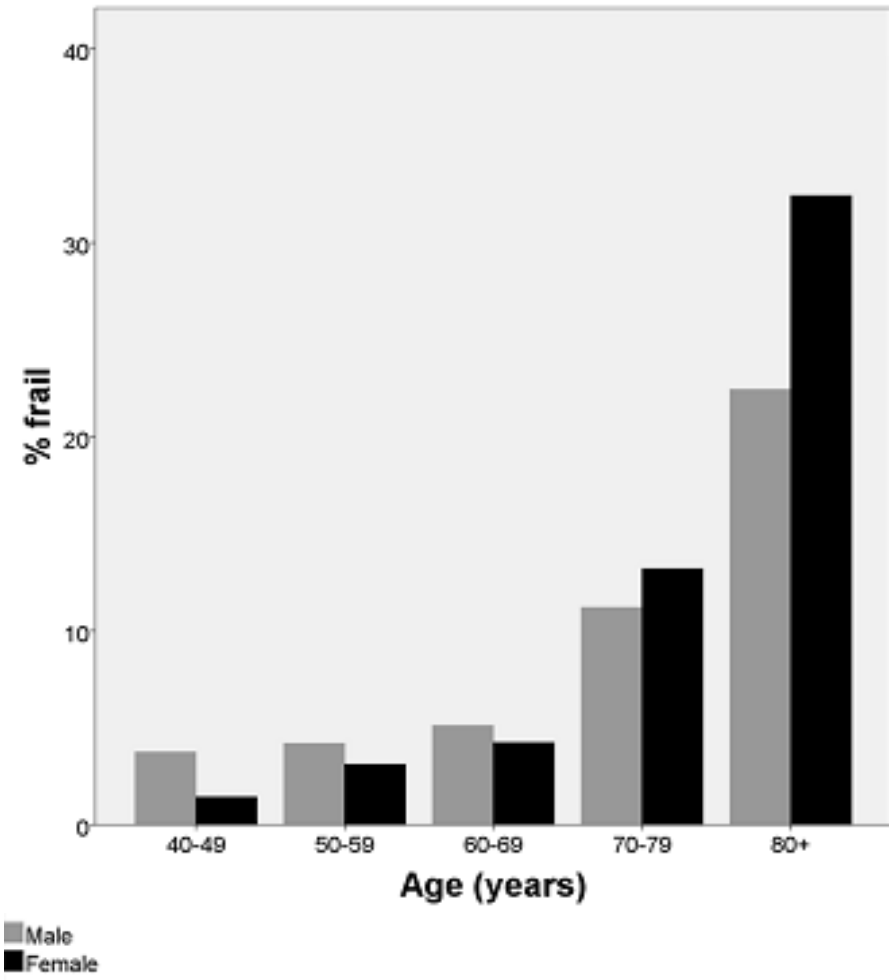
Life expectancy worldwide has increased, and, with that, populations are aging. In 2001, 7.3% of the total population in South Africa was aged 60 years or more with a

life-expectancy in South Africa of 55.2 years. In 2016 this number increased to 8.1% and the life-expectancy increased to 62.4 years (13). Although old age itself does not define frailty, frailty is more prevalent with older age and therefore the incidence of frailty is also increasing (14). It is therefore necessary to be able to recognize this geriatric syndrome as well as being aware of its potential impact on hospitalisation of elderly participants. A recent study in the United Kingdom revealed a worrying fact, in that although people lived longer, they also had more years of expected dependency and poor health which indicates that they are probably more frail (15).

The exact prevalence of frailty is difficult to define due to the multiple different definitions. In a literature review done, the prevalence in international (the review included studies from the UK, USA, Canada, Australia, Taiwan and several European countries) community dwelling elderly people was estimated to be anywhere between 4 – 59.1% with an overall weighted prevalence of 10.7% (16). A European study found a prevalence of 6 - 44% (17). In the Cardiovascular Health Study (CHS) (community based older people), the incidence of frailty was 6.9% overall with 47% of the population fulfilling criteria to be classified as pre-frail (18). These studies did not distinguish between primary and secondary frailty. Secondary frailty is similar to primary frailty but the cause is an underlying inflammatory or immune disease.

In a South African study of community dwelling older participants in a rural part of the country, frailty was prevalent in 7% of the study participants. The prevalence of frailty rose with increasing age (figure 1) (19). This study assessed frailty with a phenotypic frailty score. Another Sub-Saharan African study estimated the prevalence of frailty in Tanzanian community dwelling older people, to be 19.1% based on a comprehensive geriatric assessment. This study also showing increasing prevalence with increasing age: age 60-69 having a 6.9%, age 70-79 a 19.9%, and age 80+ showing a 44.7% prevalence of frailty (20). There are no studies done on frailty in hospitalised participants in South Africa.

Figure 1: Differences in prevalence of frailty by sex and age category in HAALSI (19)



9.3 Pathogenesis of frailty

The pathogenesis of frailty is complex and multifactorial. Oxidative stress, mitochondrial dysfunction, DNA damage and cell senescence, combined with gene variation and inflammatory diseases contribute to impaired physiological systems. The subsequent inflammation and neuroendocrine dysregulation triggers anorexia, sarcopaenia, impaired immune functioning, impaired cognition and glucose metabolism. This leads to the clinical picture of the physical phenotype of frailty with slowness, weakness, weight loss, decreased activity and fatigue (2).

Frailty is a dynamic condition. Participants with early frailty can improve to pre-frail conditions. Severely frail participants often cannot recover due to a lack of reserves

and the end-stage of frailty may result in impaired functional status, development of significant apathy and a decrease in appetite which ultimately results in death (14). Frailty can be a primary or secondary diagnosis (14).

9.4 Diagnosing frailty

There are several indices described to define frailty. Most of these do not incorporate cognitive assessment and hence only evaluate clinical physical frailty.

The Comprehensive Frailty Assessment Instrument (CFAI) incorporates environmental indicators together with physical, psychological and social domains to identify frailty and motivates towards a more holistic approach (21). The CFAI-plus also incorporates the cognitive domain.

The Rockwood clinical frailty scale is a picture and clinical impression-based scale where participants can score 1 (very fit) to 7 (severely frail – dependent on others for the activities of daily living or terminally ill). It correlated well with other frailty indices (22).

The Physical Frailty Phenotype was developed by Fried et al (18) to provide a potential clinical assessment for frailty and was shown to correlate with the increased risks of frailty. It is the most commonly used index in research studies. When no criteria are met, a patient is classified as robust and with 1-2 criteria being met, the patient is classified as pre-frail. Frailty is defined when three or more of the following criteria are met:

- Weight loss (≥5 % of body weight in the last year)
- Exhaustion (a “yes” response to questions regarding the effort required for activity)

- Weakness (decreased grip strength)
- Slow walking speed (>6 to 7 seconds to walk 15 feet (4.6 meters))
- Decreased physical activity (kilocalories spent per week: males < 383 Kcals and females < 270 Kcal)

The study of osteoporotic fractures frailty tool (23) consists of 3 questions or signs with the presence of two or more making it a frail classification:

- Have you lost more than 5% of your body weight in the past year?
- Are you able to rise from a chair five times without the use of your arms?
- A “no” response to the question: “Do you feel full of energy?”.

The Canadian Study of Health and Aging Frailty Index by Kenneth Rockwood looks at accumulated deficits in symptoms, signs, diseases and disabilities (22). It consists of 70 to 92 variables (short or long version) and the higher the score, the higher the risk of frailty. The Frailty Index may be more indicative of potential adverse outcomes, but it does not assist in detecting the etiology of frailty (24).

The FRAIL scale (25) was developed as a practical screening tool which overcomes the limitation of having population norms. The FRAIL scale is a useful bedside assessment tool and therefore it was chosen to evaluate frailty in this study. It is also used to identify patients at risk of frailty i.e. “pre-frail” patients who would then benefit from further intervention. It has been validated in studies in older Australian men (26) and women (27) as well as North Americans (28) to demonstrate its predictive value but it has not been validated in South Africa.

The FRAIL scale consists of 5 simple questions directed to the patient or caregiver:

- F (fatigue) – do you feel fatigued?
- R (resistance) – are you able to climb a flight of stairs?
- A (activity) – can you walk around one block?
- I (illnesses) – do you have 5 or more illnesses?
- L (loss of weight) – have you lost more than 5% of body weight in the past year?

If 3 or more answers are positive, the patient is defined as frail, and if 1 or 2 answers are positive, the patient is pre-frail. A robust patient will score no positive answers.

There are few direct comparisons of the different frailty indicators and their ability to predict adverse outcomes. One European study (which included the FRAIL scale and Frailty Index mentioned above as well as other indices not mentioned) highlighted the variability between scales due to the different characteristics of frailty that is measured and the lack of a clear definition (17).

9.5 Other clinical tools useful for the assessment of clinically frail older persons

Various non-frailty specific tools can be used in clinical practice to assist with the assessment of frail patients. The comprehensive geriatric assessment involves an expansive evaluation of an older person to identify geriatric conditions such as cognitive impairment and loss of functional abilities. It is ideally performed by a multi-disciplinary team and should include a frailty assessment as well using the tools described below to develop a plan to maximize quality of life and health with aging (29).

As described above, one of the hallmarks of frailty is weight loss. The mini-nutritional assessment (MNA®) is a useful tool to assess the patient's general nutritional status and the need to intervene (26).

The Rankin Scale was described in 1957 as a predictor of outcome in stroke patients. It measures functional outcome after devastating illness and global disability and is therefore applicable in the setting of frailty (30, 31). It allows for a clinically meaningful description of changes in a patient's functional status

Table 1: The modified Rankin Score

Grade	Modified Rankin Score
0	No symptoms at all
1	No significant disability: despite symptoms, able to carry out all usual duties and activities
2	Slight disability: unable to perform all previous activities, but able to look after own affairs without assistance
3	Moderate disability: requiring some help, but able to walk without assistance
4	Moderately severe disability: unable to walk without assistance and unable to attend to own bodily needs without assistance
5	Severe disability: bedridden, incontinent and requiring constant nursing care and attention
6	Death

In the original Rankin Score, scores of 0 and 6 were not applicable.

The majority of frailty assessment indices/tools do not adequately assess cognitive function, missing this important domain in clinical practice. In clinical practice assessment of cognition can be time consuming and limited by education level and language biases. Usual bedside clinical tools include the mini-mental state

examination, the Montreal cognitive assessment, the mini-cog (which is a brief screening tool) or the longer and more costly neuropsychological batteries.

The mini-Cog has been compared to longer neuropsychological batteries to screen for possible dementia and was found to have similar sensitivity and specificity to these longer batteries (32). It is a quick 3-minute screening test which consists of a clock drawing task and recall of three unrelated words. If unable to recall any of the words, the patient is classified as possibly demented and if they recall all three words, they are non-demented. If they recall one or two words, the patient is classified according to their clock drawing skills which is either abnormal or normal and then classifies the patient as demented or not demented (33). Patients who screen positive for dementia in clinical practice would then undergo more confirmatory assessment for establish a firm diagnosis.

9.6 Risk factors for developing frailty

The risk factors for developing frailty include the following: deterioration in cognition, multiple comorbidities, decreased functional capacity, and a poor perception of health and old age (34). In the Women's Health Initiative (WHI) the frail women in the study were more likely to have another illness including stroke and ischemic heart disease, diabetes mellitus, hypertension, arthritis, cancer and chronic obstructive pulmonary disease. Women that were living alone, were less likely to be frail – possibly because disabled people lose the ability to live independently (34).

There is also an increased prevalence in patients with a lower education level, although the significance of this risk factor was found to be doubtful in the WHI Observational Study (34). Other risk factors for developing frailty were also identified in the WHI study - smoking, being underweight or obese, as well as depressive symptoms and current treatment with antidepressants (35). The mechanism of frailty in antidepressants may be related to their side-effects and increased risk of falls and

fractures which subsequently leads to frailty. Three groups of anti-depressants were studied including selective serotonin reuptake inhibitors, tricyclic antidepressants and other/multiple drugs. The mechanism of frailty in patients with depression can possibly be explained by the increased cytokines, risk of weight loss, fatigue and becoming less active (35).

The use of postmenopausal hormone therapy has also been identified as a risk factor, but this was only observational and no studies to evaluate the mechanism behind this has been done to the author's knowledge (35).

Alzheimer's disease pathology in older people have also been linked to frailty, even in patients that do not have dementia (36). There has been several studies that suggests that components of frailty (eg impaired grip strength, slow gait and weight loss) predicts the development of dementia. In this study by Buchman et al, they speculate that the buildup of Alzheimer's disease pathology affects the above frailty components by harming neural systems that are involved in the planning and monitoring of certain movements that frailty and Alzheimer's disease share an underlying etiology or pathogenesis. (36)

A study in Bordeaux identified that unhealthy eating patterns may also increase the risk of frailty – in particular "biscuits and snacking" and "pasta" patterns were identified as high risk (37). There is an increased risk for frailty in obese women which may indicate that a higher body weight does not protect against frailty, despite it being thought of as a "wasting syndrome" (34). The Mini Nutritional Assessment (MNA®) is a useful clinical tool to determine the risk of malnutrition in the elderly population (38).

These risk factors represented easily identifiable risks and therefore provide important targets for prevention.

9.7 Adverse effects of frailty

Participants in the Cardiovascular Health Study (CHS) who were frail had increased risk of mortality, functional decline, morbidity, and falls. The simple Study of Oteoporotic Fractures (SOF) index predicts risk of falls, disability, fracture, and mortality in men as well as the more complex CHS index (39).

Hospitalisation has shown to have a significant impact on frail patients, where the risk may be up to seven times higher to develop disabilities within one month of hospitalisation than non-frail patients (40).

Frailty is an independent risk factor for hospitalisation, nursing home admission and death (41). The hazard or odds ratio of mortality in severely frail patients was documented in 4 large studies with the following results (42):

- Cardiovascular health study: 1.63 (1.27-2.08)
- Canadian study of health and aging: 3.69 (2.26-6.02)
- Women's health and aging study: 6.03 (3.00-12.08)
- Study of osteoporotic fractures: 2.75 (2.46-3.07)

Frailty is also a predictor of surgical outcome (43) as well as a risk factor for mortality in patients with coronary artery disease (44). Frailty has also been identified as a risk factor for early re-admission into hospital (45). Frailty outcomes in a Canadian study indicated that frail patients had a delayed and often incomplete recovery of impaired mobility in acutely ill older adults admitted to hospital (46).

In geriatric oncology, frailty has been shown to be predictive for poor clinical outcomes in older patients with colorectal cancer that receives chemotherapy (47).

Frailty in human immunodeficiency virus (HIV) positive patients have also been associated with increased mortality and accelerated immune-function deterioration (48).

Depression can be an adverse effect of frailty (and as previously mentioned is also a risk factor to develop frailty).

Impaired cognition is not only a risk factor for adverse events in frail patients, it is also an outcome of frailty (36, 49). It appears that executive function is often most impaired in frail patients (50).

Sarcopenia is defined as “the age-associated loss of skeletal muscle mass and function” (51). The loss of mass indicates that sarcopenia can be a feature of frailty. Sarcopenia is also a strong risk factor for frailty and subsequently frailty leads to an increased risk of falls (hazard ratio 1.23 to 2.44 in various studies) (42) and hip fractures (52).

9.8 Management of frailty

Once frailty is identified, however, the management is still significantly lacking in that the evidence supporting the management of frailty is limited. The main problem in identifying management is due to the multiple different criteria to identify frailty.

Potential interventions depend on the level of frailty. In pre-frail patients, exercise has been shown to have the most benefit, but it is useful in the management plan of even the frailest patients. It improves the older adult’s quality of life and functionality (53). The suggested exercise program should include strength/resistance training and be adjusted according to the patient’s abilities.

It is important to review the patient's medication list and using various criteria (e.g. Beer's list or the screening tool of older people's prescriptions and screening tool to alert to right treatment (STOPP/START) criteria) to examine the need and potential harm of each drug a patient is using.

Nutritional interventions to assist with sarcopenia and weight loss are also indicated (54). An increased intake of protein and calories is recommended, and vitamin D supplementation may be indicated in deficient patients. Vitamin D deficiency is associated with a higher risk of frailty (39), but the exact relationship between vitamin D status and frailty still needs to be examined further. The recommended daily intake of vitamin D is 800-1000 international units.

Comprehensive geriatric assessment will help to improve physical and psychological function through a multidisciplinary team that can coordinate their care of the older patient.

Several hormonal interventions have been studied but proven ineffective in managing frailty including routine testosterone replacement in older men without androgen deficiency. Studies have also examined the use of exogenous growth hormone replacement and dehydroepiandrosterone sulphate (DHEA-S) supplementation with no benefit being shown (55, 56).

In advanced frailty, the use of palliative care should not be forgotten. It can help to alleviate the symptoms of associated health problems. It may also assist the patient and families or loved ones to determine goals of care and the appropriateness of potentially aggressive interventions such as chemotherapy and surgery.

It is vital that healthcare systems are developed that meet the health as well as social needs of vulnerable elderly adults. Social care and health care are indivisible

for older people. In the United Kingdom (UK) an electronic frailty index was developed that can identify high risk older people with increased risks of future nursing home admission, hospitalisation, longer length of hospital stay and morbidity in the routine primary healthcare setting (57).

10 Protocol

10.1 Aim

To determine the impact of frailty measured clinically using the FRAIL scale in participants aged 65 years and older hospitalised in the urban Johannesburg environment.

10.2 Objectives

- To determine whether frailty has an impact on the outcome of hospitalisation in the South African environment and the extent thereof.
- To determine the clinical value of the FRAIL scale in a South African setting. There are no frailty criteria that have been specifically validated for the South African population and the FRAIL scale is practical for everyday clinical use as opposed to other criteria that require complicated calculations and instrumentation. The FRAIL scale has been validated in multiple other countries.
- To describe the 6-month outcome in frail participants after discharge.

10.3 Study design



An observational, prospective study.

10.4 Population

Inclusion criteria:

- Patients admitted to the medical wards of Helen Joseph Hospital (wards 6, 10, 11, 12, 13, 14, 15, 22, 23)

- Patients admitted to the Wits Donald Gordon hospital geriatric ward (section C)
- Older than 65 years of age

Exclusion criteria:

- No command of the English language and no interpreter available
- Significant visual and/or hearing impairment with no available collateral history that reasonably precludes effective communication
- Unable to give consent and no proxy available
- Pre- and postoperative patients admitted

10.5 Methodology

Subjects will be recruited over a period of 10 -14 months or until 200 -300 cases are collected. The cases will be collected using convenience sampling. Patients will be identified on daily rounds through the medical wards mentioned above, using the date of birth as screening from the original admission wards.

The patient will then be asked for written informed consent (Appendix 1 and 3) to be included in the study and for a proxy to be contacted. The proxy consent will be obtained before including the patient in the study and will be obtained in all cases to facilitate the follow-up consent if a patient should deteriorate in the 6 months at home. (Appendix 2 and 4) The consent form will also include separate consent to contact the patient (or proxy) 6 months after discharge to determine their long-term progress.

Demographic detail will be collected including age, sex, current hospital, date of admission. Their modified Rankin Score on admission will be determined.

The patient will be asked the relevant questions for completion of the FRAIL scale. (25) (Appendix 5) The original proposed FRAIL scale did not specify precise values with regards to one flight of stairs and the distance of one block. For the purpose of this study one flight of stairs is defined as 20 stairs and one block is 100 meters.

A mini nutritional assessment (MNA®) (57) will be conducted. The patient will be weighed with a standard bathroom scale without shoes and heavy outer clothing. Their height will be measured with a height gauge or standard tape measure for measuring half arm span. The half arm span is measured from the sternal notch to the tip of the middle finger with the arm held horizontally. If the patient is not mobile, calf circumference will be used to determine the nutritional state of the patient. The calf circumference will be measured over the widest part of the calf with the tape measure at a right angle to the leg. The body mass index (BMI) will be calculated as kg/m^2. According to the MNA® the patient is at risk of malnutrition with a score of 8 - 11 and classified as malnourished with a score of <8.

The patient will then undergo cognitive testing using the modified mini-COG test, which consists of a clock drawing task and recall of three unrelated words. It is useful to screen a patient for dementia. If unable to recall any of the words, the patient is classified as possibly demented and if they recall all three words, they are non-demented. If they recall one or two words, the patient is classified according to their clock drawing skills which is either abnormal or normal and then classifies the patient as demented or not demented.

The patient's chronic drug/medication history will be obtained and will be classified as 4 or less, 5 or more (which will be define as polypharmacy) and unknown.

Upon discharge the patient will be reviewed to determine their RANKIN score again and circumstances after discharge. The duration of stay will also be documented as well as whether a geriatric team consultation was received.

It is proposed that a potential illness severity score could be developed in this study where a patient is classified as having a severe illness if they stay in hospital for more than 7 days and have a change in Rankin Score of more than 1.

The patients or proxies will be contacted again telephonically in 6 months' time and asked what their condition is and the level of care they are experiencing at that time for longer term progress review.

If any unmet clinical information that is of relevance to the treating physician is discovered during the time spent with the patient, the patient's treating physician will be informed through a note left in the patient's file after examination. Informed consent will be obtained again prior to disclosure of such information.

10.6 Investigators

The principal investigator is Dr. Susan Coetzer. Other data collectors are Dr. Lindy Sinclair, Dr. India Butler, and Dr. Brent Tipping. The other data collectors are to collect data from Donald Gordon Hospital. They will receive a briefing and copies of all the consent forms and data sheets for use in the study.

10.7 Statistics

All clinical information will be recorded on a numbered datasheet. An identifying code book will be kept by the principal investigator. Access to the data will be limited to the principal investigator.

Data will be imported into a Microsoft Excel spread sheet where after it will be reviewed and “cleaned” of missing information and inconsistencies. Inconsistencies will still be mentioned (albeit separately) to ensure that there is no bias.

STATISTICA software – available from the University of the Witwatersrand – will be used to fully analyse the data.

The variables measured will be the patient’s admitted hospital, age and sex. The pre-admission, immediate post-discharge and follow-up modified Rankin score and living environment will be determined. The duration of hospital stay, FRAIL score, dementia screen, prescription drug count and whether a geriatric consultation was requested during hospitalisation will also be recorded.

Parametric data will be described using mean and standard deviation. Non-parametric data will be described using median and interquartile range with a 95% confidence interval.

The parametric data will further be analysed using Chi-squared testing and the non-parametric data will be analysed using the Mann-Whitney test.

10.8 Strengths

The setting is a typical South African hospital – including both the public and private sector with busy medical wards and is therefore applicable to practice in South Africa where there is no such data at present.

The assessment tools are practical and are frequently used in every day geriatric specialist assessment.

10.9 Limitations

There may be a bias towards English speaking patients and/or those patients with family members and care givers that are able to give a good history.

The study will only involve those geriatric patients that are admitted to medical or specific geriatric wards and exclude the surgical and orthopaedic patients.

Past medical and social history as well as the current diagnosis is not taken into account although the change in the modified Rankin Score may give an idea of the impact of the disease.

10.10 Potential benefits

The study may increase awareness of the frailty syndrome and its potential impact on hospitalisation.

It may also serve to recognise the pre-frailty syndrome and subsequently encourage primary prevention (or “prehabilitation”).

Lastly it may indicate the prevalence of frailty and motivate to establish “step down” facilities for rehabilitation and permanent care facilities for the support of frail patients.

10.11 Ethics

The study proposal will be submitted to the WITS ethics committee for approval prior to data collection.

The proposed observations are physically non-invasive and have only a minimal chance of being psychologically invasive. In case of emotional distress however, psychological counselling will be offered.

Proxy consent as set out by the National Health Act of the Republic of South Africa (60, 61) guidelines will be obtained if the patient is confused.

10.12 Timing

Research proposal and ethics clearance:	August – December 2013
Data collection:	January – December 2014
Data analysis:	January – March 2015
Writing of thesis:	March – May 2015
Writing of article for publication:	May – June 2015

10.13 Funding

The costs will be funded privately by the principal investigator.

The proposed costs would include the following:

- Bathroom scale R250
- Tape measure R80
- Height gauge R400
- Photocopies of data sheets and consent forms R1000
- Other stationery R100
- Telephone calls to proxies and follow up calls R600

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The impact of frailty on the outcome of hospitalised older people in Johannesburg, South Africa

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Figures: 2

12.1 Abstract

12.2 Aim

To determine the impact of frailty measured clinically using the FRAIL scale in participants aged 65 years and older, hospitalised in the Johannesburg environment.

12.3 Methods

This is an observational prospective study of patients admitted to the medical wards of Helen Joseph hospital and Wits Donald Gordon Medical Centre. Participants were evaluated for frailty according to the FRAIL scale. Nutritional status was determined using the mini-nutritional assessment (MNA®). Functional status was determined using the modified Rankin score. Participants had telephonic follow-ups at 6 months to review their functional status and living environment.

12.4 Results

Of the 108 recruited participants, 78 (72%) were assessed as frail by the FRAIL scale on admission. Hospital survival overall was 93.5%. All participants who died were classified as frail. Frail participants were older (81.0 vs. 77.3 years, p=0.027), more likely to be malnourished (90.3% vs. 9.7%, p<0.001), more functionally disabled (93.5% vs. 46,7%, p<0.0001) and more likely to have required care assistance prior to admission (70.5% vs. 36.7%, p=0.0029). There were no significant differences between frail and robust participants in polypharmacy, hospital length of stay, cognitive impairment, and gender. Follow-up data were available for 94 participants. Frail participants had higher mortality (39.5% vs. 4.3%, p=0.0013, RR 9.1 (95% CI 1.3-63). Frail participants had more functional impairment at hospital discharge than non-frail participants (98.6% vs. 30%, p<0.0001). At 6 months follow-up there was no functional difference between frail and non-frail participants due to the increased mortality.

12.5 Conclusions

The FRAIL scale has utility in identifying older participants at risk of mortality and in-hospital functional decline.

12.6 Introduction

Frailty is defined by the American Geriatric Society in 2004 as “a state of increased vulnerability to stressors due to age-related declines in physiologic reserve across neuromuscular, metabolic and immune systems” (1). Homeostenosis is a theory that there are diminishing physiologic reserves available to meet challenges to homeostasis which therefore leads to this ‘increased vulnerability’ (2).

Life expectancy worldwide has increased, and, with that, populations are aging. In 2001, 7.3% of the total population in South Africa was aged 60 years or more with a life-expectancy in South Africa of 55.2 years. In 2016 this number increased to 8.1% and the life-expectancy increased to 62.4 years (3). Increased longevity is coming at the expense of more years of dependency and poor health (4). Although old age itself does not define frailty, frailty is more prevalent with older age and therefore the incidence of frailty is also increasing (5). It is therefore necessary to be able to recognize this geriatric syndrome as well as being aware of its potential impact on hospitalisation of elderly participants. The exact prevalence of frailty is difficult to define due to the different definitions and in a literature review done the prevalence in international community dwelling elderly people was estimated to be between 4.0% and 59.1% (6).

In a South African study of community dwelling older participants in a rural part of the country, frailty was prevalent in 7% of the study population. This study also proved the increased prevalence of frailty with age and females were affected more than their male counterparts (7).

The pathogenesis of frailty is complex and multifactorial. Oxidative stress, mitochondrial dysfunction, DNA damage and cell senescence, combined with gene variation and inflammatory diseases contribute to impaired physiological systems. The subsequent inflammation and neuroendocrine dysregulation triggers anorexia,

sarcopaenia, impaired immune functioning, impaired cognition and glucose metabolism. This leads to the clinical picture of the physical phenotype of frailty with slowness, weakness, weight loss, decreased activity and fatigue (1).

Frailty is a dynamic condition. Patients with early or mild frailty can improve to pre-frail conditions. Severely frail patients often cannot recover due to a lack of reserves and the end-stage of frailty may result in impaired functional status, development of significant apathy and a decrease in appetite which ultimately results in death (5).

The FRAIL scale (8) was developed as a practical screening tool which overcomes the limitation of having population normative data. It is also used to identify patients at risk of frailty i.e. “pre-frail” patients who would then benefit from further intervention. It has been validated in studies in older Australian men (9) and women (10) as well as Americans (11) to demonstrate its predictive value, but it has not been validated in South Africa.

Hospitalisation has shown to have a significant impact on frail patients, where the risk may be up to seven times higher to develop disabilities within one month of hospitalisation than non-frail patients (12).

There is a bidirectional relationship between frailty and impaired cognition (13,14). Sarcopenia is also a strong risk factor and subsequent frailty leads to an increased risk of hip fractures (15). Frailty is an independent risk factor for hospitalisation, nursing home admission and death (16).

The hypothesis for this study was that frail elderly hospitalised patients in SA have a longer duration of inpatient stay compared to the non-frail and an increased mortality and greater functional deterioration during hospital admission. The following objectives were aimed for:

- To determine whether frailty has an impact on the outcome of hospitalisation in the South African environment and the extent thereof.
- To determine the clinical value of the FRAIL scale in a South African setting. There are no frailty criteria that have been specifically validated for the South African population and the FRAIL scale is practical for everyday clinical use as opposed to other criteria that require complicated calculations and instrumentation.
- To describe the 6-month outcome in frail participants after discharge.

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12.7 Methods

12.7.1 Study Design and Setting

An observational, prospective study done in two South-African urban hospitals, Helen Joseph Hospital (government institution) and Wits Donald Gordon Medical Centre (private institution). There was a baseline admission evaluation, discharge evaluation and then 6-month follow-up evaluation.

12.7.2 Inclusion Criteria, Outcomes and Definitions

The study population were patients admitted to the medical wards of Helen Joseph Hospital and Wits Donald Gordon Medical Centre that were 65 years and older. Patients were excluded if they had no command of the English language (or significant visual or hearing impairment without collateral history) and no interpreter was available. Pre- and postoperative patients were also excluded as well as patients that had no proxy available.

They were recruited over a period of 24 months (from January 2014 to December 2015) using convenience sampling. Initial data was collected during the admission and then they were contacted again after 6 months to determine the subject's condition at the time (functionally) as well as the level of care they were receiving at the time.

The initial data collected included the following:

Demographic detail was collected including age, sex, current hospital, date of admission. Their modified RANKIN Score on admission was determined to ascertain their disability/functional needs (17) and was defined by the following criteria:

- Rankin 0 - No symptoms at all

- Rankin 1 – No significant disability: despite symptoms, able to carry out all usual duties and activities
- Rankin 2 – Slight disability: unable to perform all previous activities, but able to look after own affairs without assistance
- Rankin 3 - Moderate disability: requiring some help, but able to walk without assistance
- Rankin 4 – Moderately severe disability: unable to walk without assistance and unable to attend to own bodily needs without assistance
- Rankin 5 – Severe disability: bedridden, incontinent and requiring constant nursing care and attention
- Rankin 6 – Death

The patient was asked the relevant questions for completion of the FRAIL scale.

- F (fatigue) – do you feel fatigued?
- R (resistance) – are you able to climb a flight of stairs?
- A (activity) – can you walk around one block?
- I (illnesses) – do you have 5 or more illnesses?
- L (loss of weight) – have you lost more than 5% of body weight in the past year?

The original proposed FRAIL scale did not specify precise values with regards to one flight of stairs and the distance of one block. For the purpose of this study one flight of stairs is defined as 20 stairs and one block as 100 meters. They were defined as frail if there was a positive response to 3 or more of the questions and non-frail if they had a positive response to 2 or less.

A mini nutritional assessment (MNA®) (18) was conducted. The participants were found to be malnourished if they had a score of 7 or less. Cognitive screening for possible dementia was done using the modified mini-COG test which consists of a clock drawing task and recall of three unrelated words (19).

The patient's chronic drug/medication history was obtained and was classified as 4 or less, 5 or more (polypharmacy) and unknown.

Upon discharge the patient was reviewed to determine their modified RANKIN score again and circumstances after discharge. The duration of stay was also documented as well as whether a geriatric team consultation was received.

12.7.3 Data Collection and Statistical Analysis

Ethics approval was obtained from the University of the Witwatersrand Human Research Ethics Committee prior to data collection. Approval number M131183.

Descriptive analysis of the data was carried out as follows: Categorical variables were summarized by frequency and percentage tabulation and illustrated by means of bar charts. Continuous variables were summarized by the mean, standard deviation, median and interquartile range, and their distribution illustrated by means of histograms.

The X^2 test was used to assess the relationship between frailty category and hospital, age (categorized), sex, care environment at admission, MR score at admission, MNA®, dementia status, number of chronic medications, geriatric team consultation. Fisher's exact test was used where the requirements for the X^2 test could not be met.

The relationship between outcome (categorised for LOS; the other outcomes are already categorical) and frailty, controlling for hospital, age, sex, care environment at admission, geriatric team consultation, was assessed by multinomial logistic regression.

Data analysis was carried out using SAS version 9.4 for Windows. The 95% significance level was used.

12.8 Results

One hundred and eleven patients were recruited for the study with three patients (or their proxies) declining participation leaving one hundred and eight patients (108) that participated.

12.8.1 Baseline demographics

The mean age of participants was 80.0 years (standard deviation (SD) 7.8 years) with the oldest patient being aged 96 years and the youngest 65 years.

The mean length of stay was 10.9 day (SD 11.2 days) with a range of 1 to 75 days.

At the Wits Donald Gordon Medical Centre, 35 patients were recruited (32.4%) and 73 patients (67.6%) from Helen Joseph hospital.

There were 75 women (69.4%) and 33 men (30.6%).

The participants were admitted from the following care environments:

- Independent living = 42 (38.9%)
- Home with a part-time caregiver = 30 (27.8%)
- Home with full time care = 21 (19.4%)
- Institutional care – assisted living or mid-care = 5 (4.6%)
- Institutional care – frail care = 10 (9.3%)

There were 7 robust participants (6.5%), 23 (21.3%) pre-frail ones, and 78 frail participants (72.2%).

The dementia screen with the mini-cog was positive in 97 (89.8%) of the participants.

The functional status of the participants according to their RANKIN scores were as follows:

- Rankin 0 – 1 (0.9%)

- Rankin 1 – 18 (16.7%)
- Rankin 2 – 22 (20.4%)
- Rankin 3 – 38 (35.2%)
- Rankin 4 – 18 (16.7%)
- Rankin 5 – 11 (10.2%)
- Rankin 6 – 0 (0%)

Of the total study population, 62 participants (57.4%) were classified as malnourished on the MNA®, 30 (27.8%) at risk of malnutrition and 16 (14.8%) were of normal nutritional status.

Thirty four (31.5%) of the participants used less than 5 chronic medications, 58 (53.7%) used 5 or more medications and for 16 (14.8%) of the participants' medication use was unknown.

Seventy five (69.4%) of the participants had a geriatric consultation during their admission.

12.8.2 Outcomes

12.8.2.1 General population status at discharge and 6-month follow up

Table 2: Modified Rankin score and care environment at discharge and 6-month follow-up

Variable	Category	N	%	N	%
Discharge from hospital				**Follow-up at 6months**	
Survival of the total participants from admission (overall; n=108)	No	7	6.5	29	26.9
	Yes	101	93.5	65	60.2
	LTFU	n/a	n/a	14	13.0
Survival of those discharged from hospital	No	7	6	22	21.8
	Yes	101	94	65	64.4
	LTFU	0	0	14	13.9
Modified Rankin score (for those who survived; n=101)	0	0	0	1	1.5
	1	10	9.9	6	9.2
	2	18	17.8	18	27.7
	3	35	34.7	21	32.3
	4	23	22.8	13	20
	5	15	14.9	6	9.2
Care environment (for those who survived; n=101)	Independent	27	26.7	22	33.8
	Home-part time care	28	27.7	14	21.5
	Home-full time care	28	27.7	21	32.3
	Institution – mid-care	2	2	2	3.1
	Institution – frail care	16	15.8	6	9.2

LTFU = lost to follow-up

12.8.2.2 Frailty status on admission

Table 3: Baseline variables of frail versus non-frail participants

Variable	**Category**	**Total**		**FRAIL Status**				**p-value for between-group test**
				Non-frail		**Frail**		
		N	**%**	**N**	**%**	**N**	**%**	
N		**108**		**30**		**78**	72.2	
Admission								
Hospital	WDGMC	35	32.4	8	22.9	27	77.1	0.50
	HJH	73	67.6	22	30.1	51	69.9	
Sex	Female	75	69.4	19	25.3	56	74.7	0.48
	Male	33	30.6	11	33.3	22	66.7	
Care environment	Independent	42	38.9	19	45.2	23	54.8	0.0029
	Home-part time care	30	27.8	7	23.3	23	76.7	
	Home-full time care or institutional care	36	33.3	4	11.1	32	88.9	
Modified Rankin score	0-1	19	17.6	14	73.7	5	26.3	<0.0001
	2	22	20.4	8	36.4	14	63.6	
	3	38	35.2	8	21.1	30	78.9	
	4	18	16.7	0	0.0	18	100.0	
	5	11	10.2	0	0.0	11	100.0	
Positive Dementia Screen	No	11	10.2	4	36.4	7	63.6	0.49
	Yes	97	89.8	26	26.8	71	73.2	
MNA® score	0-7 malnourished	62	57.4	6	9.7	56	90.3	<0.0001
	8-11 risk of malnutrition	30	27.8	14	46.7	16	53.3	
	12-14 normal	16	14.8	10	62.5	6	37.5	
Chronic medication	<5	34	37.0	15	44.1	19	55.9	0.063
	>=5	58	63.0	14	24.1	44	75.9	
Geriatric consultation	No	33	30.6	15	45.5	18	54.5	0.01
	Yes	75	69.4	15	20.0	60	80.0	

WDGMC – Wits Donald Gordon Medical Centre; HJH – Helen Joseph Hospital; MNA® - Mini-nutritional assessment

Table 4: Length of stay

Length of stay(days)							p-value for between-group test
FRAIL status	**N**	**Mean**	**SD**	**Median**	**Minimum**	**Maximum**	
Non-frail	**30**	11.6	15.1	8	1	75	0.53
Frail	**78**	10.6	9.4	7	1	64	

On admission the majority of participants (72.2%) were classified as frail. Frail participants were significantly older (P-value = 0.027). Hospital of recruitment, sex and length of stay did not differ significantly between frail and non-frail participants.

Frail participants were more likely to have higher care requirements and poorer functional status on admission (table 2).

Ninety-eight (89.8%) participants had a positive dementia screen suggesting that only 11 (10.2%) participants were unlikely to have dementia. Participants with a positive dementia screen were not more likely to be frail.

Frail participants were significantly more likely to be malnourished (P-value = <0.0001).

There was a non-significant trend towards frail participants having more polypharmacy (p=0.063).

Frail participants were more likely to receive geriatric consultation (p=0.01).

12.8.2.3 Discharge outcomes

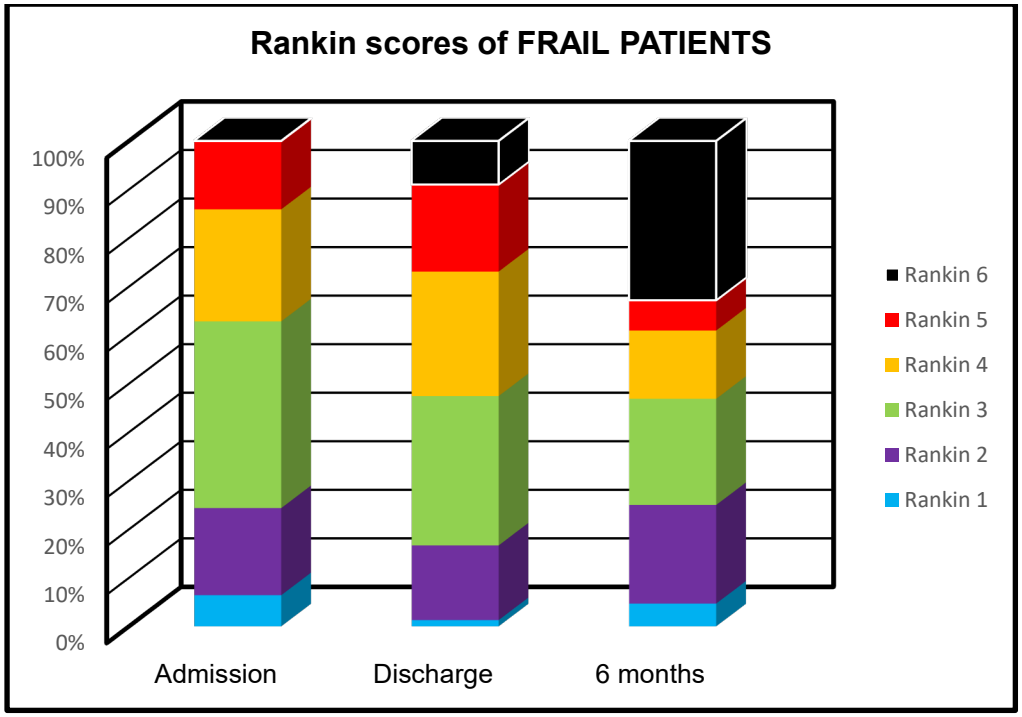
One hundred and one (93.5%) participants survived to discharge with all 7 participants who died being classified as frail. Of those who survived frail participants were significantly more likely to suffer a decline in function ($p<0.001$) as determined by an increase in their Rankin score. At discharge the frail patients with a Rankin score of 3,4 or 5 were 68.6%, 87,0% and 93.3% respectively.

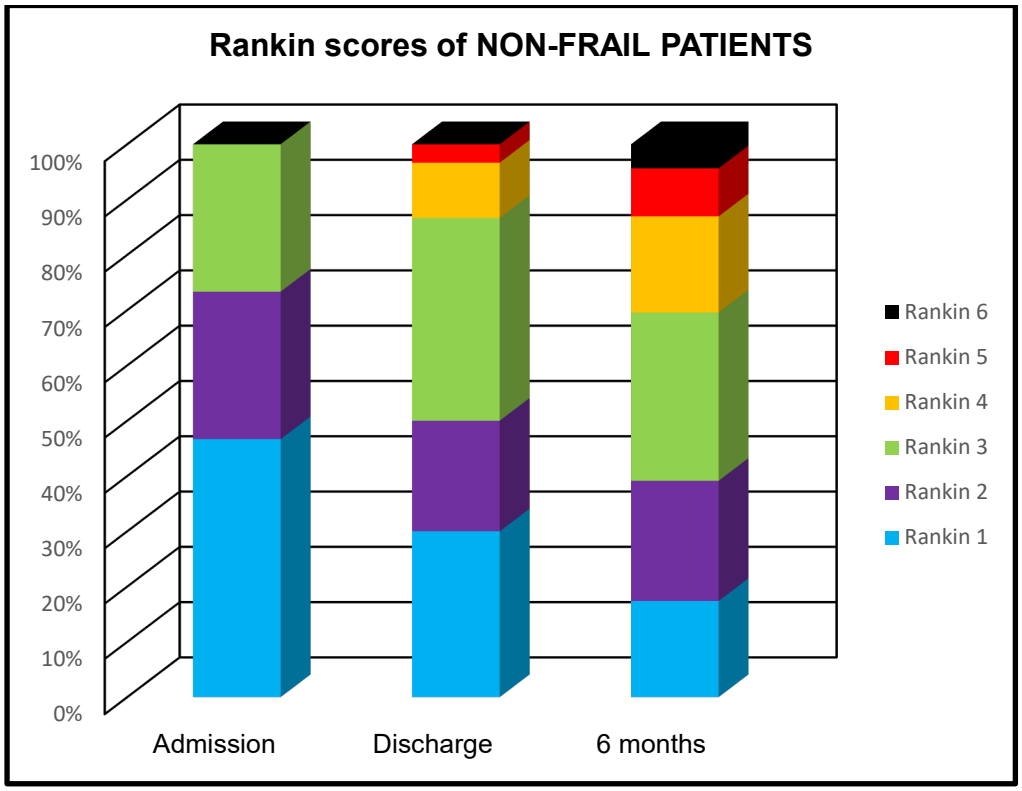
Overall only 27 (26.7%) participants were able to be discharged home with no care. This was less than the admission 42 (38.7%). Of the 27 participants that went home with no additional care, 14 (51.9%) were frail. Of the 28 discharged home requiring part-time care, 19 (67.9%) were frail and of the 46 discharged to an institution or home with permanent care, 38 (82,6%) were frail. Patients who were frail required more care at discharge ($p=0.02$).





Figure 2: Functional outcomes of frail versus non-frail participants (p<0.001 for between group difference)





12.8.2.4 6-month follow-up outcomes

Table 5: 6-month follow-up survival and functional outcomes of frail vs non-frail participants

Variable	**Category**	**Overall**		**Frailty**				**p-value for between-group test**
				Non-frail		**Frail**		
		N	**%**	**n**	**%**	**N**	**%**	
N		**108**		**30**		**78**		
6-month follow-up								
Survival (for those who were discharged and FU; n=87)	No	22	25.3	1	4.5	21	95.5	0.0056
	Yes	65	74.7	22	33.8	43	66.2	
Survival (overall, for those FU; n=94)	No	29	30.9	1	3.4	28	96.6	0.0013
	Yes	65	69.1	22	33.8	43	66.2	
Modified Rankin score (for those who survived; n=65)	0-1	7	10.7	4	57.1	3	42.9	0.73
	2	18	27.7	5	27.8	13	72.2	
	3	21	32.3	7	33.3	14	66.7	
	4	13	20.0	4	30.8	9	69.2	
	5	6	9.2	2	33.3	4	66.7	
Care environment (for those who survived; n=65)	Independent	22	33.8	11	50.0	11	50.0	0.13
	Home-part time care	14	21.5	3	21.4	11	78.6	
	Home-full time care or institutional care	29	44.6	8	27.6	21	72.4	

FU – followed up

At 6-month telephonic follow-up 7 participants were lost to follow-up leaving 87 participants. Overall 65 participants (74.7%) survived to 6-months. Frail participants had a higher mortality (p=0.0056). The relative risk of surviving to hospital discharge

for frail patient was 7.5 (CI=1.1-53) and RR of the frail participants surviving to 6-month follow-up was 9.1 (CI=1.3-63).

While the proportion of participants living independently at home increased from 28% at discharge to 33.8% at 6 months, there was an absolute reduction from 27 participants living independently at discharge to only 22 at 6-month follow-up.

The number of participants admitted from a frail care facility increased from 9.3 to 15.8% requiring frail care at discharge, but at 6-month follow-up this has decreased again to 9.2%.

The mortality at 6-month follow-up was 25.3% of which 95.5% of these participants were also classified as frail on initial admission to the hospital.

When patients between the two study hospitals were compared, there was no significant difference between the groups for sex, presence of frailty, dementia, malnutrition, length of stay or survival to discharge. Patients at WDGMC had a significantly higher rate of polypharmacy (80% versus 41%, p=0.0015), a higher rate of geriatric consultation (100% versus 54%, P<0.0001) and a higher rate of follow-up at 6 months (97% versus 80%, p=0.028). Patients at WDGMC had significantly higher Rankin scores on admission (p=0.0019) and at 6 months follow-up (p=0.019), but not at discharge (p=0.11).

Rankin scores for all the participants indicated functional loss at both hospital discharge and 6-month follow-up. (Figure 2). This decline in functional status was statistically significant in frail participants at hospital discharge (p<000.1) but not at 6-month follow-up.

12.9 Discussion

12.9.1 Discussion of demographics and clinical parameters

There are very few studies that evaluated frailty in hospitalised patients in low middle income countries.

The prevalence of frailty in this study was 72%. This is in keeping with a similar study done in Singapore (which studied different frailty criteria, namely FRAIL scale, Clinical Frailty Scale and Tilburg Frailty Indicator) that showed a prevalence estimate of 87.1%. The prevalence of frailty using the FRAIL scale in that study was 50% and the FRAIL scale was also identified as most useful in predicting in-hospital mortality (20).

Participants in the study that were frail had a higher mean age demonstrating the link between older age and increased risk of frailty (5).

The strong link between malnutrition and frailty is also confirmed in this study with the majority of malnourished participants being classified as frail (25).

In this study, frail participants had a non-significant trend toward a higher incidence of polypharmacy. Polypharmacy has also been shown elsewhere to be associated with a higher risk of frailty (22). Data suggests a dose response relationship. The underlying mechanisms are unknown but participants with polypharmacy may have higher multimorbidity and subsequently higher degrees of inflammation that can lead to frailty (23).

Nearly 90% of the total population of participants had a positive dementia screen. This number is out of keeping with other literature reviews involving both high and

low-middle income countries (even if considering the diagnosis to rather be delirium as the cause of the cognitive impairment detected by the mini-cog). The incidence of delirium has been documented at up to 42% of hospitalised elderly participants, but not almost 90% (24). This could be due to several reasons including lower education levels, language barriers and other communication barriers (e.g. uncorrected hearing or vision loss). There was no significant difference with respect to frailty and a positive dementia screen as the total risk was so high.

The number of participants that were classified as malnourished was also higher than in other literature. An international study (where only high income countries were studied) indicated a prevalence of malnutrition in hospitalised participants of 38.7% (25).

This study shows that the majority of older persons discharged from hospital required transition to a higher care level. Frail patients significantly more so. This could be due to the need for increased care that was already present pre-admission, but not acted on or realised by family or it may be due to the deterioration in functional status due to factors developing from the illness and at the admission.

Studies have shown that frail patients have a longer length of hospital stay (12). Participants that were classified as frail had a shorter hospital stay of 1 day in both the mean and median length of stay but this was not statistically significant. The small numbers of this study may have masked this difference. Other explanations to consider are that increased mortality could mask this, though not all of the recruited patients died. It may also be that treatment was thought to be futile and patients were discharged earlier for palliative care. Frail participants were also more likely to come in for admission from a higher care setting, making it simpler to discharge them without delays in procuring placement.



The mortality both during the hospital stay and at 6-month follow-up was also significantly higher in the frail group of participants.

Using the FRAIL scale possibly identified high risk participants correctly in our setting, based on the outcomes – 95% of those who didn't survive were initially classified as being frail.

The number of participants that were living independently at home increased again at the 6-month follow-up. A possible explanation for this is that the frail older people passed away and the remaining participants had improved health, thus suitable for independent care again. Another explanation is that the socio-economic situation was not viable for affording more costs e.g. carers and placement. This may also explain the change in care from frail care facilities which deteriorated at the 6 months follow-up.

12.9.2 The long-term outcomes of frail participants post-discharge:

At 6-month follow-up, the frail participants still had the highest mortality rate at 29.7% of those that were followed-up.

Compared to non-frail participants, the frail ones were also more likely to require the care of a part-time carer at home or institutionalized care.

They were also more likely to have a poorer functional score than non-frail participants.

Patients in this study were noted to have a shorter length of stay than other studies. This may be due to mortality (i.e. they died before they stayed too long) or that the

treatment was thought to be futile and they were discharged earlier for palliation. Because frail participants were also more likely to come from an increased care setting, it may have also been simpler to discharge them for outpatient rehabilitation instead of finding a care facility for them to transition to.

12.9.3 Differences between hospitals

The two institutions where the study was conducted could differentiate the population group into high (the private facility) and low (the government facility) socio-economic groups. Although few of the data was statistically significant, it was interesting to note that a higher proportion of low-socio-economic participants had no additional care, where-as a higher proportion of the high-socio-economic participants were from frail care facilities. However, then one also must take into account the fact that the Wits Donald Gordon hospital participants were admitted specifically for geriatric sub-speciality care and therefore were likely to be frailer which was also reflected in the data.

12.9.4 Strengths of the study

This study involved a real-life clinical population in both the public and private sector and is applicable to everyday practice in South Africa where no other similar data exists. Assessing and documenting the existence of frailty in the older population has a role in assisting with better management and discharge planning of this vulnerable group.

The assessment tools used in the study are practical and while frequently used in everyday geriatric specialist assessment, can easily be used by non-specialist medical practitioners

12.9.5 Limitations

This study has some limitations. It is a descriptive study of a population limited to two institutions. The mini-cog test for the dementia screen may have been biased against participants that were non-English speaking or had a poor education level (less than 5 years of formal education) or are illiterate.

There may have been a bias towards recruiting English speaking participants and easily contactable family members who provided consent and provided the background history.

The study only evaluated geriatric participants that were admitted to medical wards and excluded surgical and orthopaedic participants. The outcomes of frail older participants undergoing surgical procedures are known to be worse (26). There may have been a selection bias in that critically ill patients may not have been selected because they had initially been admitted to intensive care units or demised prior to selection. This would have resulted in a potential bias to missing well older persons with catastrophic illnesses in the study cohort.

The past medical and social history as well as the diagnosis on admission was not considered. It was proposed that the change in the modified Rankin score together with a prolonged length of stay (≥7 days) may be a proxy to indicate disease severity, but the criteria proved insufficiently sensitive. There were only one out of the 108 participants which would have then had a serious illness, but this is unlikely to have been the true situation. Repeat admissions and healthcare visits weren't documented to indicate the potential burden on the health care system.

While the small sample size limits the significance of individual clinical parameters, the significance shown on major clinical outcomes (namely care needs, mortality and functional decline), makes the information useful for clinicians.

The modified Rankin score is often used in stroke studies and units. This study was limited by this score not being sufficiently sensitive to detect minor changes in abilities. Other more comprehensive activity scores, like the Barthel activities of daily living questionnaire, would be better used in clinical practice.

Some information, especially functional status at the time of admission and 6-month follow up, was based on a patient or collateral's self-reporting and not standardised objective clinical measurements. This is also a potential limitation in the FRAIL scale when compared to original frailty studies which used more objective measures such as Fried's frailty index (27). Participants or their proxies may (often unknowingly) underestimate or overestimate their abilities. In the study of rural community-dwelling South Africans, it was also noted that the question of "are you fatigued" may be ambiguous in the local language and the question was adapted to review the change of health over the last 12 months (7).

12.10 Conclusion

This study evaluates the clinical role of using the FRAIL scale in the care of older persons hospitalised in two different urban South African hospitals. The FRAIL scale has utility in identifying older participants at risk of mortality both in the hospital and within 6 months of discharge as well as in-hospital functional decline. Use of the FRAIL scale will assist healthcare workers to identify the clinical syndrome of frailty. Frail participants needed higher care assistance upon discharge. Identification of frailty therefore has an important role in care planning upon hospital discharge as well as managing health care expectations in care of older persons.

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13 Appendix

13.1 Ethics clearance certificate

R14/49 Dr Susan Coetzer

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M131183

NAME: (Principal Investigator)	Dr Susan Coetzer
DEPARTMENT:	Internal Medicine - Geriatrics Helen Joseph Hospital Wits Donald Gordon Medical Centre
PROJECT TITLE:	The Impact of a Clinical Frailty Assessment on the Outcome of Hospitilized Elderly Patients in South Africa
DATE CONSIDERED:	29/11/2013
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Dr B Tipping
APPROVED BY:	Professor P Cleaton-Jones, Chairperson, HREC (Medical)
DATE OF APPROVAL:	09/03/2015

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

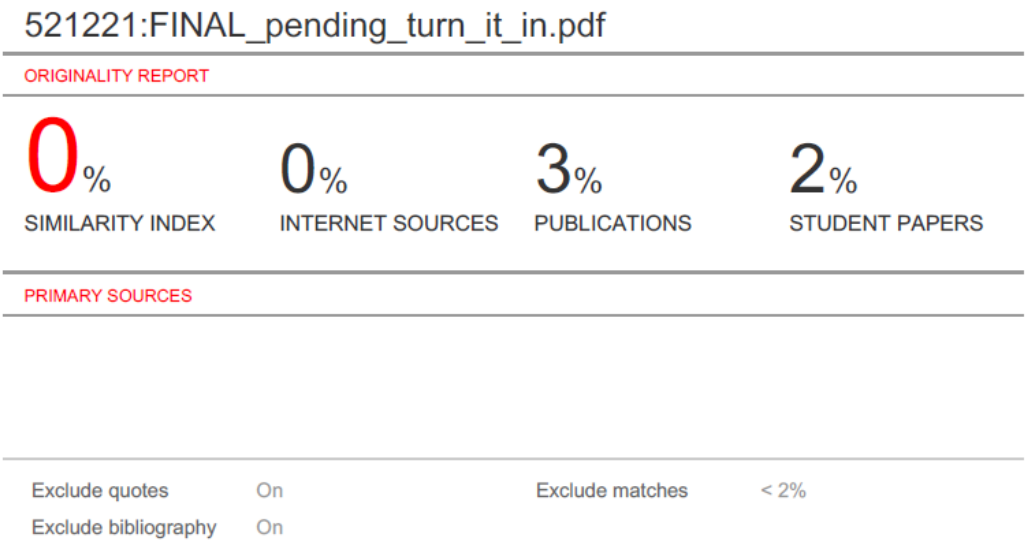
DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Secretary in Room 10004, 10th floor, Senate House, University.
I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report.**

Principal Investigator Signature _____ Date _____

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

13.2 Plagiarism / “Turn-it-in” certificate



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PRIMARY SOURCES

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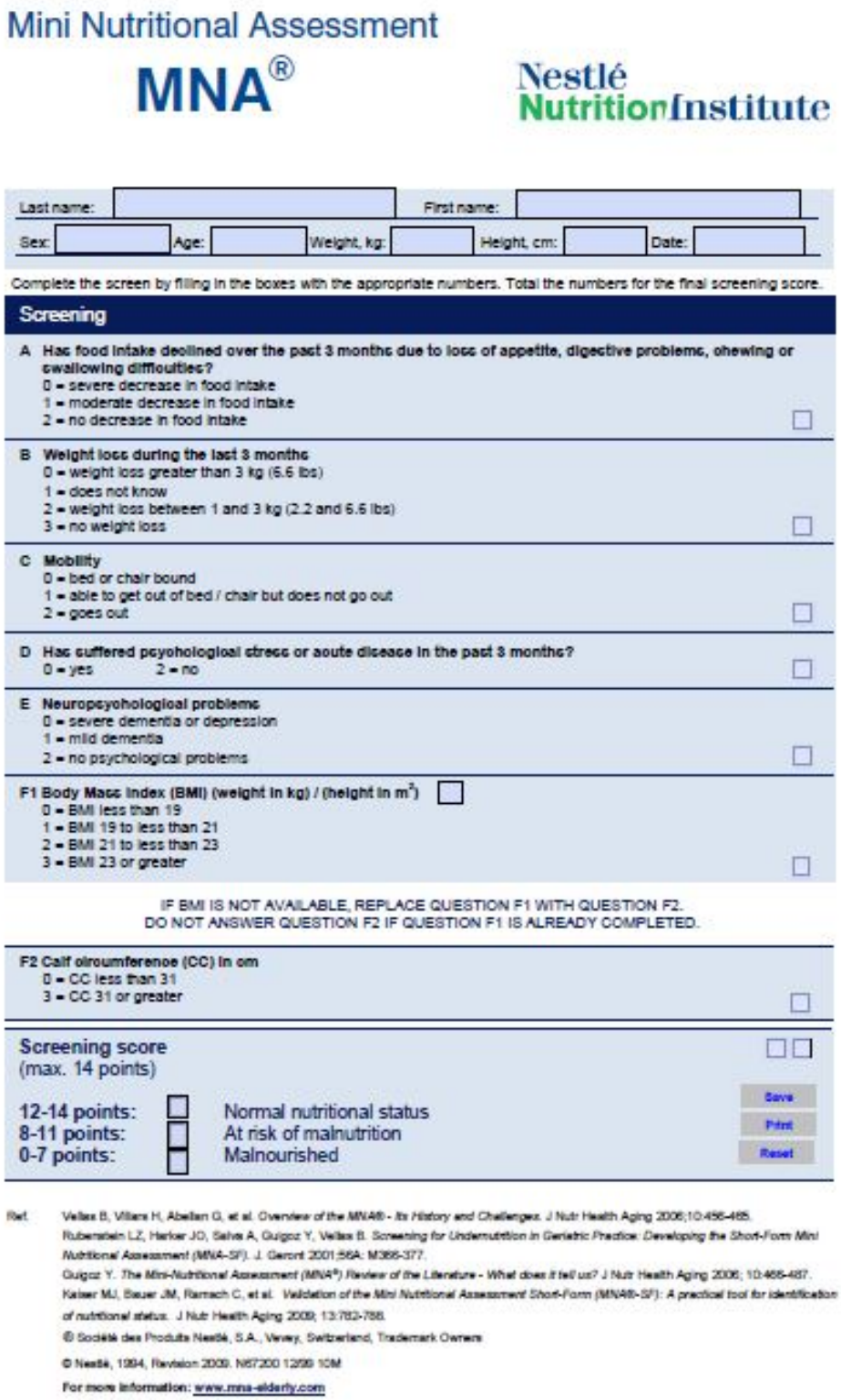
13.3 Datasheet used to obtain study data

	DATA SHEET	ref nr		
demographics	**hospital**	DG		
		HJH		
	age			
	sex	male		
		female		
	consent	self		
		proxy		
pre-admission	**mRANKIN**			
	environment	home (no carer)		
		home (part time carer)		
		home (permanent carer)		
		institution (mid-care)		
		institution (frail care)		
admission	**DOA**			
	FRAIL score	0 = robust		
		1-2 = prefrail		
		3-5 = frail		
	mini-COG (dementia screen)	positive		
		negative		
	drug count	<5		
		≥5		
		unknown		
	MNA	12-14 = Normal nutritional status		
		8-11 = At risk of malnutrition		
		0-7 =Malnourished		
	geriatric team consultation	yes		
		no		
discharge	**DOD**			
	duration of stay (days)			
	mRANKIN			
	environment	home (no carer)		
		home (part time carer)		
		home (permanent carer)		
		institution (mid-care)		
		institution (frail care)		
follow-up	**mRANKIN**			
	environment	home (no carer)		
		home (part time carer)		
		home (permanent carer)		
		institution (mid-care)		
		institution (frail care)		

13.4 Mini-Nutritional Assessment ®



Mini Nutritional Assessment

MNA®

Nestlé Nutrition Institute

Last name: First name:

Sex: Age: Weight, kg: Height, cm: Date:

Complete the screen by filling in the boxes with the appropriate numbers. Total the numbers for the final screening score.

Screening

A Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties?
0 = severe decrease in food intake
1 = moderate decrease in food intake
2 = no decrease in food intake

B Weight loss during the last 3 months
0 = weight loss greater than 3 kg (6.6 lbs)
1 = does not know
2 = weight loss between 1 and 3 kg (2.2 and 6.6 lbs)
3 = no weight loss

C Mobility
0 = bed or chair bound
1 = able to get out of bed / chair but does not go out
2 = goes out

D Has suffered psychological stress or acute disease in the past 3 months?
0 = yes 2 = no

E Neuropsychological problems
0 = severe dementia or depression
1 = mild dementia
2 = no psychological problems

F1 Body Mass Index (BMI) (weight in kg) / (height in m²)
0 = BMI less than 19
1 = BMI 19 to less than 21
2 = BMI 21 to less than 23
3 = BMI 23 or greater

IF BMI IS NOT AVAILABLE, REPLACE QUESTION F1 WITH QUESTION F2.
DO NOT ANSWER QUESTION F2 IF QUESTION F1 IS ALREADY COMPLETED.

F2 Calf circumference (CC) in cm
0 = CC less than 31
3 = CC 31 or greater

Screening score
(max. 14 points)

12-14 points: Normal nutritional status
8-11 points: At risk of malnutrition
0-7 points: Malnourished

Save Print Reset

Ref. Vellas B, Villars H, Abellan G, et al. *Overview of the MNA® - Its History and Challenges.* J Nutr Health Aging 2006;10:456-465.
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