

https://dspace.org/

The impact of a nursing falls assessment tool on reducing the inpatient falls in a neuro-orthogeriatric ward at the Wits Donald Gordon Medical Centre: an observational study (2014-2018)

Sunny, Sharon Elizabeth

2021

https://hdl.handle.net/10539/32482

Downloaded from a DSpace repository. https://dspace.org/

The impact of a nursing falls assessment tool on reducing the inpatient falls in a neuro-orthogeriatric ward at the Wits Donald Gordon Medical Centre: An observational study (2014-2018)

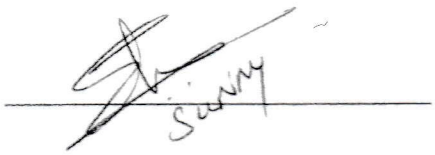
Sharon Elizabeth Sunny

A research report submitted to the Faculty of Health Sciences, University of Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Medicine in the branch of Internal Medicine

Johannesburg 2020

i. Declaration

I, Sharon Elizabeth Sunny, do hereby declare that this research report is my own unaided work. It is being submitted in the submissible format as recognized by the Faculty of Health Sciences for the degree of Master of Medicine in the branch of Internal Medicine. I further declare that this work has not been submitted for any other examination or degree at this or any other University.



The 4th day of August 2020.

ii. Dedication

I would like to thank my parents for their unwavering support during this endeavour, my fiancé, Vasish, for his support, and friend, Samantha Arnold for her continued encouragement.

iii. Presentation originating from this research

None at the time of submission of this research report.

iv. Ethical considerations

Permission for this retrospective study was obtained from Professor B.Tipping, (Head of the division of Geriatric Medicine, Wits Donald Gordon Medical Centre), Dr.S.Tager (Chief Executive Officer, Wits Donald Gordon Medical Centre), Mr.F.Sydney (Clinical Risk Manager, Wits Donald Gordon Medical Centre) and the Human Research Ethics Committee of the University of Witwatersrand (clearance number – M180263).

v. Abstract

Background: Inpatient hospital falls are relevant for a number of reasons as they are a common adverse event, a common cause of morbidity among the elderly, a leading cause of injurious death in the elderly, a potential liability for the hospital and may result in increased resource use. To begin to address these problems, there is a need to promote awareness amongst staff members who care for patients at risk of falling in an inpatient hospital setting. There is limited research into effective strategies in reducing inpatient hospital fall rates in both an International and South African context.

Objective: To describe the nature and occurrence of inpatient falls in a neuro-orthogeriatric ward at the Wits Donald Gordon Medical Centre. To evaluate whether the clinical implementation of a falls assessment tool reduces the inpatient fall rate and to evaluate if the falls assessment tool correctly identifies patients who have in hospital falls.

Methods: A single centre, retrospective study of patients admitted to the neuro-orthogeriatric ward, at the Wits Donald Gordon Medical Centre with review of falls risk assessment data and clinical incident reports of reported falls from prior to implementation of the nursing falls assessment tool(February 2014 to January 2016) to after implementation of the assessment tool(February 2016 to January 2018). The tool was performed by the admitting nurse if patients had any of the risk factors mentioned in the tool.

Results: A total of 358 patients were included in the analysis, with 64 patients admitted pre-introduction of the assessment tool and 294 admitted post introduction of the assessment tool. In the post introduction cohort, 91.8% (270 of 294) had falls risk assessments performed at admission, and of these, 84.1% (227 of 270) were complete. There were 15 patients (6.6%) who had a documented fall. The median age of patients who fell was 76 years and 51% were men. Falls occurred mainly in the room of the patient (75.5%), 57.6% occurred after hours and 34% incurred an injury. The study showed a decline in the fall rate pre-introduction of the assessment tool 2.64 per 1000 patient bed days (95%CI 2.02-3.40) versus 1.49 per 1000 patient bed days (95%CI 1.06-2.05) post introduction of the assessment tool. The sensitivity of the assessment tool was a 100% but had very poor specificity of 3.3% (95% CI 0.98-5.63) and a positive predictive value of 6.82% (3.5-10.10%).

Conclusion: The study showed a decline in the fall rate post introduction of the nursing falls assessment tool. The tool was shown to be highly sensitive but had very poor specificity and positive predictive value. This small study suggests that raising fall awareness may have an impact on reducing falls.

vi. Acknowledgements

The support and assistance of the following persons in preparation for this research report is gratefully acknowledged:

- Professor Brent Tipping – for his guidance and patience with me as my supervisor on this study, review of the prepared manuscript and constant availability, support and encouragement.
- Dr. Tendesayi Chakezha and Petra Gaylard for their expert assistance with statistics.
- Professor Michelle Wong and Professor Adam Mahomed for always encouraging me to go further.
- Pauline Bergamasco, unit manager of ward section C, and Fagan Sydney, nursing risk manager, Wits Donald Gordon Medical Centre for support with this project and for making patient safety a priority at the Wits Donald Gordon.

Table of Contents

i. Declaration ii

ii. Dedication iii

iii. Presentations originating from this research iv

iv. Ethical considerations v

v. Abstract vi

vi. Acknowledgements vii

vii. List of tables ix

viii. List of figures ix

ix. Nomenclature x

Chapter 1: Extended Review of the Literature

1.1 Introduction 1

1.1.1 Definition of a fall 1

1.2 Incidence of falls 1

1.3 Aetiology and risk factors for falls in an inpatient hospital setting 2

1.4 Implications of falls in an inpatient hospital setting 5

1.5 Strategies to reduce falls 6

1.6 Assessment of fall risk in an inpatient hospital setting 9

1.7 Rationale for undertaking the study 13

1.8 Strategies to reduce falls 13

References 14

Chapter 2: Study Protocol

Background 18

Aim 21

Objectives 21

Methodology 22

Limitations of the Study 23

Data Analysis 24

Ethical Considerations 24

Timing **25**

Gantt Chart showing the timeline of the study 25

Funding **26**

References **26**

Chapter 3: Submissible Article **29**

Chapter 4: Appendix **48**

A. Data collection sheet 48

B. Ethics Clearance Certificate 50

C. Plagiarism Report 51

vii. List of tables

Table 1: Demographic characteristics of included patients at admission who underwent falls risk assessment 42

Table 2: Profile of inpatient falls 43

Table 3: Nature of injuries incurred 43

Table 4: Performance of the fall risk assessment tool administered at admission in predicting a fall during admission 44

viii. List of figures

Figure 1: Study flow 45

Figure 2: Fall rates pre and post-introduction of falls risk assessment, done quarterly 46

Figure 3: ROC curve of performance of fall risk score in predicting a fall during admission 47

ix. Nomenclature

HFRM	Hendrich II Fall risk Model
MFS	Morse Fall Scale
NEJM	New England Journal of Medicine
NHS	National Health Service
NICE	National Institute for Health and Care Excellence
NPSA	National Patient Safety Agency
ProFANE	Prevention of Falls Network Europe
STRATIFY	St. Thomas's Risk Assessment Tool in falling elderly inpatients
USA	United States of America
WHO	World Health Organization

Chapter 1: Extended literature review

1.1. Introduction

1.1.1. Definition of a fall

A fall is defined as an event resulting in a person coming to rest unintentionally on the ground, floor or other lower level(1). As there are many definitions of a fall, a uniform definition is important when analysing the outcomes of studies, so that data is comparable.

1.2. Incidence of falls

A 2010 Cochrane review of interventions for preventing falls in older people in nursing care facilities and hospitals, reported rates of 6.2 falls per person per year in a psycho-geriatric ward and 3.4 falls per person per year in a geriatric rehabilitation ward(2). Older people are defined as those over the age of 65 years in developed countries and more than 60 years in underdeveloped countries(3). People over the age of 65 have a high risk of falling, with 30% of those above the age of 65 years predicted to have at least one fall per year and 50 % of those above the age of 80 years to have at least one fall per year(4). There are several ways of reporting falls. They may be reported as the number of falls per month or over a certain quarter in a specific unit. However, this approach does not take into account how full the unit was at a particular time irrespective of the standard of care. As a result, calculating a fall rate, that is the number of falls per 1000 occupied bed days is recommended(5). In the United States, the inpatient fall rate for acute hospitals ranges from 1.7-25 falls per 1000 patient days depending on the unit, with the geriatric and psychiatric wards being at highest risk(6). Another study which looked at 6100 nursing units, representative of 1263 non-federal acute care general hospitals in the Unites States of America (USA), encompassing the North-West, Mid-West, South and West American regions, observed a fall rate of 3.53/1000 bed days, the highest being in the medical ward (4.03/1000 bed days), followed by the medical-surgical wards (3.62/1000 bed days), followed by the surgical ward (2.76/1000 bed days)(7). In London and Wales, during a one-year period, 206 350 falls were reported to the National Patient Safety Agency (NPSA) in inpatient settings. They calculated a fall rate of approximately 4.8/1000 bed days. This is equivalent to 1260 falls per year in a 800 bed hospital(8). Fall rates do vary from ward to ward in the hospital. This may be because patients in some units may not be as ambulatory as in other

units, such as in the Intensive Care Unit. Patients in the medical wards are at higher risk of falling because of the inherent nature of their disease and treatments.

In the South African context, very limited published data are available for fall rates. There has been one study in the Western Cape, South Africa, which analysed the prevalence of falls in the community but not in an inpatient setting(9). There are no published data available from the public sector for in hospital fall rates in South Africa. In the private health sector, only the Mediclinic hospital group reports annual fall rates across its hospitals in the Annual Clinical Services Report. In the South African hospitals run by Mediclinic, the fall rates were 1.14 per 1000 patient bed days in 2015, 1.07 in 2016 and 1.01 in 2017(10). The paucity of data in the South African hospital setting, may be due to very limited fall data collection.

1.3. Aetiology and risk factors for falls in an inpatient hospital setting

Causes of in-hospital falls are frequently multifactorial with contributors being:

1. Age related changes in the neuromuscular control of posture and balance
2. Disease and medication related
3. Environmental/situation related

Risk factors for falls can also be categorized as intrinsic and extrinsic(11). There are also short- and long-term precipitating factors, for example, an accidental trip on the floor, alcohol consumption, intercurrent illness or side effects of a new drug used to treat a new infection that may increase fall risk. New surroundings in an in hospital setting, related to flooring, lighting, surrounding furniture and the presence of fittings such as rails and inappropriate footwear may also increase fall risk(12). Fall risk increases with increasing number of risk factors. One year fall risk doubles with additional risk factors, with 8% risk of a fall with no risk factors to 78% risk of a fall when 4 risk factors are identified(13).

Intrinsic risk factors include age associated physiological changes: Walking requires coordination of cognition, concentration, eye sight, hearing, touch, proprioception and muscle tone. As age increases, these processes are affected and slow down. Elderly patients may also develop more medical illnesses as they age, and this with the side effects of the medications used to treat these illnesses, increase the fall risk (12). The studies on falls have shown that fall risk strongly correlates with the following factors: presence of a falls history, gait disturbances, use of assistive devices, movement disorders, vertigo, anti-epileptic medication, incontinence (this related to the actual disease process causing the incontinence or occurring during the

process of trying to void in the bathroom)(14). Diseases and related processes that can increase fall risk can be broadly divided into:

1. Neurological diseases – such as cerebrovascular accident, dementia, vestibular disease and Parkinson's disease are the most common disorders that increase the fall risk in the elderly.
2. Musculoskeletal disease – such as reduced muscle density, arthritis of various aetiologies, lower limb problems (weakness, neuropathy, oedema, skin ulcers, amputations) and deformities.
3. Cardiovascular disease – such as syncope, orthostatic hypotension and arrhythmias.
4. Others include, diabetes mellitus associated peripheral neuropathy, major depressive disorder and sleep disorders that may affect cognitive abilities.
5. Psychological factors related to fear of recurrent falls, especially if there is a history of falls, can lead to dependency and immobility and being unable to perform activities of daily living, which can all increase the fall risk(14)
6. Side effects of medications: These include blood pressure medication, such as diuretics, angiotensin converting enzyme inhibitors, beta blockers and calcium channel blockers, which can result in orthostatic hypotension. Sedatives and benzodiazepines for example, temazepam, antidepressants for example, amitriptyline, antipsychotics such as olanzapine and risperidone, and drugs used for Parkinson's disease- bromocriptine and levodopa, can all alter the level of consciousness and can cause orthostatic hypotension which may affect coordination of walking. All these factors increase the risk of falls. It is advised that one assesses the indication for the drug, bearing in mind that the condition it is treating, may predispose to a fall as well(15).

Extrinsic factors include environmental factors such as wet floors, inadequately lit walkways and inappropriate footwear. Unsafe chair height, reduced staffing levels, for example in the event there is a delay in responding to a patient's call for help may result in an increase in fall rate, as patients may attempt self- mobilization when unfit. Potential trip hazards are additional factors that should be considered in this group, that include, floors contaminated by water, food, grease, bodily fluids, cords and tubing on the floor, improperly used floor mats and irregular indoor walking surfaces.

Furthermore, frailty is defined as a state of decrease in function and reserve of multiple physiological systems, resulting in increased vulnerability to stressors and higher risk of falls and functional dependency following acute stressors. A simple tool for screening for frailty, in the clinical setting, is the FRAIL score:

F - Fatigue,

R - Resistance: being able to walk up one flight of stairs,

A - Aerobic, being able to walk more than one block,

I - Illness: more than 5 illnesses,

L - Loss of weight, more than 5% in 6 months.

Having 3 or more of these features is suggestive of frailty and therefore higher fall risk(16). Patients who have had a previous fall have slow gait speed, short stride length and longer double support phase, which all increases fall risk(17). Delirium, nocturia and falling asleep during the day are other factors to consider(16). Anaemia may result in muscle weakness and physical decline causing disability. According to the World Health Organization (WHO), anaemia is defined as a haemoglobin of less than 12g/dL in women and less than 13g/dL in men. It is thought that anaemia causes reduced oxygen delivery to the muscles and subsequent reduction in muscle strength. This muscle weakness then results in reduced physical performance, fatigue, less activity and deconditioning. This results in a higher fall risk and has been shown to be related to recurrent falls. As the prevalence of anaemia is higher in older patients, this increases their fall risk as well(18). There is also an increased risk of falls in males, which has been noted to be consistent in large scale studies(19).

Time of occurrence of falls may also be important. Day time falls occur while performing daily activities, while night time falls mainly occur because of attempts to mobilize without assistance and the use of sedative medication. Falls occurring during the early mornings or late evenings may also be related to in ward routines such as bathing patients, changing linen, staff change over and reduced patient activity at night(20). There is limited data regarding time of day in relation to fall risk. These studies are generally retrospective analyses of incident reports. Two studies were reviewed by Renteln-Kruse, one based in a nursing home and the other in a hospital setting, which showed no difference in falls between night and day and no obvious peak time(21). A monthly variation has also been noted, with falls being more common in winter than Spring. This has been attributable to a seasonal variation in delirium noted by Gallerani(22).

In a review by Sutton et al, in 1994, approximately 80-90% of falls were unwitnessed and 50-70% occur from the bed, bedside chair or during transfer between the two(23). This was based on accident report forms as the only source of information. About 10-20% of falls occur in toilets or bathrooms, which is unusually high given the small amount of time patients spend in these facilities. There seems to be a variation in the type of ward as well, where patients in the

acute and rehabilitation units tend to fall from the bed while those in a psychiatry unit for example, fall while walking. The type of room patients are in, that is single versus shared, has also been analysed, and shows a higher fall rate in single rooms, possibly due to less observation by staff and less social interaction with other patients(24). In addition, if a patient is about to fall, there is less staff surveillance and no fellow patients to assist in single rooms. Although single rooms have been associated with more privacy, improved interaction between patient and family, and more easily accessible bathroom facilities, patients in single rooms, may attempt to mobilize to the bathroom without aid, under the impression that the distance may be shorter. There may also be a delay to respond to the call bell due to long walking distances between the rooms and the nursing station(25).

The actual beds used in hospitals have also been assessed and two studies have found that low height beds with rails may not reduce fall rates(26). Although it has been found that side rails assist some patients with entry and exit into the bed and for in-bed movement, the grip on the side rails as well as the shape may be a limiting factor, as it may not be a comfortable reach, depending on the patient's position on the bed. It has also been found that getting up from a low bed was only possible with great effort or assistance, and once standing, patients had difficulty in keeping their balance(27).

1.4 Implications of falls in an inpatient hospital setting

Falls are a common cause of morbidity in patients in a hospital setting. In Britain, falls have been reported to cost the National Health Services(NHS) 2.3 billion pounds per year(28). Inpatient hospital falls are relevant for a number of reasons:

1. They are a common adverse event. Falls are estimated to range from 2.3-7 falls per 1000 patient days(1, 2);
2. A potential liability for the hospital due to injuries incurred by patients and complaints from patients and families regarding inadequate care and negligence by hospital staff;
3. May result in increased resource use which may include increasing staff numbers to improve staff surveillance, change in actual ward layout to accommodate better surveillance by nursing staff, change in height of beds and rails on beds to accommodate patients at high risk of a fall;
4. They are a common cause of morbidity among the elderly: about 30% of inpatient falls result in injury and are a leading cause of injurious death in the elderly. Approximately 4-6%,

result in serious injury, which include fractures, subdural hematomas, excessive bleeding, and death(29). A study done by Schwendimann et al, in a 300 bed hospital in Zurich, Switzerland over a 5 year period, showed of 3842 falls, 1142 (29.7%) resulted in minor injuries, categorized as bruise/hematoma/lacerations and 148(3.9%) resulted in major injuries, categorized as fractures and intracranial bleed(30).

Complications of falls are two-fold. The physical complications include, pain, bruising, superficial injuries such as abrasions, lacerations and hematomas, and more serious injuries such as fractures, intracranial bleeding and death. Psychological complications include self-limitation of mobilization because of fear of falling and consequently increasing functional decline, loss of self-confidence and major depressive and anxiety disorders(31). These disorders may further require treatment, and the additional side effects of these medications can increase fall risk as mentioned previously.

1.5 Strategies to reduce falls

To begin to address these problems there has been a need to promote awareness amongst staff members who care for patients at risk of falling in an inpatient hospital setting. There has been very limited research into effective strategies in reducing inpatient hospital fall rates in both an international and South African context(1). Thus, attempting to implement a cost-effective fall prevention strategy is desirable. Fall interventions can be applied in the community, in an in-hospital setting and nursing homes. In 1994, Tinetti and colleagues, published an article in the New England Journal of Medicine (NEJM), which showed falls could be prevented by a multidisciplinary team approach(13). This approach suggests possible redesign to the ward layout so that patients are observed continuously from the nursing stations. As well as accommodating low beds for certain patients and increasing awareness of patients at high risk of falls.

Most fall intervention strategies are multidimensional and include(32):

1. Patient factors: which assess disease and medication history;
2. Environmental factors and
3. Exercise programmes.

In addition, vitamin D supplementation has been shown to decrease the fall rate among elderly patients in the community and nursing homes who are vitamin D deficient(33). This may be

through improvement of muscle function and strength(34). Vitamin D binds to its receptor in muscle and results in gene transcription that modulates calcium and phosphate uptake. This is turn affects muscle cell proliferation and differentiation and improves muscle function and gait. It is through this mechanism that it reduces falls. Vitamin D deficient patients show atrophy of type II muscle fibres on muscle biopsy, which recruit first to prevent a fall(35). In addition, vitamin D supplementation has been shown to improve proximal myopathy(36). In a meta-analysis of 8 randomized controlled trials, native vitamin D reduces falls by 13%, but only high dose vitamin D (700-1000IU) achieved 25-hydroxyvitamin D concentrations more than 24ng/ml and reduced falls by 19 to 23%(37).

In an in-hospital setting, a comprehensive assessment as suggested by The National Institute for Health and Excellence, includes(38):

(i) A previous history of falls – reviewing the cause and consequence of the fall;
(ii) A review of medication;
(iii) A complete neurological exam which includes, cognition, gait, balance, muscle strength, mobility;
(iv) An elderly patient's perceived level of function and fear related to falling;
(v) Visual assessment;
(vi) Cardiovascular exam;
(vii) Presence of urinary and faecal incontinence.

Additional factors are related to footwear and other comorbidities.

Ideally, a multidimensional assessment needs to predict which patients are at risk of a fall. In a study by Oliver et al, they suggested all patients over the age of 65 years and those between the age of 50-64 years assessed by a clinician to be a high fall risk should have a fall prevention strategy implemented(39). In attempting to reduce the fall rates in hospital, Prevention of Falls Network Europe fall prevention taxonomy (ProFane), was developed(40). ProFane is a network of scientists, clinicians and other health professionals, focussing on Falls, and is funded by the European Commission. They aim to reduce falls and improve postural stability in the elderly. The four main areas of work include the co-ordination of trials, assessment and management, balance assessment and addressing psychological aspects of falling. The group recommends a multifactorial intervention strategy that addresses each component of the fall risk assessment.

A fall risk assessment encompasses the following components:

- Gait and balance assessment,

- Cardiovascular assessment,
- Medication review,
- Visual check,
- Foot assessment,
- Psychological assessment focussing on fear of falling and
- Self-efficacy and being able to comprehend nursing instructions and explanations regarding the presence of a calling bell, how to use bed rails, and how to ask for assistance in case of difficulty. Assess if they are able to comprehend their surroundings and to perceive when they need help keeping in mind their comorbidities, medication use and current reason for admission.

Environmental assessment includes assessment in the community, in rehabilitation and long-term care facilities, both of which are not applicable in the assessment of in-hospital fall risk. However, environmental assessments in the hospital setting focusses on:

(i) Flooring including, having non-slip surfaces, cleaning spills quickly, and a dry and low shine cleaning strategy. Steps should be clearly visible and floor patterns that create illusions of steps or heights for people with visual problems should be avoided.

(ii) Lighting including, appropriate light to avoid glare, especially in areas of the bathroom and toilet and during the night, around furniture and in the distance of walkways between patient rooms and nursing stations should be considered for better surveillance by staff.

(iii) Avoiding clutter in patients' rooms and use of handrails and provision of correct type and height of assistive device which is easily accessible to the patient should be instituted.

(iv) Posting of clearly visible signs of the bathroom and other areas for those with cognitive, visual and language barriers can be done.

(v) Furniture, for example bed and chairs, should be of the appropriate height and should be stable for handheld walking. Wheelchairs and beds should have brakes applied as needed depending on the activity performed by the patient.

(vi) Safe footwear checklist should also be done and includes thin, firm shoe soles, tread sole to improve grip, and low and square heel which improve stability. Patients should be discouraged from walking with socks, as there is a ten times higher risk of falls(41).

(vii) Presence of intravenous lines and urinary catheters are also a risk factor for falls and patients should be cautioned(42).

Interventions to reduce the risks of falls may be single or multiple. Categories of interventions include exercises (whether supervised or unsupervised), medication review, surgery (eye, cardiovascular, orthopaedic procedures), management of urinary and faecal incontinence, fluid and nutritional treatment, psychological review, improving knowledge of surroundings, use of assistive devices such as communication aids and mobility aids, and social environment such as staff numbers and staff competency. Successful interventions encompass common specific areas, such as strength and balance training; assessments of hazards in the environment; visual assessment; and review of medication, in addition to the categories of interventions mentioned above. Given the increased level of resources required for fall prevention strategies, it is most cost-effective to identify patients who are at highest risk of falls and target interventions towards them. Assessment of a patient falls risk is therefore the first step in implementing a cost-effective strategy.

1.6. Assessment of Fall risk in an in-hospital setting

In an in-hospital setting, there are tools that evaluate common risk factors associated with falls for all patients regardless of their likelihood of a fall. Furthermore, there are tools that risk stratify patients in addition to identifying risk factors for a fall. There are several tools in existence and are used for patients more than 16 years of age. These tools have differing results and have also been used in environments such as in the community, rehabilitation and long-term care facilities, for which it was not originally intended.

Most simple risk assessment tools with variables as mentioned below, have a sensitivity and specificity of more than 70%, however their validation in various clinical settings is still to be proven(43). Some of the validated fall risk assessment tools include the St. Thomas's Risk Assessment Tool In Falling Elderly Inpatients (STRATIFY), Hendrich Fall Risk Model (HFRM) and the Morse Fall Scale (MFS)(44). All three falls risk tools are based on a scoring system that categorizes patients as being low risk, moderate risk and high-risk patients for falling. The subgroups of each tool differ but broadly covers a history of previous falls; mental status; gait assessment and ability to mobilize; use of ambulatory aids; medication history; visual assessment and frequent toileting needs. Another falls risk tool, the John Hopkins Falls Risk Assessment tool assesses the same aspects and is also based on a scoring system. The Falls Risk Assessment tool was developed by the Peninsula Health Falls Prevention Service in 1999 and is a three part tool that screens at risk patients, identifies risk factors and has an action plan(43, 45).

The STRATIFY tool was developed by Oliver and colleagues in Britain for elderly patients in hospital and assesses 5 aspects:

1. History of falls.
2. Dependency in transfer and ability to self-mobilize.
3. Primary nurses' judgement if patient is agitated.
4. Frequency of toileting.
5. Visual impairments.

Each aspect is scored between 0 and 1, with 0 being absent and 1 being present. A score of 3 or more is indicative of a high risk of falls. Validation studies showed that this tool is better at classifying patients at low risk for falls. Sensitivity and specificity are 69% and 96% respectively.

The Hendrich Fall Risk Model is based on a 22-point system, with more than 3 points considered as high risk of falls. The components include:

1. Confusion or disorientation: if present, a score of 3 is awarded- patient may be agitated, impulsive, display inappropriate behaviour or be unable to follow instruction.
2. Depression: if present is scored 4 points.
3. Altered elimination is scored out of 3 in the presence of faecal incontinence, urinary incontinence, frequent urination, diarrhoea, nocturia.
4. Dizziness/vertigo is a score of 3 if present.
5. A history of falls is scored of 7.
6. Impaired mobility or generalized weakness is scored out of 2. The sensitivity and specificity of the tool is 77% and 72% respectively. Therefore, if seen as high risk, they were correctly identified as fallers. This score was revised in wide case control studies and called the Hendrick II Fall Risk Model, and encompasses the first 4 components of the original tool, but includes whether:

a) Gender - male, scoring 1.
b) Administration of antiepileptics, if present, scored 2.
c) Administration of benzodiazepines, if present, scored 1.
d) Ability to rise from a chair termed the timed up and go test - with a score of 0 if able to rise unassisted, a score of 1 if able to rise in one attempt, a score of 2 if successful with multiple attempts, a score of 3 if unable to rise without assistance.

A score of more than 5 indicates a high risk, with a sensitivity and specificity of 75% and 74% respectively.

The Morse Fall Scale is a score between 0-120 points, which assesses the likelihood of falling, with 0-24 indicating no risk, a score of 25-44 indicating moderate risk and a score of 45 or higher indicating higher risk. Based on analysis of falls with this assessment tool, it was deemed feasible to use in clinical areas with sensitivity and specificity of 72% and 51% respectively(46). Validation studies have shown about 70% of patients who did not fall were still scored as high risk, therefore it should be analysed with caution in long term care settings. It assesses 6 categories:

1. History of falling: 0 being No and 25 being Yes.
2. Presence of a secondary diagnosis: 0 being No and 15 being Yes.
3. Intravenous therapy: 0 being No and 20 being Yes.
4. Use of ambulatory aids:
    a) 0 score if able to walk without a walking aid, assisted by a nurse, use of a wheelchair, bedbound patients,
    b) score of 15 if patient uses stick or walker,
    c) score of 30 with use of furniture.
5. Gait:
    a) score of 0 being normal,
    b) score of 10 for abnormal gait with stooped posture, short steps but head still up,
    c) score of 20 for gait impaired by difficulty rising from chair, needs several attempts to push up, often the head is down, and they watch the ground.
6. Mental status: score of 0 being normal if consistent with nurse's assessment, and score of 15 if unaware of surroundings or self-limitations.

The John Hopkins Falls Risk Assessment tool was developed by the John Hopkins Hospital and reduced fall incidence by 21% and fall related injuries by 61%. This tool is in two parts, the first part is to determine the fall risk score and the second part is the implementation of interventions as determined by the category of fall risk. The components include:

1. Age:
    a) 60-69 years - 1 point,
    b) 70-79 years - 2 points,
    c) more than 80 years - 3 points.
2. Fall history: If a fall occurred within 6 months of current admission is a score of 5 points.

3. Elimination:
    a) incontinence - 2 points,
    b) urgency - 2 points,
    c) urgency and frequency - 4 points.
4. Medications which include anticonvulsants and antihypertensives, psychotropics, opiates, laxatives:
    a) if on 1 high fall risk drug, 3 points,
    b) if on more than 2 high fall risk drugs, 5 points,
    c) if sedated within last 24 hours, 7 points.
5. Any equipment attached to patient, for example, intravenous lines, urinary catheters:
    a) if one present - 1 point,
    b) if two present - 2 points,
    c) if more than 3 present - 3 points.
6. Mobility:
    a) if requires assistance – 2 points,
    b) if unsteady gait – 2 points,
    c) if with hearing or vision impairment – 2 points.
7. Cognition:
    a) if altered awareness – 1 point,
    b) if impulsive – 2 points,
    c) if poor insight into own limitations in terms of cognitive and physical capabilities – 4 points.

A score of 6-13 is a moderate fall risk and any score more than 13 is a high fall risk.

The Falls Risk Assessment Tool is a 3-part tool that identifies 1. Fall risk status which assesses 4 parts including recent falls, medication use, psychological state and cognitive status, and a score out of 20 is calculated. A score of more than 16 is considered high risk. Once the falls risk score is calculated then part 2 entails the assessment of a risk factor check list which reviews visual function, ability to mobilize, ability to transfer objects, patients behaviour, if able to perform activities of daily living, if able to identify immediate environment, nutritional state, continence and other risk factors present but not described in the check list. The history of falls and description of previous falls should be explored. This then leads to part 3 which is the action plan, that is, the implementation of a strategy to manage the identified risk factors(47).

In validation studies, the Morse Fall Score and the STRATIFY assessment tools have been validated in more than one clinical scenario. Both have rigorous designs. They have good sensitivity, are easy to use and provide a platform for intervention.

1.7. Challenges involved in undertaking studies to evaluate falls

There are a number of factors that make it challenging to evaluate fall studies. The lack of a uniform definition of a fall makes it difficult to compare fall studies. The study site also differs with various fall studies as they can be hospital, community and care facility based, making comparisons troublesome. Reporting of falls as a fall rate versus number of falls over a month or specific quarter make comparisons difficult. In an in-hospital setting, fall reporting may differ according to the different wards, that is, fall reporting in an orthopaedic ward versus a psychiatric ward, where there may be less concern for a fall. There may be less reporting of falls that do not lead to injuries and staff fear, related to possible disciplinary action. Inadequate reporting by inexperienced staff who are not familiar with the reporting procedure in the ward and inadequate record keeping of falls and clinical incident reports, makes data collection potentially inaccurate. As a result, fall rate evaluation and the assessment of factors affecting falls in a hospital setting is challenging.

1.8. Rationale for undertaking the study

In the South African hospital setting, there is a paucity of data about in-hospital fall rates. Falls are a common cause of in-hospital morbidity in the elderly worldwide, the incidence of which is unknown in South Africa. As a consequence, there are implications with regards to time and resource management in a resource constrained environment and the need to develop intervention strategies for a common but under recognized problem in our hospitals. Therefore, it is important to identify a falls risk assessment tool that correctly identifies risk factors associated with falls for all patients, is validated by predictive capabilities and is used in the correct population for which it is intended. The limitations of the tool should be understood and it should be used as an aid to clinical judgement. Importantly, it may aid in development of intervention strategies that would involve primary prevention, which ideally should include a detailed assessment of the risk factors outlined above, as well as secondary prevention which entails a plan after the occurrence of a fall.

References

1. Barker AL, Morello RT, Wolfe R, Brand CA, Haines TP, Hill KD, et al. 6-PACK programme to decrease fall injuries in acute hospitals: cluster randomised controlled trial. BMJ. 2016;352:h6781.
2. Cameron ID, Dyer SM, Panagoda CE, Murray GR, Hill KD, Cumming RG, et al. Interventions for preventing falls in older people in care facilities and hospitals. Cochrane Database of Systematic Reviews. 2018(9).
3. Orimo H, Ito H, Suzuki T, Araki A, Hosoi T, Sawabe M. Reviewing the definition of "elderly". Geriatrics & Gerontology International. 2006;6(3):149-58.
4. O'Loughlin JL, Robitaille Y, Boivin JF, Suissa S. Incidence of and risk factors for falls and injurious falls among the community-dwelling elderly. American journal of epidemiology. 1993;137(3):342-54.
5. Morse JM, Morse RM. Calculating fall rates: methodological concerns. QRB Quality review bulletin. 1988;14(12):369-71.
6. Blair E, Gruman C. Falls in an Inpatient Geriatric Psychiatric Population. Journal of the American Psychiatric Nurses Association. 2005;11(6):351-4.
7. Bouldin EL, Andresen EM, Dunton NE, Simon M, Waters TM, Liu M, et al. Falls among adult patients hospitalized in the United States: prevalence and trends. Journal of patient safety. 2013;9(1):13-7.
8. Healy F SS, Glampson B, Pryce A, Joule N, Willmott M. The third report from the Patient Safety Agency. London: National Patient Agency 2007; 2007. 72 p.
9. Kalula SZ, Ferreira M, Swingler GH, Badri M. Risk factors for falls in older adults in a South African Urban Community. BMC Geriatr. 2016;16:51-.
10. Clinic Services Report 2017 [press release]. 2017 2017.
11. Al-Aama T. Falls in the elderly: spectrum and prevention. Can Fam Physician. 2011;57(7):771-6.
12. Kallin K, Lundin-Olsson L, Jensen J, Nyberg L, Gustafson Y. Predisposing and precipitating factors for falls among older people in residential care. Public health. 2002;116(5):263-71.
13. Tinetti ME, Kumar C. The patient who falls: "It's always a trade-off". JAMA. 2010;303(3):258-66.
14. Dionyssiotis Y. Analyzing the problem of falls among older people. Int J Gen Med. 2012;5:805-13.

15. de Jong MR, Van der Elst M, Hartholt KA. Drug-related falls in older patients: implicated drugs, consequences, and possible prevention strategies. Ther Adv Drug Saf. 2013;4(4):147-54.
16. Morley JE, Vellas B, van Kan GA, Anker SD, Bauer JM, Bernabei R, et al. Frailty consensus: a call to action. J Am Med Dir Assoc. 2013;14(6):392-7.
17. Donoghue OA, Cronin H, Savva GM, O'Regan C, Kenny RA. Effects of fear of falling and activity restriction on normal and dual task walking in community dwelling older adults. Gait & posture. 2013;38(1):120-4.
18. Nutritional anaemias. Report of a WHO scientific group. World Health Organization technical report series. 1968;405:5-37.
19. Gale CR, Westbury LD, Cooper C, Dennison EM. Risk factors for incident falls in older men and women: the English longitudinal study of ageing. BMC Geriatr. 2018;18(1):117.
20. Manfredini R, Fabbian F, Pala M, De Giorgi A, Menegatti AM, Boari B, et al. Time of Occurrence of In-Hospital Falls: A Systematic Mini Review. Journal of the American Geriatrics Society. 2012;60(6):1183-4.
21. Renteln-Kruse W, Krause T. Fall events in geriatric hospital in-patients. Results of prospective recording over a 3 year period]. Zeitschrift für Gerontologie und Geriatrie. 2004;37:9-14.
22. Gallerani M, Manfredini R. Seasonal variation in the occurrence of delirium in patients admitted to medical units of a general hospital in Italy. Acta Neuropsychiatrica. 2013;25.
23. Sutton J, Standen P, Wallace WA. Patient accidents in hospital: Incidence, documentation and significance. The British journal of clinical practice. 1994;48:63-6.
24. Singh I, Okeke J, Edwards C. Outcome of in-patient falls in hospitals with 100% single rooms and multi-bedded wards. Age Ageing. 2015;44(6):1032-5.
25. Roszell S, Jones C, Lynn M. Call Bell Requests, Call Bell Response Time, and Patient Satisfaction. Journal of nursing care quality. 2009;24:69-75.
26. Morse JM, Gervais P, Pooler C, Merryweather A, Doig AK, Bloswick D. The Safety of Hospital Beds: Ingress, Egress, and In-Bed Mobility. Glob Qual Nurs Res. 2015;2:2333393615575321-.
27. Healey F, Oliver D, Milne A, Connelly JB. The effect of bedrails on falls and injury: a systematic review of clinical studies. Age and ageing. 2008;37(4):368-78.
28. The College of Optometrists. Falls Awareness Week press release London2011 [cited 2019 11 October]. Available from: https://www.college-

optometrists.org/uploads/assets/a3fb5c93-e272-446f-a3ac7dcad6666f2a/Falls-Awareness-Week-Press-Release.pdf.

29. Terroso M, Rosa N, Torres Marques A, Simoes R. Physical consequences of falls in the elderly: a literature review from 1995 to 2010. European Review of Aging and Physical Activity. 2014;11(1):51-9.

30. Schwendimann R, Bühler H, De Geest S, Milisen K. Falls and consequent injuries in hospitalized patients: effects of an interdisciplinary falls prevention program. BMC health services research. 2006;6(1):69.

31. Stel VS, Smit JH, Pluijm SM, Lips P. Consequences of falling in older men and women and risk factors for health service use and functional decline. Age and ageing. 2004;33(1):58-65.

32. Cumming R. Falls prevention in older persons2013.

33. Kalyani RR, Stein B, Valiyil R, Manno R, Maynard JW, Crews DC. Vitamin D treatment for the prevention of falls in older adults: systematic review and meta-analysis. Journal of the American Geriatrics Society. 2010;58(7):1299-310.

34. Edwards RH. Physiological analysis of skeletal muscle weakness and fatigue. Clinical science and molecular medicine. 1978;54(5):463-70.

35. Ceglia L. Vitamin D and skeletal muscle tissue and function. Molecular aspects of medicine. 2008;29(6):407-14.

36. Sorensen OH, Lund B, Saltin B, Lund B, Andersen RB, Hjorth L, et al. Myopathy in bone loss of ageing: improvement by treatment with 1 alpha-hydroxycholecalciferol and calcium. Clinical science (London, England : 1979). 1979;56(2):157-61.

37. Bischoff HA, Stahelin HB, Dick W, Akos R, Knecht M, Salis C, et al. Effects of vitamin D and calcium supplementation on falls: a randomized controlled trial. Journal of bone and mineral research : the official journal of the American Society for Bone and Mineral Research. 2003;18(2):343-51.

38. Centre for Clinical Practice at N. National Institute for Health and Care Excellence: Clinical Guidelines. Falls: Assessment and Prevention of Falls in Older People. London: National Institute for Health and Care Excellence (UK)

Copyright (c) National Institute for Health and Care Excellence, 2013.; 2013.

39. Oliver D, Daly F, Martin FC, McMurdo ME. Risk factors and risk assessment tools for falls in hospital in-patients: a systematic review. Age and ageing. 2004;33(2):122-30.

40. Skelton DA, Becker C, Lamb SE, Close JCT, Zijlstra W, Yardley L, et al. Prevention of Falls Network Europe: a thematic network aimed at introducing good practice in effective falls prevention across Europe. Eur J Ageing. 2004;1(1):89-94.
41. Menant JC, Steele JR, Menz HB, Munro BJ, Lord SR. Optimizing footwear for older people at risk of falls. Journal of rehabilitation research and development. 2008;45(8):1167-81.
42. Mion LC, Chandler AM, Waters TM, Dietrich MS, Kessler LA, Miller ST, et al. Is it possible to identify risks for injurious falls in hospitalized patients? Jt Comm J Qual Patient Saf. 2012;38(9):408-13.
43. Stapleton C, Hough P, Oldmeadow L, Bull K, Hill K, Greenwood K. Four-item fall risk screening tool for subacute and residential aged care: The first step in fall prevention. Australasian journal on ageing. 2009;28(3):139-43.
44. Aranda-Gallardo M, Morales-Asencio JM, Canca-Sanchez JC, Barrero-Sojo S, Perez-Jimenez C, Morales-Fernandez A, et al. Instruments for assessing the risk of falls in acute hospitalized patients: a systematic review and meta-analysis. BMC health services research. 2013;13:122.
45. Ang E, Mordiffi S, Bee W, Devi K, Evans D. Evaluation of three fall-risk assessment tools in an acute care setting. Journal of advanced nursing. 2007;60:427-35.
46. O'Connell B, Myers H. The sensitivity and specificity of the Morse Fall Scale in an acute care setting. Journal of clinical nursing. 2002;11(1):134-6.
47. Wong Shee A, Phillips B, Hill K. Comparison of two fall risk assessment tools (FRATs) targeting falls prevention in sub-acute care. Archives of gerontology and geriatrics. 2012;55:653-9.

Chapter 2: Study Protocol

Background

Definition

A fall is defined as an event resulting in a person coming to rest unintentionally on the ground, floor or other level(1). As there are many definitions of a fall, a uniform definition is important when analysing the outcomes of studies, so that data is comparable.

Incidence

A 2010 Cochrane review of interventions for preventing falls in older people in nursing care facilities and hospitals, reported rates of 6.2 falls per person per year in a psycho-geriatric ward and 3.4 falls per person per year in a geriatric rehabilitation ward(2). There are several ways of reporting falls. They may be reported as the number of falls per month or over a certain quarter in a specific unit. However, this approach does not take into account how full the unit was at a particular time irrespective of the standard of care. As a result, calculating a fall rate, that is the number of falls per 1000 occupied bed days is recommended(3). In the United States, the inpatient fall rate for acute hospitals ranges from 1.7-25 falls per 1000 patient days depending on the unit, with the geriatric and psychiatric wards being at highest risk(4). Another study which looked at 6100 nursing units, representative of 1263 non-federal acute care general hospitals in the Unites States, encompassing the North West, Mid-West, South and West American regions, observed a fall rate of 3.53/1000 bed days, the highest being in the medical ward (4.03/1000 bed days), followed by the medical-surgical wards (3.62/1000 bed days), followed by the surgical ward (2.76/1000 bed days)(5). In London and Wales, during a one-year period, 206 350 falls were reported to the National Patient Safety Agency in inpatient settings. They calculated a fall rate of approximately 4.8/1000 bed days. This is equivalent to 1260 falls per year in a 800 bed hospital(6). Fall rates do vary from ward to ward in the hospital. This may be because patients in some units may not be as ambulatory as in other units, such as in the Intensive Care Unit. Patients in the medical wards are at higher risk of falling because of the inherent nature of their disease and treatments(7).

In the South African context, very limited published data are available for fall rates. There has been one study in the Western Cape, South Africa, which analysed the prevalence of falls in the community but not in an inpatient setting. There are no published data available from the public sector for in hospital fall rates in South Africa. In the private health sector, only the

Mediclinic hospital group reports annual fall rates across its hospitals in the Annual Clinical Services Report(8).

Causes of in-hospital falls are frequently multifactorial with contributors being:

1. age related,
2. disease and medication related,
3. environmental/situation related.

Risk factors for falls can also be categorized as intrinsic and extrinsic(9). Intrinsic risk factors include age associated physiological changes; disease symptoms such as arrhythmias, seizures, poor eyesight, abnormal gait; side effects of medications and psychological factors. Extrinsic factors include environmental factors such as wet floors, inadequately lit walkways and inappropriate footwear. Additional risk factors include frailty, fear of falling, delirium, nocturia, falling asleep during the day, and postural hypotension from beta blockers and diuretics used for treatment of hypertension(10). Anaemia may result in muscle weakness and physical decline causing disability(11). Time of occurrence of falls has also been explored(12). Day time falls occur while doing daily activities, while night time falls mainly occur because of attempts to mobilize without assistance. The type of room patients are in, that is single versus shared, has also been analysed, and shows a higher fall rate in single rooms, possibly due to less observation by staff and less social interaction with other patients(13).

Implications of falls in an inpatient hospital setting

Falls are a common cause of morbidity in patients in a hospital setting. Inpatient hospital falls are relevant for a number of reasons: they are a common adverse event; a potential liability for the hospital; may result in increased resource use; are a common cause of morbidity among the elderly; and are a leading cause of injurious death in the elderly(14). Complications of falls are two-fold. The physical complications include, pain, bruising, superficial injuries such as abrasions, lacerations and hematomas, and more serious injuries such as fractures, intracranial bleeding and death. Psychological complications include self-limitation of mobilization because of fear of falling and consequently increasing functional decline(15).

Strategies to reduce falls

To begin to address these problems there has been a need to promote awareness amongst staff members who care for patients at risk of falling in an inpatient hospital setting. There has been very limited research into effective strategies in reducing inpatient hospital fall rates in both an

international and South African context(1). Thus, attempting to implement a cost-effective fall prevention strategy is desirable. Fall interventions can be applied in the community, in an in-hospital setting and nursing homes. Most fall intervention strategies are multidimensional and include, patient factors – disease and medication related; environmental factors and exercise programmes(16). In addition, vitamin D supplementation has been shown to decrease the fall rate among elderly patients in the community and nursing homes(17). This may be through improvement of muscle function and strength(18). Vitamin D deficient patients show atrophy of type II muscle fibres on muscle biopsy, which recruit first to prevent a fall(19). In addition, vitamin D supplementation has been shown to improve proximal myopathy(20). In an in-hospital setting, a comprehensive assessment as suggested by The National Institute for Health and Excellence, includes a previous history of falls; a review of medication; a complete neurological exam which includes, cognition, gait, balance, muscle strength, mobility; an elderly patient's perceived level of function and fear related to falling; visual assessment; cardiovascular exam; and presence of urinary and faecal incontinence(21). In attempting to reduce the fall rates in hospital, Prevention of Falls Network Europe fall prevention taxonomy, categorizes intervention strategies into several groups(22). The groups are further subdivided within each category. Interventions to reduce the risks of falls may be single or multiple. Categories of interventions include exercise (whether supervised or unsupervised), medication review, surgery (eye, cardiovascular, orthopaedic procedures), management of urinary and faecal incontinence, fluid and nutritional treatment, psychological review, knowledge of surroundings, use of assistive devices such as communication aids and mobility aids, and social environment such as staff numbers and staff competency. Given the increased level of resources required for fall prevention strategies, it is most cost effective to identify patients who are at highest risk of falls and target interventions towards them. Assessment of a patient falls risk is therefore the first step in implementing a cost-effective strategy.

Assessment of fall risk in an in-hospital setting

There are multiple tools that try to identify patients at risk of falling. Some of the validated fall risk assessment tools include the St. Thomas's Risk Assessment Tool In Falling Elderly Inpatients (STRATIFY), Hendrich Fall Risk Model (HFRM) and the Morse Fall Scale(23). All three falls risk tools are based on a scoring system that categorizes patients as being low risk, moderate risk and high-risk patients for falling. The subgroups of each tool differ but broadly cover a history of previous falls, mental status, gait assessment and ability to mobilize, use of ambulatory aids, medication history, visual assessment and frequent toileting needs. Other falls risk tools such as the John Hopkins Falls Risk Assessment tool assess the same aspects and is

also based on a scoring system. The Falls Risk Assessment tool was developed by the Peninsula Health Falls Prevention Service in 1999 and is a three part tool that screens at risk patients, identifies risk factors and has an action plan(24).

Challenges involved in undertaking studies to evaluate falls

There are a number of factors that make it challenging to evaluate fall studies. The lack of a uniform definition of a fall makes it difficult to compare fall studies. The study site also differs with various fall studies as they can be hospital, community and care facility based, making comparisons troublesome. Reporting of falls as a fall rate versus number of falls over a month or specific quarter make comparisons difficult. In an in-hospital setting, fall reporting may differ according to the different wards, that is, fall reporting in an orthopaedic ward versus a psychiatric ward, where there may be less concern for a fall. There may be less reporting of falls that do not lead to injuries and staff fear related to possible disciplinary action. Inadequate reporting by inexperienced staff who are not familiar with the reporting procedure in the ward and inadequate record keeping of falls and clinical incident reports, makes data collection potentially inaccurate. As a result, fall rate evaluation and the assessment of factors affecting falls in a hospital setting is challenging.

Rationale for undertaking the study

As falls are an important cause of morbidity in elderly patients in an inpatient hospital setting and there is poor data in the South African context with regards to this important quality of care issue, this research aims to explore whether implementation of a falls risk assessment tool altered the rate and nature of inpatient hospital fall rates in a high risk population group.

Aims and Objectives:

Aim

To assess the impact of the implementation of a nursing falls risk assessment tool on the inpatient fall rate in the neuro-orthogeriatric ward, at the Wits Donald Gordon Medical Centre.

Objectives

1. To describe the nature and occurrence of inpatient falls in a neuro-orthogeriatric ward at the Wits Donald Gordon Medical Centre.

2. To evaluate whether the clinical implementation of a falls assessment tool reduces the inpatient fall rate in a neuro-orthogeriatric ward at the Wits Donald Gordon Medical Centre.
3. To evaluate if the falls assessment tool correctly identifies patients who have in hospital falls.

Methodology

Study Site

The study will take place in the neuro-orthogeriatric ward, section C, at the Wits Donald Gordon Medical Centre. The Wits Donald Gordon Medical Centre is a 194 bed, private academic hospital situated in Parktown, Johannesburg. It is an accredited specialist and subspecialist training centre and is owned and managed by both the private hospital group, Wits Mediclinic and The University of the Witwatersrand. Ward section C is a 42-bed ward that primarily admits geriatric, neurology, neurosurgical, plastic surgery and orthopaedic patients.

Study Design

An observational review of falls risk assessment data and clinical incident reports of reported falls of patients admitted to the neuro-orthogeriatric ward, section C, at the Wits Donald Gordon Medical Centre.

Method

The research study will analyse the fall rates during a two-year period, February 2014 to January 2016, prior to the implementation of the assessment tool, and a two-year period, February 2016 to January 2018, during which the assessment tool was implemented.

Patient details will be protected to maintain confidentiality and a numbering system will be used to document details so that no identifying data is used.

All falls in the neuro-orthogeriatric ward, Section C, are required to be recorded by the nursing staff and a clinical incident report is completed by the attending nursing staff. The completion of this form serves to record the fall, ensure the patient has been assessed and managed and to document that such care has been given. In February 2016, Sr. Pauline Bergamasco (Unit Manager of section C), Dr. Brent Tipping (Geriatrician) and Mr. Fagan Sydney (Clinical Risk Manager), instituted a measure to try to improve quality of care, by trying to identify patients

at high risk of falling admitted in the neuro-orthogeriatric ward, section C. This measure involved that all at risk patients admitted to the ward would require the completion of a falls risk assessment tool by the admitting nursing staff.

The Falls risk assessment tool (appendix A) records the age and sex of the patient and includes six items: previous history of falling, timed up and go test, use of an ambulatory aid, medication review, objective gait analysis, and mental status at time of admission for all patients that nurses considered to be "high risk" of falling in the ward. The falls risk assessment tool calculates a score which is used to determine the risk of a fall for that particular patient. This tool was used as part of a Master's study by a nurse in Mediclinic, in the Western Cape.

The clinical incident reports for the four study years will also be reviewed and the following details will be recorded: age, sex, total number of falls, injuries incurred, location of falls and time of fall.

Hospital records will be reviewed to obtain the number of admissions to the ward and the bed occupancy rate for the four-year study period. Fall rates will be calculated as the number of falls per 1000 days of bed occupancy.

The clinical incident reports of all falls reported before implementation of the falls risk assessment tool will be compared to the clinical incident reports of all falls reported after implementation of the falls risk assessment tool for a study period February 2014 till January 2018. Patients who were identified as high risk for falls by the falls risk assessment tool will be compared to those patients who actually fell and their clinical incident reports to evaluate whether the tool correctly identified them as high risk fall patients.

Limitations of the study

These are mostly methodological and include:

- Reporting of falls may have been inconsistent by nursing staff who may not have been familiar with the reporting system used in the ward.
- Not all falls may have been reported resulting in lack of completion of a clinical incident report.
- Some falls may have been missed by the nursing staff if unreported by the patient as the patient may not have sustained any injuries after the fall and managed to get up without assistance.

- Some patients who have fallen, may not have had a falls risk assessment done.
- The falls risk assessment tool may have been incorrectly completed by nursing staff.
- Incomplete capturing of records by clerks when reporting fall incidents.

Data Collection

Data collection will require liaising with the Clinical Risk Manager of the Wits Donald Gordon Medical Centre and the Unit Manager of the neuro-orthogeriatric ward, section C, to gain access to archived records to retrieve data for the four-year study period, from February 2014 to January 2018.

Data Analysis

The demographic information (age and sex) of the study group will be described. Data analysis will be carried out by SAS. The 5% significance level will be used. The data collection sheets, the falls risk assessment tool forms and clinical incident reports will be kept in the ward office and entered onto a database, which only myself, my supervisor and statistician will have access to view. Categorical variables will be presented as frequencies and percentages with 95% confidence intervals.

Ethical Considerations

This research proposal will be submitted to the Post-graduate Committee of the University of the Witwatersrand and the Human Research Ethics Committee of the University of the Witwatersrand.

The establishment of a prospective database to evaluate the efficacy of the falls risk assessment tool by Dr. Tipping was approved by the Human Research Ethics Committee of the University of the Witwatersrand (M160126) in February 2016.

Written permission from Dr. Tipping, Head of the division of Geriatric Medicine, Wits Donald Gordon Medical Centre, Dr. Tager, Chief Executive Officer, Wits Donald Gordon Medical Centre and Mr. Fagan Sydney, Clinical Risk Manager, Wits Donald Gordon Medical Centre will be obtained for data to be collected. All data will be collected by myself once written permission is granted. All information will be collected from the database of the falls risk assessments, filed by the ward secretary at the time of the patient's discharge and the clinical

incident reports will be collected from the filed records of the Clinical Risk Manager. During the collection process, the patient details will be protected and the details will be documented using a numbering system. No identifying data is used. The study will be conducted in adherence to the principles of the Declaration of Helsinki(25).

Timing

Gantt Chart showing the timeline of the study:

	Dec 18	Jan 19	Feb 19	Mar 19	Apr 19	May 19	June 19	Jul 19	Aug 19	Sept 19	Oct 19	Nov 19
Literature review												
Preparing protocol												
Protocol assessment												
Ethics application												
Collecting data												
Data analysis												
Writing up – thesis												
Writing up – paper												

Funding

The study will be funded by the primary investigator, that is, myself, and statistical support will be funded by Wits Donald Gordon Medical Centre.

Table 2.1

Expense	Cost	Sponsor
Transport	R500	SE Sunny
Photocopying	R500	SE Sunny

References

1. Barker AL, Morello RT, Wolfe R, Brand CA, Haines TP, Hill KD, et al. 6-PACK programme to decrease fall injuries in acute hospitals: cluster randomised controlled trial. BMJ. 2016;352:h6781.

2. Cameron ID, Dyer SM, Panagoda CE, Murray GR, Hill KD, Cumming RG, et al. Interventions for preventing falls in older people in care facilities and hospitals. Cochrane Database of Systematic Reviews. 2018(9).

3. Shorr RI, Mion LC, Chandler AM, Rosenblatt LC, Lynch D, Kessler LA. Improving the capture of fall events in hospitals: combining a service for evaluating inpatient falls with an incident report system. Journal of the American Geriatrics Society. 2008;56(4):701-4.

4. Currie L. Advances in Patient Safety

Fall and Injury Prevention. In: Hughes RG, editor. Patient Safety and Quality: An Evidence-Based Handbook for Nurses. Rockville (MD): Agency for Healthcare Research and Quality (US); 2008.

5. Bouldin EL, Andresen EM, Dunton NE, Simon M, Waters TM, Liu M, et al. Falls among adult patients hospitalized in the United States: prevalence and trends. Journal of patient safety. 2013;9(1):13-7.

6. Healy F SS, Glampson B, Pryce A, Joule N, Willmott M. The third reprt from the Patient Safety Observatory: Slips, trips and falls in hospital. National Patient Agency2007.

7. Kalula SZ, Ferreira M, Swingler GH, Badri M. Risk factors for falls in older adults in a South African Urban Community. BMC Geriatr. 2016;16:51-.

8. International M. Clinical Services Report [Internet]2017 [cited 2018. Available from: http://annualreport2017.mediclinic.com/pdf/Clinical_Services_Report_2017.pdf.

9. Al-Aama T. Falls in the elderly: spectrum and prevention. Can Fam Physician. 2011;57(7):771-6.

10. Morley JE. Frailty, falls, and fractures. J Am Med Dir Assoc. 2013;14(3):149-51.

11. Penninx BW, Pahor M, Woodman RC, Guralnik JM. Anemia in old age is associated with increased mortality and hospitalization. The journals of gerontology Series A, Biological sciences and medical sciences. 2006;61(5):474-9.

12. Manfredini R, Fabbian F, Pala M, De Giorgi A, Menegatti AM, Boari B, et al. Time of Occurrence of In-Hospital Falls: A Systematic Mini Review. Journal of the American Geriatrics Society. 2012;60(6):1183-4.

13. Singh I, Okeke J, Edwards C. Outcome of in-patient falls in hospitals with 100% single rooms and multi-bedded wards. Age and ageing. 2015;44(6):1032-5.

14. Terroso M, Rosa N, Torres Marques A, Simoes R. Physical consequences of falls in the elderly: a literature review from 1995 to 2010. European Review of Aging and Physical Activity. 2014;11(1):51-9.

15. Schwendimann R, Bühler H, De Geest S, Milisen K. Falls and consequent injuries in hospitalized patients: effects of an interdisciplinary falls prevention program. BMC health services research. 2006;6(1):69.

16. Cumming R. Falls prevention in older persons. Continuing Medical Education. 2013;31(10):378-81.

17. Kalyani RR, Stein B, Valiyil R, Manno R, Maynard JW, Crews DC. Vitamin D treatment for the prevention of falls in older adults: systematic review and meta-analysis. Journal of the American Geriatrics Society. 2010;58(7):1299-310.

18. Edwards RH. Physiological analysis of skeletal muscle weakness and fatigue. Clinical science and molecular medicine. 1978;54(5):463-70.

19. Ceglia L. Vitamin D and skeletal muscle tissue and function. Molecular aspects of medicine. 2008;29(6):407-14.

20. Sorensen OH, Lund B, Saltin B, Lund B, Andersen RB, Hjorth L, et al. Myopathy in bone loss of ageing: improvement by treatment with 1 alpha-hydroxycholecalciferol and calcium. Clinical science (London, England : 1979). 1979;56(2):157-61.

21. Centre for Clinical Practice at N. National Institute for Health and Care Excellence: Clinical Guidelines. Falls: Assessment and Prevention of Falls in Older People. London: National Institute for Health and Care Excellence (UK)

Copyright (c) National Institute for Health and Care Excellence, 2013.; 2013.

22. Skelton DA, Becker C, Lamb SE, Close JCT, Zijlstra W, Yardley L, et al. Prevention of Falls Network Europe: a thematic network aimed at introducing good practice in effective falls prevention across Europe. Eur J Ageing. 2004;1(1):89-94.

23. Aranda-Gallardo M, Morales-Asencio JM, Canca-Sanchez JC, Barrero-Sojo S, Perez-Jimenez C, Morales-Fernandez A, et al. Instruments for assessing the risk of falls in acute hospitalized patients: a systematic review and meta-analysis. BMC health services research. 2013;13:122.

24. Stapleton C, Hough P, Oldmeadow L, Bull K, Hill K, Greenwood K. Four-item fall risk screening tool for subacute and residential aged care: The first step in fall prevention. Australasian journal on ageing. 2009;28(3):139-43.

25. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. JAMA. 2013;310(20):2191-4.

Chapter 3: Submissible Article

TITLE: **The impact of a nursing falls assessment tool on reducing the inpatient falls in a neuro-orthogeriatric ward at the Wits Donald Gordon Medical Centre: An observational study (2014-2018).**

Authors:

1. Sunny, S.E
2. Tipping, B.N

Affiliations:

1. Department of Medicine, Faculty of Health Sciences, University of the Witwatersrand.
2. Wits Donald Gordon Medical Centre, Division of Geriatric Medicine, Department of Medicine, Faculty of Health Sciences, University of the Witwatersrand.

Short title: Impact of a nursing falls assessment tool on reducing inpatient falls at Wits Donald Gordon Medical Centre.

Conflict of interest: Nil

Keywords: Falls assessment tool, inpatient falls

Word count: 3274

Abstract word count: 419

Abstract

Background: Inpatient hospital falls are relevant for a number of reasons as they are a common adverse event, a common cause of morbidity among the elderly, a leading cause of injurious death in the elderly, a potential liability for the hospital and may result in increased resource use. To begin to address these problems, there is a need to promote awareness amongst staff members who care for patients at risk of falling in an inpatient hospital setting. There is limited research into effective strategies in reducing inpatient hospital fall rates in both an International and South African context.

Objective: To describe the nature and occurrence of inpatient falls in a neuro-orthogeriatric ward at the Wits Donald Gordon Medical Centre. To evaluate whether the clinical

implementation of a falls assessment tool reduces the inpatient fall rate and to evaluate if the falls assessment tool correctly identifies patients who have in hospital falls.

Methods: A single centre, retrospective study of patients admitted to the neuro-orthogeriatric ward, at the Wits Donald Gordon Medical Centre with review of falls risk assessment data and clinical incident reports of reported falls from prior to implementation of the nursing falls assessment tool (February 2014 to January 2016) to after implementation of the assessment tool (February 2016 to January 2018). The tool was performed by the admitting nurse if patients had any of the risk factors mentioned in the tool.

Results: A total of 358 patients were included in the analysis, with 64 patients admitted pre-introduction of the assessment tool and 294 admitted post introduction of the assessment tool. In the post introduction cohort, 91.8% (270 of 294) had falls risk assessments performed at admission, and of these, 84.1% (227 of 270) were complete. There were 15 (6.6%) patients who had a documented fall. The median age of patients who fell was 76 years and 51% were men. Falls occurred mainly in the room of the patient (75.5%), 57.6% occurred after hours and 34% incurred an injury. The study showed a decline in the fall rate pre-introduction of the assessment tool 2.64 per 1000 patient bed days (95%CI 2.02-3.40) versus 1.49 per 1000 patient bed days (95%CI 1.06-2.05) post introduction of the assessment tool. The sensitivity of the assessment tool was a 100% but had very poor specificity of 3.3% (CI 0.98-5.63) and a positive predictive value of 6.82% (3.5-10.10%).

Conclusion: The study showed a decline in the fall rate post introduction of the nursing falls assessment tool. The tool was shown to be highly sensitive but had very poor specificity and positive predictive value. This small study suggests that raising fall awareness may have an impact on reducing falls.

Introduction

A fall is defined as an event resulting in a person coming to rest unintentionally on the ground, floor or other lower level(1).

A 2010 Cochrane review of interventions for preventing falls in older people in nursing care facilities and hospitals, reported rates of 6.2 falls per person per year in a psycho-geriatric ward and 3.4 falls per person per year in a geriatric rehabilitation ward(2). There are several ways of reporting falls. They may be reported as the number of falls per month or over a certain quarter

in a specific unit. However, this approach does not take into account how full the unit was at a particular time irrespective of the standard of care. As a result, calculating a fall rate, that is the number of falls per 1000 occupied bed days is recommended(3). In the United States, the inpatient fall rate for acute hospitals ranges from 1.7-25 falls per 1000 patient days depending on the unit, with the geriatric and psychiatric wards being at highest risk(4). Another study which looked at 6100 nursing units, representative of 1263 non-federal acute care general hospitals in the Unites States, encompassing the North West, Mid-West, South and West American regions, observed a fall rate of 3.53/1000 bed days, the highest being in the medical ward (4.03/1000 bed days), followed by the medical-surgical wards (3.62/1000 bed days), followed by the surgical ward (2.76/1000 bed days)(5). In London and Wales, during a one-year period, 206 350 falls were reported to the National Patient Safety Agency in inpatient settings. They calculated a fall rate of approximately 4.8/1000 bed days. This is equivalent to 1260 falls per year in a 800 bed hospital(6). Fall rates do vary from ward to ward in the hospital. This may be because patients in some units may not be as ambulatory as in other units, such as in the Intensive Care Unit. Patients in the medical wards are at higher risk of falling because of the inherent nature of their disease and treatments(7).

In the South African context, very limited published data are available for fall rates. There has been one study in the Western Cape, South Africa, which analysed the prevalence of falls in the community but not in an inpatient setting. There are no published data available from the public sector for in hospital fall rates in South Africa. In the private health sector, only the Mediclinic hospital group reports annual fall rates across its hospitals in the Annual Clinical Services Report(8).

Causes of in-hospital falls are frequently multifactorial with contributors being:

1. age related,
2. disease and medication related,
3. environmental/situation related.

Risk factors for falls can also be categorized as intrinsic and extrinsic(9). Intrinsic risk factors include age associated physiological changes; disease symptoms such as arrhythmias, seizures, poor eyesight, abnormal gait; side effects of medications and psychological factors. Extrinsic factors include environmental factors such as wet floors, inadequately lit walkways and inappropriate footwear. Additional risk factors include frailty, fear of falling, delirium, nocturia, falling asleep during the day, and postural hypotension from beta blockers and diuretics used for treatment of hypertension(10). Anaemia may result in muscle weakness and physical decline

causing disability(11). Time of occurrence of falls has also been explored(12). Day time falls occur while performing daily activities, while night-time falls mainly occur because of attempts to mobilize without assistance. The type of room patients are in, that is single versus shared, has also been analysed, and shows a higher fall rate in single rooms, possibly due to less observation by staff and less social interaction with other patients(13).

Falls are a common cause of morbidity in patients in a hospital setting. Inpatient hospital falls are relevant for a number of reasons: they are a common adverse event; a potential liability for the hospital; may result in increased resource use; are a common cause of morbidity among the elderly; and are a leading cause of injurious death in the elderly(14). Complications of falls are two-fold. The physical complications include, pain, bruising, superficial injuries such as abrasions, lacerations and hematomas, and more serious injuries such as fractures, intracranial bleeding and death. Psychological complications include self-limitation of mobilization because of fear of falling and consequently increasing functional decline(15).

To begin to address these problems there has been a need to promote awareness amongst staff members who care for patients at risk of falling in an inpatient hospital setting. There has been very limited research into effective strategies in reducing inpatient hospital fall rates in both an international and South African context(1). Therefore, attempting to implement a cost-effective fall prevention strategy is desirable. Fall interventions can be applied in the community, in an in-hospital setting and nursing homes. Most fall intervention strategies are multidimensional and include, patient factors – disease and medication related; environmental factors and exercise programmes(16). In addition, vitamin D supplementation has been shown to decrease the fall rate among elderly patients in the community and nursing homes(17). This may be through improvement of muscle function and strength(18).

In an in-hospital setting, a comprehensive assessment as suggested by The National Institute for Health and Excellence, includes a previous history of falls; a review of medication; a complete neurological exam which includes, cognition, gait, balance, muscle strength, mobility; an elderly patient's perceived level of function and fear related to falling; visual assessment; cardiovascular exam; and presence of urinary and faecal incontinence(21). In attempting to reduce the fall rates in hospital, Prevention of Falls Network Europe fall prevention taxonomy, categorizes intervention strategies into several groups(22). The groups are further subdivided within each category. Interventions to reduce the risks of falls may be single or multiple. Categories of interventions include exercises (whether supervised or unsupervised), medication review, surgery (eye, cardiovascular, orthopaedic procedures), management of urinary and

faecal incontinence, fluid and nutritional treatment, psychological review, knowledge of surroundings, use of assistive devices such as communication aids and mobility aids, and social environment such as staff numbers and staff competency. Given the increased level of resources required for fall prevention strategies, it is most cost-effective to identify patients who are at highest risk of falls and target interventions towards them. Assessment of a patient falls risk is therefore the first step in implementing a cost-effective strategy.

There are a number of factors that make it challenging to evaluate fall studies. The lack of a uniform definition of a fall makes it difficult to compare fall studies. The study site also differs with various fall studies as they can be hospital, community and care facility based, making comparisons troublesome. Reporting of falls as a fall rate versus number of falls over a month or specific quarter make comparisons difficult. In an in-hospital setting, fall reporting may differ according to the different wards, that is, fall reporting in an orthopaedic ward versus a psychiatric ward, where there may be less concern for a fall. There may be less reporting of falls that do not lead to injuries and staff fear, related to possible disciplinary action. Inadequate reporting by inexperienced staff who are not familiar with the reporting procedure in the ward and inadequate record keeping of falls and clinical incident reports, makes data collection potentially inaccurate. As a result, fall rate evaluation and the assessment of factors affecting falls in a hospital setting is challenging.

This research aims to describe the nature and occurrence of inpatient falls in a neuro-orthogeriatric ward at the Wits Donald Gordon Medical Centre and whether implementation of a falls risk assessment tool altered the rate and nature of inpatient hospital fall rates in a high-risk population group.

Methods

The study took place in ward section C, at the Wits Donald Gordon Medical Centre – a 194 bed, private academic hospital situated in Parktown, Johannesburg. Ward section C is a 42-bed ward that primarily admits geriatric, neurology, neurosurgical, plastic surgery and orthopaedic patients.

An observational review of falls risk assessment data captured by a falls assessment tool and clinical incident reports of reported falls of patients admitted to ward section C, within the study period analysing fall rates during a two year period, February 2014 to January 2016, prior to the implementation of the assessment tool and a two year period, February 2016 to January

2018, during which the assessment tool was implemented was performed. The assessment tool assessed six components:

(i) A history of falling, immediate or within 3 months:

a) No - 0 points,
b) Yes - 25 points;

(ii) Get up and Go test:

a) Rise easy - 0 points,
b) Able to rise with help - 15 points,
c) Unable - 30 points;

(iii) Ambulatory aid:

a) Bed rest/nurse assist - 0 point,
b) Crutches/ Cane/ Walker- 15 points,
c) Furniture - 30 points;

(iv) Sedatives/antiepileptics/analgesics/antihypertensives:

a) No - 0 points,
b) Yes - 15 points;

(v) Gait/Transferring (way patient mobilizes):

a) Normal/bedrest/immobile - 0 points,
b) Weak- 10 points,
c) Impaired- 20 points;

(vi) Mental Status:

a) Oriented to own ability - 0 points,
b) Forgets limitations - 15 points.

This tool was selected by the Hospital Risk Manager at our hospital for use in the ward and was part of a Masters study by a nurse in the Western Cape. The specific components of the tool were derived from existing falls risk assessment tools and highlights the important risk factors for falls. A score of 25 or more to identify at risk patients is based on the scoring system used in the Morse Fall Scale, a validated assessment tool, where a score of 25 or more is considered

at risk for a fall. The nurses were told about the components of the assessment tool and if patients admitted to the ward had any of the risk factors mentioned in the tool, then a falls risk assessment would be performed by the admitting nurse at admission to the ward.

The clinical incident reports recorded the time, location and consequence of the fall, for example if an injury had occurred or not. Patients identified as at risk for falls by the falls risk assessment tool (a calculated score of 25 or more) were compared to those who actually fell and their clinical incident reports to identify whether the tool correctly identified them as high risk fall patients. In addition, data were analysed to describe the nature and occurrence of inpatient falls, and whether the clinical implementation of a falls assessment tool reduced the inpatient fall rate in a neuro-orthogeriatric ward at the Wits Donald Gordon Medical Centre.

Statistical analysis

The demographic information (age and gender) of the study group will be described. Data were captured into a REDCap database and exported into Stata 14.2 for analysis. Descriptive statistics were used to describe individuals who were admitted and had a fall assessment tool administered. Median and interquartile ranges were used for continuous variables while frequencies and percentages were used for categorical data.

Results

The total number of patients assessed during the study period was 364. Six patients were excluded as they were admitted prior to the start of the study period, resulting in a total of 358 patients included in the study for analysis (99.3% of initial patient cohort). Sixty-four were assessed pre-introduction of the assessment tool as being admitted and then had a fall (17.4% of the total included in the analysis) and two hundred and ninety-four were assessed post introduction of the assessment tool (82.4% of the total included in the analysis).

On admission, 24 of the 294 patients in the post-introduction of the assessment tool group, did not have a completed falls risk assessment performed (8.2%), while 270 patients had a completed assessment performed (91.8%). It was noted that the patients who had completed assessments done, 43 were excluded due to incompletely filled forms, resulting in 227 patients who had correctly completed falls assessments done with scores available.

The analysis of these forms showed 15 of the 227 patients (6.6%) had a documented fall during their admission and 212 of the 227 (93.4%) did not have a documented fall. The other 23 patients who fell, did not have a fall risk assessment done and therefore were not identified as

patients at risk of falls, however, this was still included in the calculation of the final fall rate post introduction of the assessment tool, but was not used to evaluate the assessment tool itself. The number of falls documented pre-introduction of the assessment tool was 61. The study showed a fall rate of 2.64 per 1000 patient bed days (95% CI 2.02-3.40) pre-introduction of the assessment tool, and a fall rate of 1.49 per 1000 patient days (95% CI 1.06-2.05) post-introduction of the assessment tool, as illustrated in figure 2. The results demonstrated that the sensitivity of the assessment tool was a 100%, as all 15 patients who had a documented fall in the group post-introduction of the assessment tool were identified as being high risk for falling. However, the specificity of the tool was 3.3% (95% CI 0.98-5.63) with a positive predictive value of 6.82% (95% CI 3.52-10.1) and a negative predictive value of a 100% as noted in table 4.

Furthermore, in the group that was identified as high risk, there was no clear cut-off in the risk scores that would accurately predict those who will fall and those who will not, as illustrated in figure 3, which did not show a clear inflection point on the curve.

The demographic characteristics of the fallers are shown in table 1. This data were extrapolated from the clinical incident reports of the documented falls.

- The median age in years of inpatient falls was 76 years (in the interquartile range of 68-82).

- Males were noted to have a slightly higher incidence of falls, accounting for 51.1% of the total fallers.

- It was noted that 40% of falls occurred in the winter months.

- More falls occurred after hours (57%), between 16h00pm - 07h00am.

- Most falls occurred in the patient's room (75.5%) while 18.2% occurred in the bathroom and 6% were unknown, as it was not documented in the clinical incident reports.

- Injuries were incurred in 34% of the documented falls. 94.9% were minor injuries, 2.6% (1 patient) had a major injury and 2.6% (1 patient) had no description of the injury. See Table 3.

Discussion

The key findings showed a decline in the fall rate post-implementation of the falls risk assessment tool. It is important to highlight that the number of patients assessed pre-implementation of the falls risk assessment tool is significantly smaller in our study. This could be due to poor record keeping at that time and may have under- represented the actual numbers

of falls that had occurred during that period. Another confounder in calculating the sensitivity, specificity and predictive values for this tool is patients being labelled as high risk for a fall would have increased nursing vigilance and care to prevent falls, thereby confounding the utility of the actual tool. Our results demonstrated that the nursing falls risk assessment tool had a high sensitivity but poor specificity and positive predictive value, so although it accurately identified high risk patients, it did not necessarily identify patients who would actually fall in the ward. This is in line with other tools such as the Morse Fall Scale and STRATIFY tools that have been validated in large scale studies(23). These findings support the notion that nursing staff are more aware of patients who are high fall risks and are able to institute measures to manage the patients risk factors and potentially reduce the fall rate. As there is limited data in the South African context in an in-hospital setting, this study demonstrates the importance of a nursing falls risk assessment tool. As falls in hospital are an important cause of morbidity and resource use, it is paramount to identify a falls risk assessment tool that correctly identifies risk factors associated with falls for all patients, is validated and is used to aid in clinical judgement(22). A recommendation for further research into this area is to develop intervention strategies once risk factors have been identified for patients at high risk for falls. Furthermore, a potential action plan following an in-hospital fall would be beneficial so as to utilize resources more efficiently in a resource limited setting and to reduce in-patient morbidity.

In line with previous studies, the mean age of patients who fell was 76 years, which highlights that elderly patients are more predisposed to falls due to multiple risk factors(26). Similarly, a slightly higher male preponderance of patients who fell was noted in our study, which is consistent with other studies(27). Our study showed 40% of falls occurred during winter, which could be attributable to the seasonal variation of delirium noted in some studies in the literature(28). More than half of the falls occurred after hours (16h00pm-07h00am). Possible explanations include, shift change over, resulting in reduced staff surveillance, reduced staff numbers at night resulting in reduced staff observation. Patients may attempt to self-mobilize without assistance during the night. The effects of certain medications such as psychotropics and sedatives given at night may potentially increase fall risk. Routines performed after hours, such as linen changes and bed baths which involve patient transfer from bed to chair or change in position on the bed may predispose to a fall(12). Most falls happened in patient's rooms (75.5%) which may be due to several reasons such as reduced staff surveillance, attempts to self-mobilize without assistance and delayed response to call bells when patients are in need of assistance(13). The fall related injuries (34% of documented falls) were mostly minor injuries such as hematomas, lacerations and abrasions. Only one patient had a fracture which is

categorized as a major injury. This shows that falls related morbidity needs to be identified so as to implement an action plan to reduce further complications for the patient. It is especially important that the details of the injury occurred be documented in the clinical incident report forms so as to further highlight the need for an action plan once a fall has occurred.

Limitations of the study

These are mostly methodological and include:

- This is a small single ward, single centre study.
- Reporting of falls may have been inconsistent by nursing staff who may not have been familiar with the reporting system used in the ward.
- Not all falls may have been reported resulting in lack of completion of a clinical incident report.
- Some falls may have been missed by the nursing staff if unreported by the patient as the patient may not have sustained any injuries after the fall and managed to get up without assistance.
- Some patients who have fallen, may not have had a falls risk assessment done.
- The falls risk assessment tool may have been incorrectly completed by nursing staff.
- Incomplete capturing of records by clerks when reporting fall incidents.
- There may have been incomplete recording of information on the clinical incident reports, such as time and location of falls as well as whether an injury had occurred.
- The alteration of nursing behaviour towards preventing falls after the introduction of the falls risk assessment tool is a confounder to assessing the tool as a predictor of fall risk as the behaviour of nurses could have led to the reduction in the fall rate in addition to the effectiveness of the tool in predicting those at risk of a fall.

Strengths of the study

- This study reported an injury rate of 34%, which is similar to other large international studies who reported a 30-35% injury rate(29). When interpreting validity of a fall reporting study, the injury rate is important and would imply fall under reporting if it is very high due to non-injurious falls being unreported. Our fall injury rate of 34% is reassuring that the reporting rate of falls in our ward is consistent with other much larger internationally based studies.

- This study provides data on in-patient falls in South Africa, an area with a paucity of previous information.
- The introduction of a falls risk assessment tool increased awareness among nursing staff on fall prevention, which could have contributed to the reduction in frequency of falls post introduction of the tool.

Conclusion

Based on our study, the falls risk assessment tool reduced the fall rate due to better staff awareness and surveillance. The tool is useful in identifying risk factors of falls in an individual patient and assists in planning appropriate interventions for reversible risk factors and raising awareness of falls and falls prevention among hospital staff. However, given the tools poor specificity and positive predictive value, a more comprehensive assessment tool is required which ideally should identify high risk falls with high specificity and following identification, an action plan should be instituted to manage risk factors with the aim to reduce the occurrence of a fall. In order for resources to be used appropriately and to be more cost effective, a comprehensive assessment tool and falls prevention protocol needs to be derived from the level of governance, hospital management, individual wards, and staff training in falls prevention. Patient as well as family education to prevent falls is especially important, as falls are a major cause of morbidity and mortality in the elderly in an inpatient hospital setting.

References

1. Barker AL, Morello RT, Wolfe R, Brand CA, Haines TP, Hill KD, et al. 6-PACK programme to decrease fall injuries in acute hospitals: cluster randomised controlled trial. BMJ. 2016;352:h6781.
2. Cameron ID, Dyer SM, Panagoda CE, Murray GR, Hill KD, Cumming RG, et al. Interventions for preventing falls in older people in care facilities and hospitals. Cochrane Database of Systematic Reviews. 2018(9).
3. Shorr RI, Mion LC, Chandler AM, Rosenblatt LC, Lynch D, Kessler LA. Improving the capture of fall events in hospitals: combining a service for evaluating inpatient falls with an incident report system. Journal of the American Geriatrics Society. 2008;56(4):701-4.
4. Currie L. Advances in Patient Safety

Fall and Injury Prevention. In: Hughes RG, editor. Patient Safety and Quality: An Evidence-Based Handbook for Nurses. Rockville (MD): Agency for Healthcare Research and Quality (US); 2008.
5. Bouldin EL, Andresen EM, Dunton NE, Simon M, Waters TM, Liu M, et al. Falls among adult patients hospitalized in the United States: prevalence and trends. Journal of patient safety. 2013;9(1):13-7.
6. Healy F SS, Glampson B, Pryce A, Joule N, Willmott M. The third reprt from the Patient Safety Observatory: Slips, trips and falls in hospital. National Patient Agency2007.

7. Kalula SZ, Ferreira M, Swingler GH, Badri M. Risk factors for falls in older adults in a South African Urban Community. BMC Geriatr. 2016;16:51-.
8. International M. Clinical Services Report [Internet]2017 [cited 2018. Available from: http://annualreport2017.mediclinic.com/pdf/Clinical_Services_Report_2017.pdf.
9. Al-Aama T. Falls in the elderly: spectrum and prevention. Can Fam Physician. 2011;57(7):771-6.
10. Morley JE. Frailty, falls, and fractures. J Am Med Dir Assoc. 2013;14(3):149-51.
11. Penninx BW, Pahor M, Woodman RC, Guralnik JM. Anemia in old age is associated with increased mortality and hospitalization. The journals of gerontology Series A, Biological sciences and medical sciences. 2006;61(5):474-9.
12. Manfredini R, Fabbian F, Pala M, De Giorgi A, Menegatti AM, Boari B, et al. Time of Occurrence of In-Hospital Falls: A Systematic Mini Review. Journal of the American Geriatrics Society. 2012;60(6):1183-4.
13. Singh I, Okeke J, Edwards C. Outcome of in-patient falls in hospitals with 100% single rooms and multi-bedded wards. Age and ageing. 2015;44(6):1032-5.
14. Terroso M, Rosa N, Torres Marques A, Simoes R. Physical consequences of falls in the elderly: a literature review from 1995 to 2010. European Review of Aging and Physical Activity. 2014;11(1):51-9.
15. Schwendimann R, Bühler H, De Geest S, Milisen K. Falls and consequent injuries in hospitalized patients: effects of an interdisciplinary falls prevention program. BMC health services research. 2006;6(1):69.
16. Cumming R. Falls prevention in older persons. Continuing Medical Education. 2013;31(10):378-81.
17. Kalyani RR, Stein B, Valiyil R, Manno R, Maynard JW, Crews DC. Vitamin D treatment for the prevention of falls in older adults: systematic review and meta-analysis. Journal of the American Geriatrics Society. 2010;58(7):1299-310.
18. Edwards RH. Physiological analysis of skeletal muscle weakness and fatigue. Clinical science and molecular medicine. 1978;54(5):463-70.
19. Ceglia L. Vitamin D and skeletal muscle tissue and function. Molecular aspects of medicine. 2008;29(6):407-14.
20. Sorensen OH, Lund B, Saltin B, Lund B, Andersen RB, Hjorth L, et al. Myopathy in bone loss of ageing: improvement by treatment with 1 alpha-hydroxycholecalciferol and calcium. Clinical science (London, England : 1979). 1979;56(2):157-61.
21. Centre for Clinical Practice at N. National Institute for Health and Care Excellence: Clinical Guidelines. Falls: Assessment and Prevention of Falls in Older People. London: National Institute for Health and Care Excellence (UK)

Copyright (c) National Institute for Health and Care Excellence, 2013.; 2013.

22. Skelton DA, Becker C, Lamb SE, Close JCT, Zijlstra W, Yardley L, et al. Prevention of Falls Network Europe: a thematic network aimed at introducing good practice in effective falls prevention across Europe. Eur J Ageing. 2004;1(1):89-94.
23. Aranda-Gallardo M, Morales-Asencio JM, Canca-Sanchez JC, Barrero-Sojo S, Perez-Jimenez C, Morales-Fernandez A, et al. Instruments for assessing the risk of falls in acute hospitalized patients: a systematic review and meta-analysis. BMC health services research. 2013;13:122.
24. Stapleton C, Hough P, Oldmeadow L, Bull K, Hill K, Greenwood K. Four-item fall risk screening tool for subacute and residential aged care: The first step in fall prevention. Australasian journal on ageing. 2009;28(3):139-43.
25. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. JAMA. 2013;310(20):2191-4.

26. O'Loughlin JL, Robitaille Y, Boivin JF, Suissa S. Incidence of and risk factors for falls and injurious falls among the community-dwelling elderly. American journal of epidemiology. 1993;137(3):342-54.
27. Gale CR, Westbury LD, Cooper C, Dennison EM. Risk factors for incident falls in older men and women: the English longitudinal study of ageing. BMC Geriatr. 2018;18(1):117.
28. Gallerani M, Manfredini R. Seasonal variation in the occurrence of delirium in patients admitted to medical units of a general hospital in Italy. Acta Neuropsychiatrica. 2013;25.
29. S Y. A Global Report on Falls Prevention, Epidemiology of Falls. Ageing Ageing and Life Course Family and Community Health World Health Organization. 2007.

Table 1: Demographic characteristics of included patients at admission (N=358) who underwent falls risk assessment

Variable	Category	All N=358	Admitted pre-introduction of form N=64	Admitted post-introduction of form N=294
Age (median, IQR)		80 (71 - 87)	75.5 (68 - 82)	80 (74 - 87)
Age (mean, s.d)		77.5 (13.1)	71.8(16.1)	78.7 (12.1)
Age category	<55	20 (5.6)	8 (12.5)	12 (4.1)
	56 - 65	30 (8.4)	6 (9.4)	24 (8.2)
	66 - 75	72 (20.1)	19 (29.7)	53 (18.0)
	76 - 85	134 (37.4)	20 (31.3)	114 (38.8)
	86 - 95	94 (26.3)	11 (17.2)	83 (28.2)
	>95	8 (2.3)	0	8 (2.7)
Gender	Male	172 (48.2)	35 (54.7)	137 (46.8)
	Female	185 (51.8)	29 (45.3)	156 (53.2)
Year of admission	2014	16 (4.5)	16 (25.0)	0
	2015	43 (12.0)	43 (67.2)	0
	2016	246 (68.7)	5 (7.8)	241 (82)
	2017	51 (14.3)	0	51 (17.4)
	2018	2 (0.6)	0	2 (0.7)
Admitted more than once	Yes	16 (4.5)	0	16 (5.4)
	No	342 (94.5)	64 (100)	278 (94.6)

Table 2: Profile of inpatient falls (N=99)

Characteristic	n (%)
Median age in years, IQR	76 (68 - 82)
Males	51 (51.5)
Occurred pre-introduction of fall assessments	61 (61.6)
Occurred post -introduction of fall assessments	38 (38.4)
Location of fall Bathroom Ward room/patient's room Other	 18 (18.2) 75 (75.5) 6 (6.1)
Occurred in winter months	40 (40.4)
Falls occurred after-hours (<7h00 & >16h00)	57 (57.6)
Injury incurred	34 (33.3)
Fall risk assessment completed	15 (15.2)
High fall risk score	15 (100)

Table 3: Nature of injuries incurred

	Injury 1 (N=34)	Injury 2 (N=5)	All injuries (N=39)
Injury type	n (%)	n (%)	n (%)
Abrasions	12 (35.3)	0 (0)	12 (30.8)
Bleeding	2 (5.9)	1 (20)	3 (7.7)
Bruising	8 (23.5)	2 (40)	10 (25.6)
Hematoma	1 (2.9)	0 (0)	1 (2.6)
Lacerations	6 (17.6)	1 (20)	7 (17.9)
Nose bleed	1 (2.9)	0 (0)	1 (2.6)
Pain	2 (5.9)	0 (0)	2(5.1)
Fracture	0 (0)	1 (20)	1 (2.6)
Not described	1 (2.9)	0 (0)	1 (2.6)
Scratch	1 (2.9)	0 (0)	1 (2.6)

There were 39 injuries in 34 unique individuals.

Table 4: Performance of the fall risk assessment tool administered at admission in predicting a fall during admission

Fall risk score/ Fall occurred	Yes	No	Total
<24 (low fall risk)	0	7	7
>=24 (high fall risk)	15	205	220
Total	15	212	227

Sensitivity = # who the assessment predicted high fall risk / # who had a fall= 15/15 = 100%

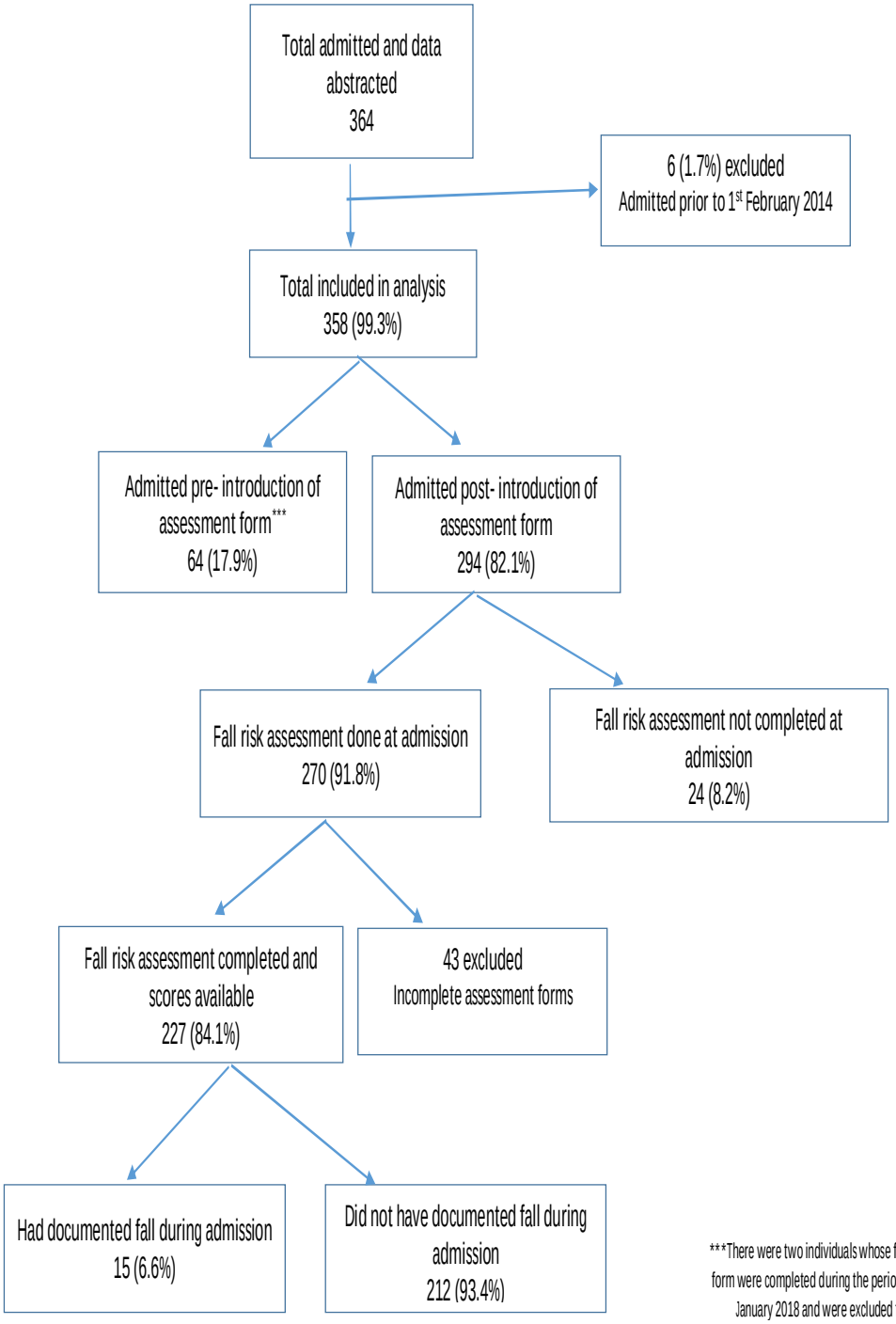
Specificity = # who the assessment predicted low fall risk/ # who did not fall= 7/212 = 3.30% (95% CI 0.98- 5.63%)

Positive predictive value (PPV) = # who had a fall/ # the assessment predicted high fall risk= 15/220 = 6.82% (3.52- 10.10%)

Negative predictive value (NPV) = # who did not fall/ # the assessment predicted low fall risk = 7/7= 100%

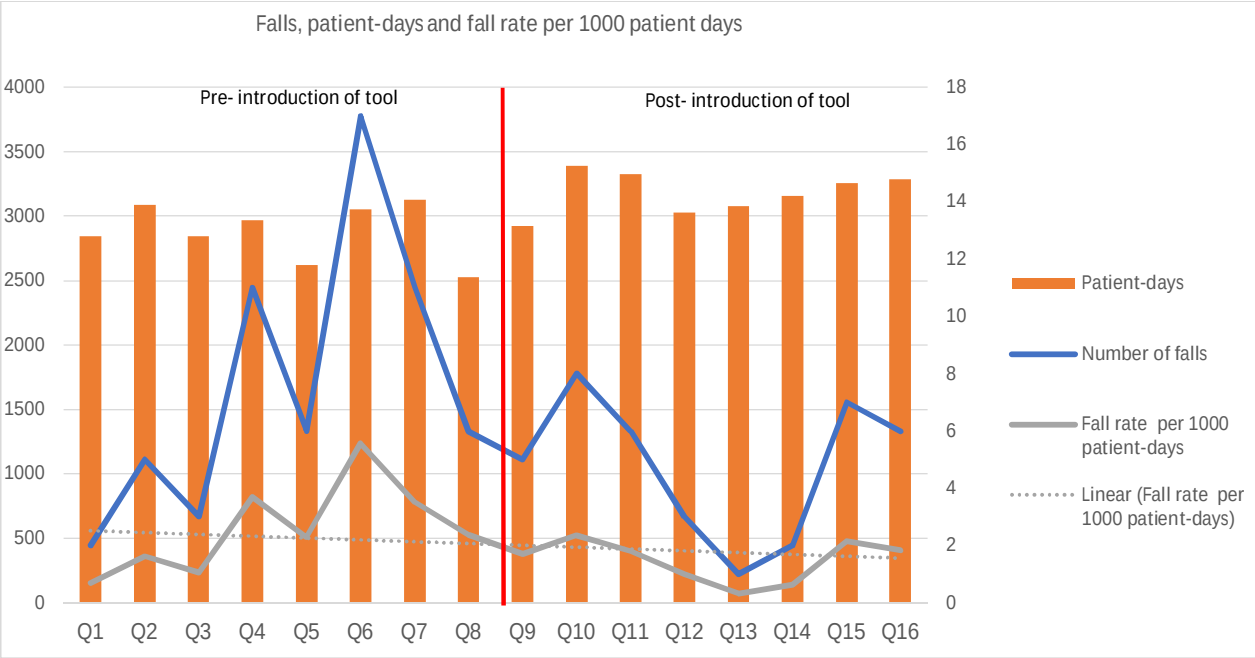
Assessment tool criteria of <24/>=24 is highly sensitive i.e. it correctly predicted those who were going to fall but had very poor specificity and positive predictive value.

Figure 1: Study Flow



***There were two individuals whose fall risk assessment form were completed during the period February 2016 – January 2018 and were excluded from analysis

Figure 2: Fall rates pre and post introduction of fall risk assessment done quarterly (3 months)

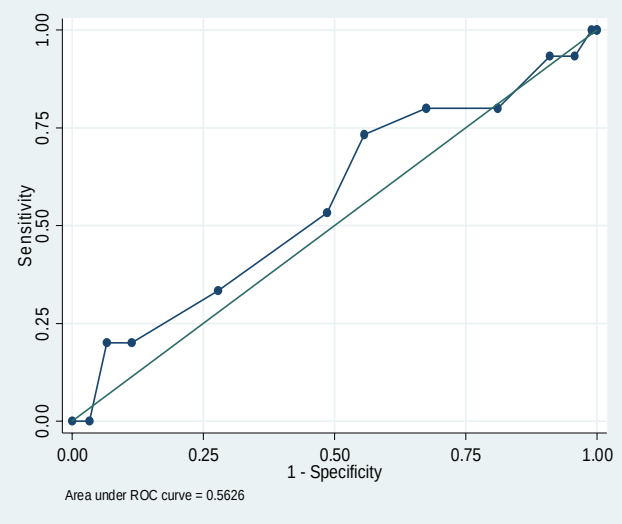


Fall rate pre-introduction of assessment tool = 2.64 (95% CI 2.02 - 3.40)

Fall rate post-introduction of assessment tool = 1.49 (95% CI 1.06 - 2.05)

Overall fall rate = 2.04 (95% CI 1.66 - 2.48)

Figure 3: ROC curve of performance of fall risk score in predicting a fall during admission



Area under the curve = 0.56 (95% CI 0.41- 0.72). AUC represents overall accuracy of the tool. It is the overall probability than any score selected at random will correctly predict the occurrence of a fall.

There is no clear inflection point on the curve, this means there is no clear cut-off in the risk scores that will accurately predict those who will fall and those who will not.

Chapter 4: Appendix

A: Data collection sheet

Baseline data – Hospital number, Age, Gender, Date of birth, Date and Time of admission

Item	Scale	Score	Day 1
1. History of falling: immediate or within 3 months	No	0 points	
	Yes	25 points	
2. Get up and go test	Rise easy	0 points	
	Able to rise with help	15 points	
	Unable to rise	30 points	
3. Ambulatory aid	Bedrest/nurse assist	0 points	
	Crutches/cane/walker	15 points	
	Furniture	30 points	
4.Sedatives/Antiepileptics/analgesics/ Anti-hypertensives	No	0 points	
	Yes	15 points	
5. Gait/Transferring (The way a patient mobilizes)	Normal/Bedrest/Immobile	0 points	
	Weak	10 points	
	Impaired	20 points	
6. Mental status	Oriented to own ability	0 points	
	Forgets limitations	15 points	
	TOTAL		
Risk Level	Score		

No risk	0-24 points		
At risk	>25 points		

B: Ethics Clearance Certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

R14/49 Dr Sharon Elizabeth Sunny

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M180263

NAME: (Principal Investigator)	Dr Sharon Elizabeth Sunny
DEPARTMENT:	Internal Medicine Wits Donald Gordon Medical Centre
PROJECT TITLE:	The Impact of a Nursing Falls Assessment Tool on Reducing the Impatient Falls in a Neuro-Orthogeriatric Ward at the Wits Donald Gordon Medical Centre: An Observational Study
DATE CONSIDERED:	23/02/2018
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Dr Brent Tipping
APPROVED BY:	Prof C Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	26/02/2018

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

DECLARATION OF INVESTIGATORS

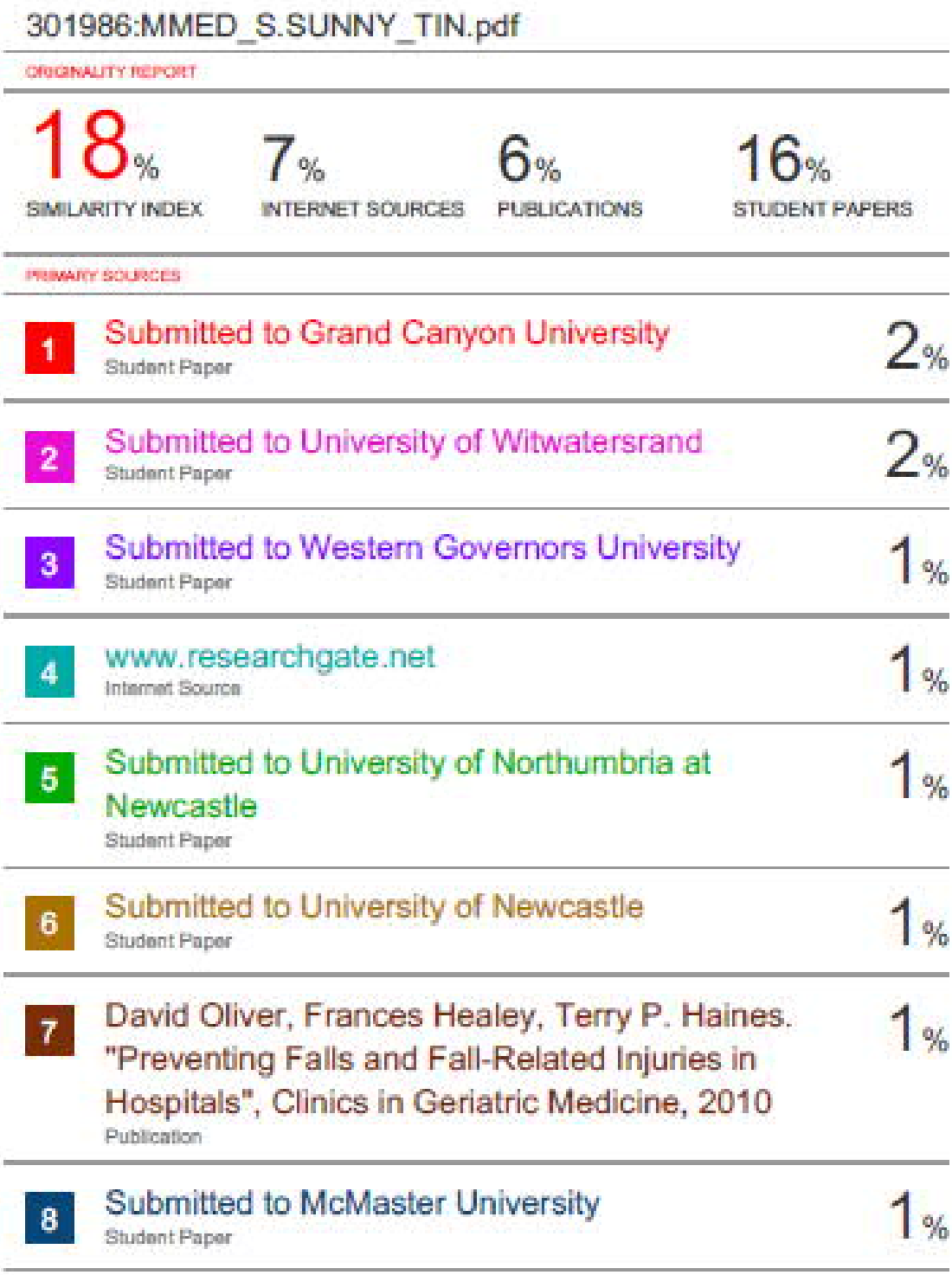
To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary in Room 301, Third floor, Faculty of Health Sciences, Phillip Tobias Building, 29 Princess of Wales Terrace, Parktown, 2193, University of the Witwatersrand. I/we fully understand the conditions under which I am/we 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**. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed in February and will therefore be due in the month of February each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature

Date 26/02/2018

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

C: Plagiarism Report



301986:MMED_S.SUNNY_TIN.pdf

ORIGINALITY REPORT

18%	7%	6%	16%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to Grand Canyon University Student Paper	2%
2	Submitted to University of Witwatersrand Student Paper	2%
3	Submitted to Western Governors University Student Paper	1%
4	www.researchgate.net Internet Source	1%
5	Submitted to University of Northumbria at Newcastle Student Paper	1%
6	Submitted to University of Newcastle Student Paper	1%
7	David Oliver, Frances Healey, Terry P. Haines. "Preventing Falls and Fall-Related Injuries in Hospitals", Clinics in Geriatric Medicine, 2010 Publication	1%
8	Submitted to McMaster University Student Paper	1%