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## **Balance and discharge destination outcomes for patients referred to physiotherapy at Bellingen and Macksville Hospitals**

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## **Abstract**

### *Introduction*

Australia has an ageing population which will continue to have an increasing effect on the both the aged care and health care systems. Accurate and timely assessment of need for aged care services will become even more important. Premature assessment for aged care can be expected to lead to the inappropriate and wasteful use of scarce aged care resources, while needlessly delayed assessment may lead to inappropriate and wasteful use of health care resources. There is a particular group of elderly people for whom entry into residential aged care facilities is inappropriate. These patients are not acutely unwell enough to require very acute care and yet are unable to participate in rehabilitation programs. Small hospitals have an important role in providing care for these elderly patients, although there is a lack of evidence describing outcomes for these patients in this setting.

### *Method*

This study investigated 89 patients (median age 84) receiving physiotherapy for mobility or balance in Bellingen and Macksville Hospitals. This study quantitatively described inpatient change in balance and factors associated with discharge to nursing home.

### *Results*

- Baseline and discharge measurements found inpatients functional balance improved significantly 8.5/56 (95% CI 6.3 – 10.6 p <0.001).
- Physiotherapists' estimates were useful in predicting how much balance would change (mean error 7/56).
- There was a large amount of variability in people's change in balance, underlining the importance of avoiding premature placement in an aged care facility.
- Balance at discharge was found to strongly correlate with probability of discharge to nursing home, emphasising the importance of providing resources to maximise the balance of elderly people in hospital.
- No correlation was found between carer availability and probability of discharge to nursing home. This suggests that local aged care services are effectively allowing people to return home, even without a carer.

### *Conclusion*

This study has shown that physiotherapy intervention is associated with statistically and clinically significant positive balance outcomes for patients, and provides objective evidence identifying elderly people for whom entry to nursing home may be appropriate and inappropriate.

## Executive Summary

### Background

#### *Model of care*

The provision of healthcare in the western world is being increasingly challenged to meet the needs of the ageing population. Many elderly people have a clear need for care in a hospital inpatient setting such as a rehabilitation ward or acute care ward or for long term care in residential aged care facilities or in their own home. A notable cohort of elderly people however, are unable to participate in rehabilitation programs and have health care needs preventing immediate return home, while not requiring long term care or care with a high level of acuity. One important model of care for this cohort in Australia and around the world appears to be hospital wards with a focus on appropriate management of aged care issues and less focus on high acuity care. There is limited published information about outcomes from this inpatient environment.

#### *Assessment of mobility and balance*

Elderly people often have multiple health issues that frequently include problems with deteriorating balance and mobility. Some of these people will require care in aged care facilities, while some will be able to return home. Physiotherapists are often required to assess and manage balance and mobility within the constraints of the model of service delivery adopted by the local provider. The stakes of this assessment and intervention are high for the patient, the aged care system and the health care system. Residential aged care facilities cost the Australian taxpayer a substantial amount of money and often involve significant costs for elderly people receiving care. Most elderly people prefer to avoid entry to residential aged care facilities and instead return home. At times however, the most appropriate place for people is in residential care, and the decision must be made to that people require entry to residential aged care facilities. Better objective information describing outcomes in hospitals can be expected to improve how this important decision is made.

### Method

This prospective measurement study described quantitatively outcomes of patients receiving physiotherapy for mobility and balance in Bellingen and Macksville Hospitals. In particular:

- How does functional balance change?
- How accurate is the physiotherapist's initial estimate of change in balance?
- What relationship exists between balance and discharge destination?
- Are there any other predictors of discharge destination or change in balance?

To achieve this, data was prospectively collected on 89 patients during 2010. This included demographic, balance and discharge destination data. The Berg Balance Scale (BBS) was used to measure functional balance as it has good intra and inter rater reliability, reasonable ability to prospectively predict falls and correlates well with several activities of daily living important to being able to remain living in the community.

## **Results**

Statistical analysis of the results revealed:

- A predominately elderly cohort of patients with a median age of 84 years and a mean age of 81 years
- Patients mean BBS improved significantly from a mean of 24.4/56 to a mean of 30.9/56. There was a mean improvement of 8.5/56 with a 95% confidence interval of 6.3-10.6/56
- The degree of improvement of BBS displayed a large amount of variation with a standard deviation of 10.4/56
- Physiotherapists were reasonably accurate in their estimate of change in BBS, with a mean error of 7.0/56 BBS (95%CI 5.6-8.4/56)
- A strong relationship was found between discharge BBS and discharge destination. A 1/56 improvement in BBS was associated with a 13% reduction in probability of discharge to nursing home
- No relationship was found between discharge destination and carer availability.

### **Strengths of this study**

- A reliable validated tool was used.
- An acceptably high participation and completion rate. Twenty three percent of eligible participants declined, with thirteen percent of enrolling participants not completing the study.
- The study is prospective.

### **Limitations of this study**

The study of hospital inpatients has shown strong association between BBS and discharge destination, but cannot prove causation. The collection of data from patients was limited to the period of their admission in one of two small rural hospitals in adjoining geographical regions. This limits the study's ability to comment on longer term outcomes and restricts the generalisability of our results. If a similar study were conducted in a hospital with different provision of physiotherapy for mobility and balance it might find different balance outcomes. A similar study conducted in a region with less effective community aged care services might find differences in how well BBS and carer availability predict nursing home placement.

The study did not have enough statistical power to explore the relationship between diagnosis and patient discharge destination or change in balance. Power analysis suggests that approximately 400 participants would be adequate to test whether or not various categories of health conditions are able to predict change in BBS during an inpatient stay.

### **Importance of the study:**

The data collected demonstrates a strong relationship between discharge BBS and discharge destination, suggesting the BBS is a valid assessment tool and highlighting the importance of maximising inpatients' functional balance. Physiotherapy for inpatient's mobility and balance was shown to be associated with a significant improvement in functional balance with the large variability in BBS changes experienced by inpatients

highlighting the importance of avoiding premature assessment for nursing home placement.

The lack of relationship between carer availability and probability of nursing home placement might suggest local community aged care services are effectively allowing people to avoid premature nursing home placement.

## **Introduction:**

The proportion of the population of people aged over 85 years in Australia is expected to increase from 1.8% in 2010 to 3.0% in 2030(1). Along with this will be a substantial increase in the number of elderly people with a relatively low level of medical acuity, but with multiple health problems, including poor mobility. Some of these people will need long term residential aged care while some will be able to return to the community. The increase the number elderly people may challenge the capacity of the aged care system to meet demand for nursing home places, in terms of issues related to both staffing and finance. Nursing home care is usually not preferred by elderly people (2). Therapy which allows people to return home rather than be discharged to a nursing home can improve people's quality of life and lead to substantial cost savings for the taxpayer and elderly people.

There is apparent need to provide healthcare for hospitalised people who are unable to participate in rehabilitation programs, but who are not acutely unwell enough to require intensive medical management in a general ward and are also deemed inappropriate for nursing home admission. In Australia, while some of this care is provided through the live-in component of transitional aged care programs (3) much care is provided by hospitals, especially smaller regional hospitals. Hospitals with between 10 and 50 beds contain 14% of Australia's hospital beds (4).

Smaller regional hospitals in Australia, such as those in Bellingen and Macksville with 32 and 42 general care beds respectively, are comparable to community hospitals in Europe. Seamark et. al. (5) surveyed 471 community hospitals in the United Kingdom, median of 33 beds. Care in 8457 of the 18579 beds was led by general practitioners and all facilities provided physiotherapy. Over three quarters of the beds were described as medical and elderly care beds. Information about the intensity of physiotherapy provided in community hospitals is limited. Young, who has conducted research in the field of community hospitals estimated that patients typically receive approximately 10-20 minutes per day (Young, J 2011 Head of Academic unit of Elderly Care and Rehabilitation Bradford Institute for Health Research, email 2<sup>nd</sup> March 2011). This level of physiotherapy input appears comparable to the amount received at Bellingen and Macksville hospitals.

There is evidence that elderly people cared for in community hospitals have better outcomes in terms of re-admission rates and independent living at six months after discharge (6, 7). Garåsen et al (8) attribute these outcomes to the health care professionals' close communication with their patients and their patients' networks, which they suggest is difficult to achieve in a larger general hospital with many and more acute admissions. Similar advantages may exist in smaller regional Australian hospitals, where care may be focussed more on effective discharge planning and maximising the functional ability of elderly clients than in a facility focussed on more acute care.

In the USA skilled nursing facilities appear to provide a significant amount of care to a comparable patient cohort. While the intensity of therapy provided by skilled nursing facilities is generally less than that provided by inpatient rehabilitation facilities (9) most patients receive more than 30 minutes physiotherapy per day for their length of stay (10). The intensity of therapy at Bellingen and Macksville hospital have not been precisely measured however, while working as a community aged care physiotherapist in the Bellingen and Macksville areas I have observed physiotherapy treatment sessions in

Hospital appear to last approximately 10-20 minutes. Skilled nursing facilities appear to offer substantially more physiotherapy intervention than Bellingen hospital, so are less useful than community hospitals in understanding the model of care in Bellingen and Macksville hospital.

### *Bellingen and Macksville Hospitals*

Bellingen and Macksville hospitals, are small rural hospitals on the mid north coast of NSW. Medical services are mainly provided by visiting local general practitioners, with occasional visits from a geriatrician. Access to other specialist medical services involves travelling to larger hospitals. Allied health services at Bellingen and Macksville hospitals have limited resources in terms of active rehabilitation. Physiotherapy services are usually available on weekdays but are not available on the weekend or public holidays. Patients typically receive sessions of 10-20 minutes time with a physiotherapist. Patients have access to an occupational therapy service at both hospitals, which is predominantly focused on assessment and home modifications with view to discharge planning. The occupational therapy service report inadequate resources to provide rehabilitation focused services for inpatients. Access to speech therapy services is also limited. Macksville Hospital has access to a speech therapy services for swallowing issues, but not speech issues. Bellingen Hospital has no access to any speech therapy services for inpatients.

### *Patient profile*

There are several reasons the medical condition of many elderly patients warrants them being in hospital including:

- Their condition not being acute enough to be in a larger hospital but still too unwell to return home
- Waiting for nursing home placement
- Waiting to be medically stable enough to be admitted to a rehabilitation ward
- Eligible for rehabilitation, but unable to access a place in a rehabilitation ward
- Having an unclear discharge destination.

It is not unusual for patients to be referred from larger hospitals to await nursing home placement but, after a few weeks, improve to the point that they are able to return to the community.

Prior to admission, and after discharge from these hospitals, inpatients are either resident in the community, low care residential aged care facilities (hostel) or high care residential aged care facilities (nursing home). Understanding the movement of patients between hospital, the community, hostel and nursing home is important in understanding the role and function of these hospitals. Additionally, information concerning the prevalence of diagnosis potentially relevant to mobility and balance and the relationship between the availability of a carer and discharge destination are considered potentially important. As Bellingen and Macksville Hospital patient profiles are similar data from both hospitals was pooled in this study.

### *Aged Care Assessment Teams (ACATs)*

Residential and community aged care services directly funded by the Australian Department of Health and Ageing are available only to people who have been assessed as

requiring them by ACATs (11). The aged care assessment and approval guideline state that

*“The role of ACATs is to determine the overall care needs of frail older people and to assist them to gain access to the most appropriate types of services. In doing this, ACATs comprehensively assess older people taking account of the restorative, physical, medical, psychological, cultural and social dimensions of their care needs. ACATs involve clients, their carers, and service providers in the assessment and care planning process.”* (11)

ACATs are multidisciplinary teams often including geriatricians, nurses, physiotherapists, occupational therapists, nurses, social workers and psychologists (11). Every person approved for services by an ACAT has an aged care client record (ACCR) completed, which contains an outline of their health, care needs, pre-existing support, recommendations for care as well as being the required approval document for care (12). The aged care guidelines state that assessments should use validated tools to assess physical capacity without mandating specific tools (11). A number of tools have been suggested as appropriate for individual ACATs (13).

#### *Balance assessment tools*

Objective physical measurements are important to describe outcomes experienced by patients in hospital. The aged care assessment and approval guidelines (11) state that a person’s capacity for mobility, bathing, grooming, toileting, continence and dressing are important considerations in assessing people as eligible for admission to nursing home. Balance is an important factor in all of these functional activities. The most appropriate tool to use when studying mobility and balance outcomes at Bellingden and Macksville hospitals should be one likely to reflect a person’s ability to do all these balance related tasks. Although balance scales are an indirect measure of mobility they can provide a more comprehensive understanding of an individual’s capacity to perform a variety of physical activities, many of which are likely help people to live independently in the community.

A number of tools have been considered. Tyson and Connel (14) identified a number of balance tools as potentially useful, including the Berg Balance Score, the Balance section of the Fugl-Meyer Motor assessment, the Brunel balance assessment, the standing balance scale, the sitting balance section of the motor assessment scale, the Sandin and Smith sitting balance test, the functional reach test, and various step tests. Nakamura et al (15) further identified the Timed up and go test, and the Performance Oriented Assessment of Balance scale (POAB Scale).

Of the measures which reflect a wide range of balance activities the POAB Scale was rejected as it appears to have a low sensitivity to change (15). The Berg Balance Scale was chosen rather than the Brunel assessment tool as it is more widely used, and appears to have more evidence related to its reliability and its ability to predict falls. The Fugl-Meyer motor assessment, Sandin and Smith, functional reach test, step tests and timed up and go tests were not chosen as they measure specific limited aspects of balance or mobility.

### *Berg Balance Scale (BBS)*

The BBS was developed in Canada (16) primarily for measuring the functional balance of elderly people. It consists of 14 components each scored between 0 and 4.

The Medline, Cinahl, Embase and Admed databases were searched for articles with “Berg Balance Scale” in their abstract or title between January 1980 and August 2010. Further articles were identified from reference lists.

Most articles studying reliability find that the BBS has a high relative inter-rater and intra-rater reliability (17-23). Donougue et al (24) studied the absolute reliability of the BBS in elderly people and found the minimal detectable change with 95% confidence (MDC95) for people with a BBS of 0-24 to be 4.6 and the MDC of people with a BBS 25-34 to be 6.3.

Most prospective studies have shown the BBS is valuable for predicting who will fall (25, 26). Li et al (27) found people in the intervention group with improved BBS scores to have significantly lower risk of falling than the control group. However measurements using the BBS demonstrate a ceiling effect in healthy, relatively young people such that the BBS is not useful for predicting falls (28) since most of these people achieve a score close to the maximum of 56/56.

A test can have a ceiling effect when a significant proportion of subjects achieve the best possible score since the test cannot detect any differences between these subjects. A test can have problems with a floor effect when a significant proportion of it’s subjects score the lowest possible score since the test will not be able to discriminate between these subjects. The ceiling effect of the BBS is not likely to be an issue when managing patients with conditions that impact on their balance and mobility. Neither floor nor ceiling effects were problems for this study.

### *Discharge Planning*

Accurately predicting what the health condition and functional abilities of individual inpatients will be when they are discharged from hospital has obvious benefits for discharge planning. Prospective measurements of how accurately physiotherapists can predict discharge BBS informs discharge planners how much weight they should place on advice from physiotherapists.

### **Aims**

This study aims to describe outcomes of inpatients receiving physiotherapy for balance or mobility at Bellinghen and Macksville hospitals. Specifically the following variables were observed:

- How balance is related to discharge destination.
- How balance changes
- Pre admission residence (community/hostel/nursing home) and discharge destination (community/hostel/nursing home).
- How accurately physiotherapists can predict change in balance.

## **Method**

### *Participants*

*Included:* All inpatients receiving physiotherapy related to mobility or balance in Bellingen and Macksville hospitals. Patients were identified by discussion with the physiotherapists working on the ward.

*Exclusion criteria:* Patients were excluded from the study for the following reasons: less than 16 years old, orthopaedically unable to fully weight bear on both legs, medically unfit to undergo balance testing, unable to understand instructions for the purpose of balance testing, unable to provide informed consent and those expected to have such a short length of stay that baseline and discharge measurement won't reflect physiotherapy intervention.

*Ethics:* Approval was granted by the North Coast Area Health Service Human Research Ethics Committee (no. 478N).

*Sampling:* Potential participants were approached by the researcher and provided written and oral information about the study and informed consent gained.

### *Measures*

Baseline and discharge BBS measurements were tested by a physiotherapist experienced in aged care physiotherapy and familiar with use of the tool. The documented BBS measurement protocol was followed (16). When any component of the BBS appeared to risk injury it was not undertaken and a score of 0/4 assigned. In some cases the presence of an extra physiotherapist might have allowed more components of the BBS to be safely tested, which may have altered the measured outcomes slightly.

### *Baseline measurements*

Patient demographics, gait status and presence of clinically relevant health issues were recorded from the medical record. Demographic information recorded included: age, gender, residence within the local hospital catchment area, the location of this preadmission residence, availability of a carer who can provide at least basic support with mobility 12 or more hours per day after discharge, and the date of initial physiotherapy intervention for mobility or balance. Patients' mobility status was recorded and included the following parameters: use of any gait aid, independent mobility, mobile with assistance or not mobile. Conditions were considered clinically significant if they either affected mobility or balance, or were a significant reason for being an inpatient. The presence or absence of the following conditions was recorded: a fall, lower limb joint replacement, medical issue affecting exercise tolerance (heart disease, respiratory disease or peripheral vascular disease), delirium, dementia, depression, other neurological disorder (eg spinal chord compromise, multiple sclerosis, Parkinson's disease, alcoholic brain damage), stroke, fractured proximal femur, fractured pelvis, non-fracture musculoskeletal injury, infection, or patients requiring palliative care.

The BBS was measured within two days of initial physiotherapy intervention for mobility or balance. The average time between initial physiotherapy intervention and baseline BBS measurement was 0.6 days. The baseline BBS was shown to the treating physiotherapist who then estimated what the patient's discharge BBS was likely to be.

### *Discharge measurements*

The discharge BBS was measured within four days of discharge, usually measured in the ward but if necessary with a home visit. The average time between discharge and measurement of discharge BBS was 0.8 days. The participant's mobility status was recorded. The discharge destination was recorded in terms of discharge to a nursing home, hostel or the community. The number of mobility and balance interventions by physiotherapists was recorded. Interventions performed solely by therapy assistants were not included based on entries in the medical records, physical observations of the wards and discussion with the physiotherapists. The number of medications (including topical medication and vitamins, excluding stockings) at the mid point between admission and discharge was counted from the medication chart. The discharge date was recorded.

### *Statistical analysis*

Statistical analysis was performed using STATA version 11. Confidence intervals for accuracy of physiotherapy estimates and change in BBS were calculated using the confidence interval function, with a 95% confidence interval. Assessments of relationship between diagnoses and change in BBS were tested with two tailed, independent t-tests. A significance level of 0.01 was used since 12 variables were tested. This significance level means that the study has a 12% chance of finding a statistically significant relationship between diagnosis and change in BBS, even if there is no real relationship (Type I error). A level of 0.004 would have been required to lower the risk of a type I error to 5%, which would make this study unlikely to find a relationship between diagnosis and change in BBS, even if there is a real relationship (ie a type II error). Comparison of change in BBS between the two hospitals was performed using a two tailed independent t test. The relationship between change in BBS and number of days under physiotherapy care was examined with Spearman's rho, as the values were not normally distributed, being very skewed to the right. The relationship between BBS and discharge destination was tested using logistic regression analysis.

### **Results**

Between the 15<sup>th</sup> of January and the 5<sup>th</sup> of November 2010 physiotherapists at Bellingham and Macksville hospitals identified 174 patients as potential participants. Forty-two patients did not meet the inclusion criteria:

- Acutely unwell (n=2)
- End stage palliative care (n=2)
- Not fully weight bearing (n=15)
- Too confused to follow instructions (n=9)
- Expected to be discharged after such a short time that the baseline and discharge measures could not be reasonably expected to change. (n=14)

Of the remaining 132 participants, 30 declined to participate. Reasons for declining were not specifically noted but it was observed that people who were unwell and those who had musculoskeletal issues likely to involve discomfort during BBS testing appeared much more likely to decline. Of the remaining 102 participants, 13 were lost from the study:

- Became acutely unwell and was subsequently withdrew from the study (n=2)
- Lost to follow up (n=7)
- Too short a length of stay (n=1)

- Withdrew (n=3)

This resulted in 89 participants who completing the study.

The residential status of participants are presented in Table 1, the age and sex means in Table 2, and the age distribution of patients in Figure 1.

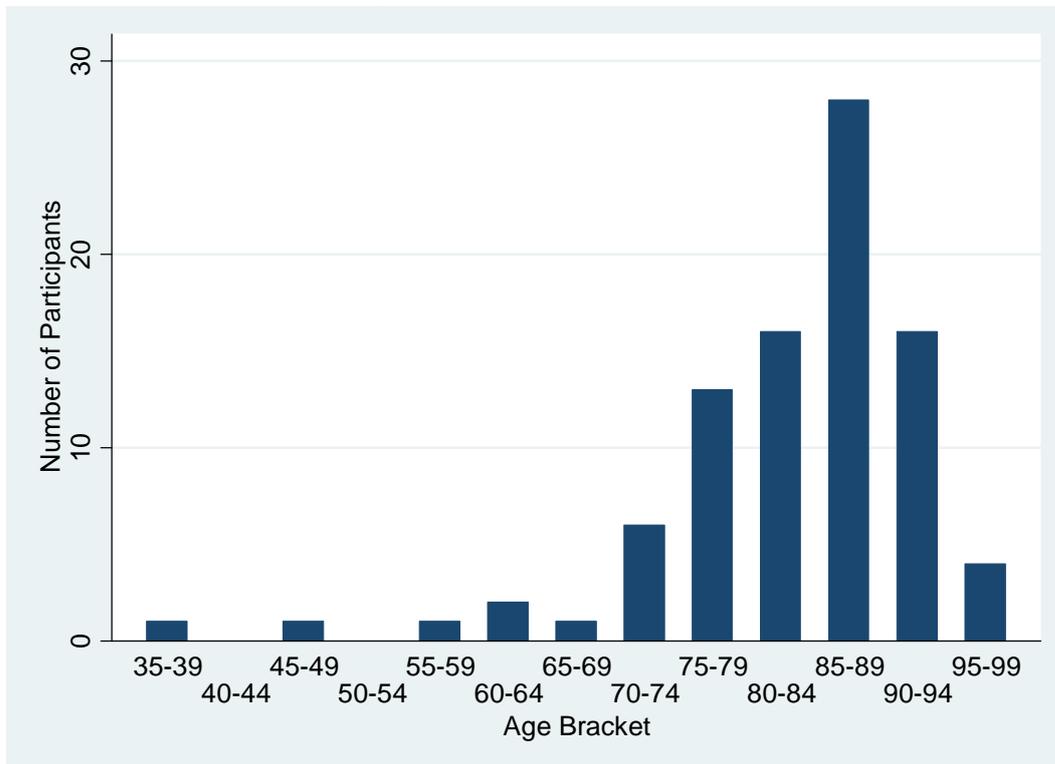
*Table 1: Residential status of participants*

Resident within local catchment	74
Not resident within local catchment	15
Total	89

*Table 2: Sex and mean age of participants*

	Number	Mean age
Male	42	78
Female	47	83
Total	89	Overall mean 81

*Figure 1: Age distribution of participants*



The clinically significant conditions of participants in a range of clinically significant conditions were identified in participants. Some participants had multiple diagnosis. The frequencies of each condition are presented in table 3.

*Table 3: Participants conditions of clinical significance*

Clinically significant condition	Number of patients with this condition
Fall	40
Dementia	33
Cardiac, Respiratory, Vascular	33
Infection	24
Musculoskeletal Problem	20
Delirium	20
Other Neurological	19
Depression	13
Stroke	13
Lower Limb Joint Replacement	9
Fractured Proximal Femur	9
Palliative Care	6
Fractured Pelvis	1

None of these conditions were able to predict change in BBS (see Appendix 2)

#### *Carer Support*

Basic mobility support for at least 12 hours a day after discharge was reported as being available in the community for 42 for patients. Support was not available for 39 patients. Eight patients lived in residential aged care facilities. There was no relationship between availability of a carer able to provide mobility support and discharge destination.

*Table 4: Participant preadmission and discharge destinations*

Pre Admission status (n)	Discharged to the community (%)	Discharged to hostel(%)	Discharged to nursing home(%)
Community (81)	64 (79%)	4 (5%)	13 (16%)
Hostel (5)	0	2 (40%)	3 (60%)
Nursing home (3)	0	0	3 (100%)

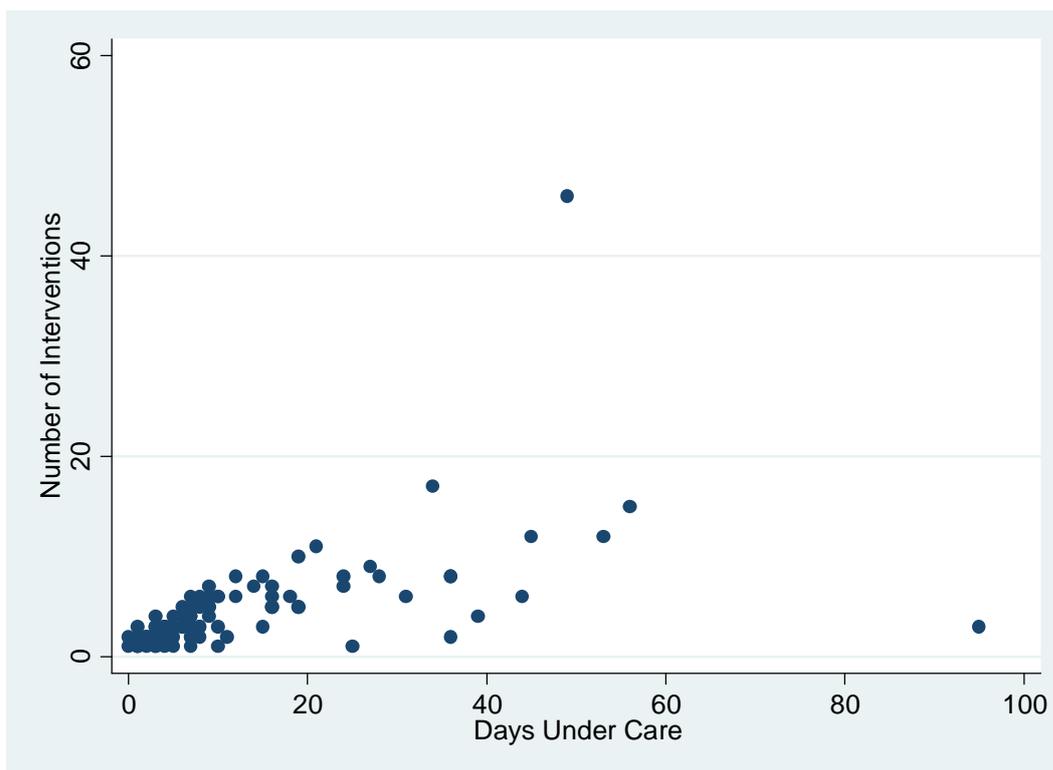
Mean change in BBS between baseline and discharge measures was significant at 8.5 (95% CI 6.3 – 10.6 p <0.001). See table 5.

*Table 5 Baseline, discharge and change in BBS*

Baseline Mean (sd)	Discharge Mean (sd)	Mean Change in BBS (sd)
22.38 (5.9)	30.85 (15.1)	8.47 (10.4)
95% CI 6.3-10.6		

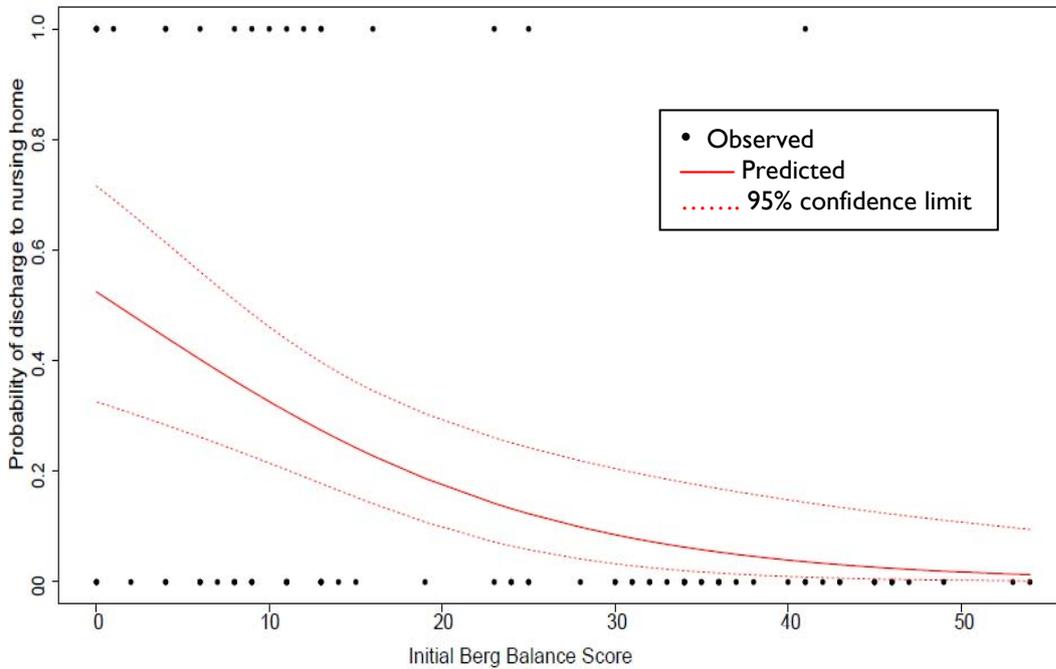
Bellingen and Macksville Hospitals did not have significantly different changes in BBS (p=0.45, 95% CI -2.4-6.9 difference)

Figure 2 Occasions of service and days under physiotherapy care



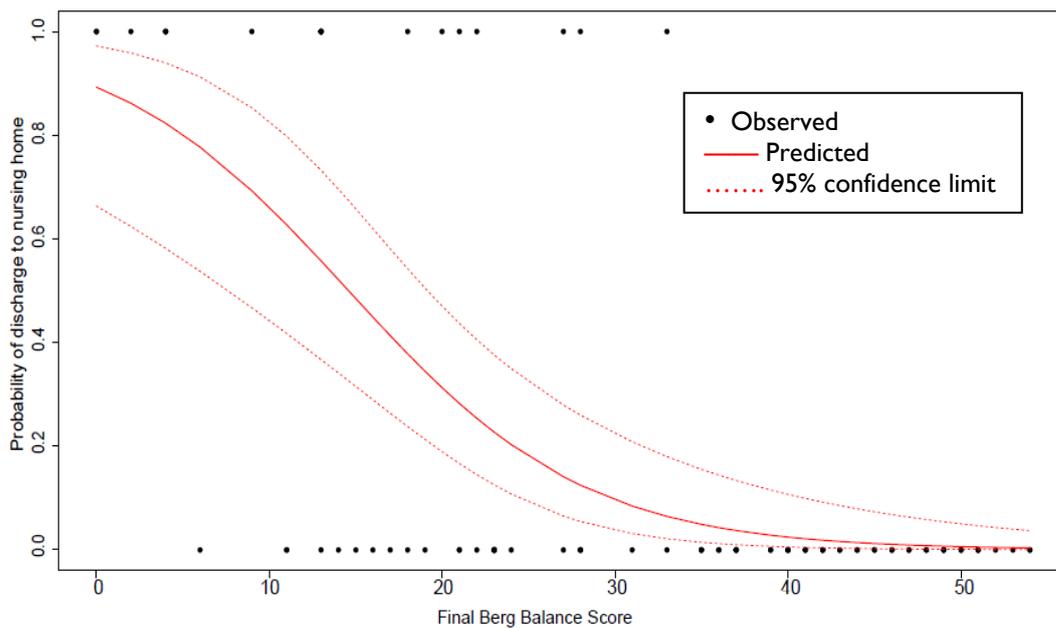
discharged to a nursing home decreases by 8% (RR 0.92, 95% CI 0.88-0.97,  $p < 0.001$ ) compared to being not being discharged to a nursing home.

Figure 3 Probability of discharge to nursing home compared to Baseline BBS



Logistic regression analysis exploring the relationship between BBS at discharge and discharge destination revealed that for a 1/56 unit increase in final BBS, the relative risk of being discharged to a nursing home decreases by 13% (RR 0.87, 95% CI 0.81-0.93,  $p < 0.001$ ) compared to being not being discharged to a nursing home.

Figure 4 Probability of discharge to nursing home compared to Final BBS

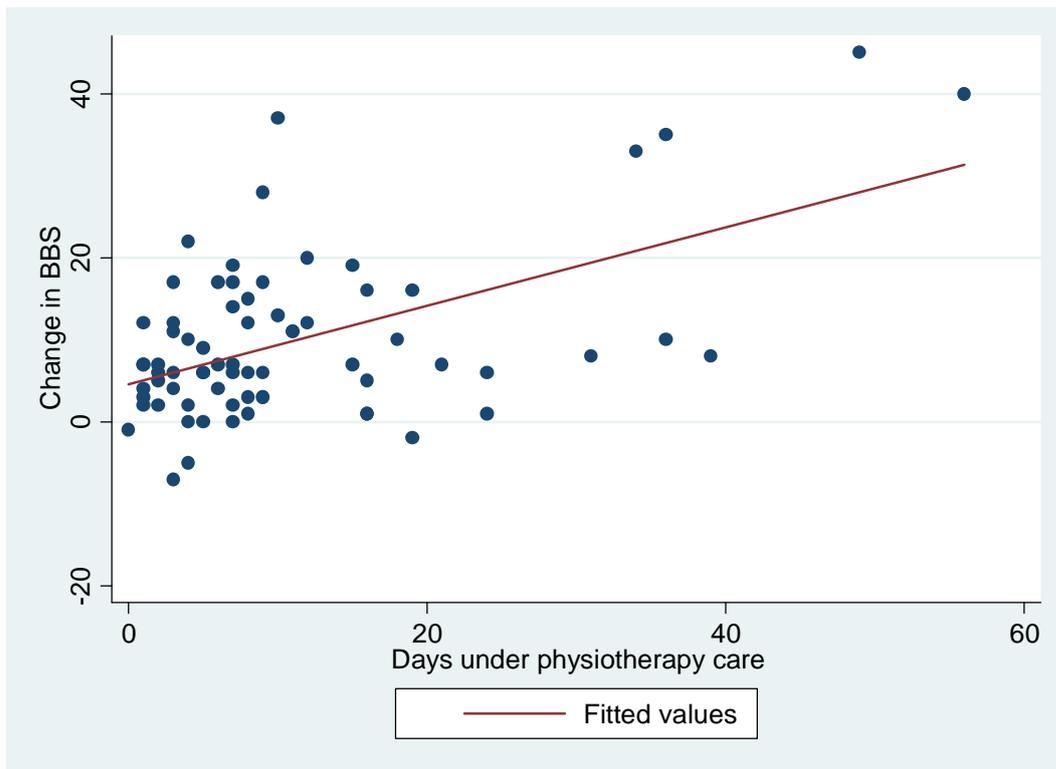


*Relationship between clinically significant diagnosis, carer availability and discharge destination.*

No relationship was found between clinically significant diagnosis and discharge destination (see appendix 2).

No relationship was found between carer availability and discharge destination (Fisher's exact test  $p=0.48$ ).

*Figure 5 Relationship between number of days under physiotherapy care and change in BBS of people discharged home or to hostel.*



Several participants had prolonged hospital stays while waiting for nursing home places, long after the decision to enter nursing home was made by the participant (or their “person responsible”), the hospital and the ACAT. The role of Bellingden and Macksville Hospitals as de-facto nursing homes for people waiting permanent nursing home appeared significantly different from their other roles, so people discharged to nursing home were excluded from this analysis. Longer length of stays were associated with more positive changes in BBS (Spearman's rho = 0.32  $p= 0.0069$ )

## **Discussion**

### *Discharge planning*

According to the Commonwealth guidelines for Aged Care Assessment Teams (ACATs) the decision to place a person in a nursing home must only be made when people are medically stable and after any rehabilitation is completed(11). Reliable prediction of likely changes in BBS of in patients, combined with substantive evidence related to the

BBS of people admitted to nursing home may provide a valuable tool to assist in decisions related to the timely and appropriate approval for placement in nursing home. Such evidence might also help hospitals focus resources where they are most effective.

Physiotherapy advice is frequently sought concerning the likely functional balance and mobility of patients at their discharge from hospital. This study investigated prospectively the accuracy of physiotherapy estimates of how the BBS of inpatients would change during their admission. Treating physiotherapists were asked, at baseline, to estimate the Final BBS. The average size of error in their predictions was 7.0/56 points. This measurement might underestimate physiotherapists' ability to predict changes in balance as in many clinical situations physiotherapists' predictions are likely to be made closer to the discharge date than in this study, which may be better than predictions made at baseline. To provide perspective on an average error of 7/56 we can compare with the test-retest minimal detectable change with 95% confidence (MDC95). Donoghue et al (24) have studied a similar cohort and found the MDC95 to vary between 4.6/56 and 6.3/56. This study suggests that physiotherapist's estimate of functional balance at discharge is sufficiently accurate that it should be considered as part of the discharge planning process.

This study found a strong relationship between discharge both BBS and probability of avoiding nursing home placement. Change in BBS showed a large amount of variability. A positive correlation was established between the number of days under physiotherapy care for mobility and improved BBS. These findings suggest the timing of ACAT assessment for high level care is critical and premature assessment should be avoided as people in small hospitals may see improved balance with ongoing time and therapy.

#### *Model of care*

This study has shown that the balance of patients receiving physiotherapy in two small rural hospitals is likely to improve, with a mean improvement of 8.5/56 on the BBS. This improvement appears to be very meaningful for many patients. Logistic regression analysis suggests that the probability of a study participant with a discharge BBS of 10/56 being discharged to a nursing home is greater than 60%, while the probability of a participant with a discharge BBS of 18.5/56 being discharged to a nursing home is approximately 40%.

There is some evidence (8) that elderly people randomly assigned to care in community hospitals, compared have better outcomes than similar patients randomly assigned to care in acute hospitals, with lower re-admission rates and higher rates of independent living at six months after discharge. Garasen et al (8) attribute these outcomes to better communication between health care professionals and their patients and patients' networks, which they suggest is more difficult to hospitals with a greater focus on more acute care. This study has not compared outcomes at Bellinghen and Macksville Hospitals with those achieved at larger hospitals. It has demonstrated, however, that patients in Bellinghen and Macksville hospital are likely to experience higher functional balance at discharge than admission. One possible explanation for this good result is that similar advantages may exist in smaller regional Australian hospitals to smaller European hospitals. A culture may exist that perceives maximising the functional ability of its elderly patients as an important priority, a culture which may be more difficult to maintain in a ward with a high rate of admissions which is necessarily focussed on providing acute care.

Available statistics are of limited use in describing how much sub acute and non acute care is actually provided by Australian hospitals. The Australian Institute of Health and Welfare (AIHW) reports that Australian hospitals recorded 3.6% of hospital separations for sub acute and non-acute care (4). Data collection and reporting practices in hospitals may bias calculations related to how much sub-acute and non-acute care is provided by Australian hospitals. The decision to classify an inpatient “non acute” has financial implications - visiting medical officers might not be able to claim as frequently for services, and patients considered “nursing home type” may be required to pay for their inpatient care while in hospital. Such financial implications may explain why only 18 of 89 participants who completed the study were recorded in statistics provided to the AIHW as receiving non-acute care during their hospital admission even though the type of care they received was in most cases substantially less acute than provided in larger hospitals. Such issues with reliability in relation to data collection may be generalisable to other Australian hospitals and it is therefore likely that significantly more sub-acute and non-acute care is provided by Australian hospitals than is suggested by the AIHW statistics.

### *Carer Availability*

The most surprising finding was that having an available carer was not associated with avoiding discharge to a nursing home, and that availability of care did not add to how well BBS predicted discharge destination. Wee et al (29) found that having a carer was a far stronger predictor of returning home than admission BBS from a stroke rehabilitation unit. The discrepancy in findings between this study and Wee’s, may suggest that carer availability is a more important predictor of nursing home admission for people who have had a stroke than for people with a wider range of health issues. It may also suggest that the mid north coast of NSW has more effective services available to elderly people in the community which allows many of them to return home despite disability and lack of a carer. One potentially confounding factor is that relatively healthy elderly people without a carer might be more likely to be admitted to small hospitals than similar people with a carer. The data suggest the possibility this may be occurring as the mean baseline BBS of participants without a carer was 25.8 compared to 21.3. Although statistical testing does not prove a real difference between the baseline BBS of participants with and without carers (2 tailed independent t-test  $p=0.2$ ) it is also consistent with a significant difference between these groups. Although there is a possibility that the surprising lack of association between the availability of a carer is partly due to confounding it seems likely that the discrepancy between this study and the previous study is more related to differences in available community services.

### *Strengths of this study*

- A reliable validated tool is used
- An acceptably high participation and completion rate. 23% of eligible participants declined, with 13% of enrolling participants not completing the study
- The study is a prospective measurement study

### *Limitations of this study and recommendations for future research:*

- The relationship between BBS and nursing home placement may be different in areas with different levels of community based supports. Repeating the study in other parts of NSW and Australia would make the results more generalisable.
- Patients were not followed up after discharge as insufficient resources were available. Future research could follow patients for several months after discharge. Knowledge about probable longer term changes in balance and their relationship with nursing home placement might help target therapy to more effectively allow people to remain living in the community.
- An improvement in BBS was demonstrated in the study participants but the specific impact of physiotherapy on this outcome was not studied. A Randomised control trial in similar hospitals where patients have greater or less access to physiotherapy services might provide evidence about the relationship between rate of physiotherapy intervention and change in BBS
- This study does not have sufficient statistical power to predict change in BBS based on medical diagnosis at baseline. A sample size of approximately 400 (see appendix 2) would be required, which would either require multi-centre data collection or data collection for several years.
- More data about BBS and nursing home placement would make information about their relationship more precise.

### **Conclusions:**

#### *BBS and nursing home placement*

A strong quantified relationship between BBS and the chance of being discharged to a nursing home suggests that maximising the balance of elderly inpatients ought to be a high priority for the health care system and for physiotherapists.

#### *How balance changes with this model of care*

Admission to two small hospitals on the Mid North Coast of NSW has been shown to be associated with clinically and statistically significantly improved balance.

#### *Discharge destination and discharge planning*

Change in BBS experienced by inpatients displayed a large variability. A positive association between days under physiotherapy care and improvement was found. These results suggest that premature placement of inpatients in nursing home accommodation should be avoided as a longer stay might result in improved balance and avoidance of nursing home placement, a result preferred by most elderly people, and which saves the community the considerable expense of nursing home care.

#### *Accuracy of physiotherapist estimates*

Physiotherapy initial estimates of patients' BBS at time of discharge are sufficiently accurate for discharge planners to use cautiously.

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## Appendix 1 – The Berg Balance Scale

<b>Berg Balance Scale</b>		Total	/56	Date
Name DOB MRN				
Please stand up. Try not to use your hand for support.	<p><b>4</b> able to stand without using hands and stabilize independently</p> <p><b>3</b> able to stand independently using hands</p> <p><b>2</b> able to stand using hands after several tries</p> <p><b>1</b> needs minimal aid to stand or stabilize</p> <p><b>0</b> needs moderate or maximal assist to stand</p>			
Please stand for two minutes without holding on	<p><b>4</b> able to stand safely for 2 minutes</p> <p><b>3</b> able to stand 2 minutes with supervision</p> <p><b>2</b> able to stand 30 seconds unsupported</p> <p><b>1</b> needs several tries to stand 30 seconds unsupported</p> <p><b>0</b> unable to stand 30 seconds unsupported</p>			
If a subject is able to stand 2 minutes unsupported, score full and skip <i>Sitting with back unsupported but feet supported on floor or on a stool</i> Please sit with arms folded for 2 minutes	<p><b>4</b> able to sit safely and securely for 2 minutes</p> <p><b>3</b> able to sit 2 minutes under supervision</p> <p><b>2</b> able to sit 30 seconds</p> <p><b>1</b> able to sit 10 seconds</p> <p><b>0</b> unable to sit without support 10 seconds</p>			
Please sit down.	<p><b>4</b> sits safely with minimal use of hands</p> <p><b>3</b> controls descent by using hands</p> <p><b>2</b> uses back of legs against chair to control descent</p> <p><b>1</b> sits independently but has uncontrolled descent</p> <p><b>0</b> needs assist to sit</p>			
Arrange chairs for pivot transfer. Ask subject to transfer toward a seat with armrests and back toward a seat without armrests. You may use two chairs or a bed and a chair.	<p><b>4</b> able to transfer safely with minor use of hands</p> <p><b>3</b> able to transfer safely definite need of hands</p> <p><b>2</b> able to transfer with verbal cuing and/or supervision</p> <p><b>1</b> needs one person to assist</p> <p><b>0</b> needs two people to assist or supervise to be safe</p>			
Please close your eyes and stand still for 10 seconds.	<p><b>4</b> able to stand 10 seconds safely</p> <p><b>3</b> able to stand 10 seconds with supervision</p> <p><b>2</b> able to stand 3 seconds</p> <p><b>1</b> unable to keep eyes closed 3 seconds but stays safely</p> <p><b>0</b> needs help to keep from falling</p>			
Place your feet together and stand without holding on.	<p><b>4</b> able to place feet together independently and stand 1 minute safely</p> <p><b>3</b> able to place feet together independently and stand 1 minute with supervision</p> <p><b>2</b> able to place feet together independently but unable to hold for 30 seconds</p> <p><b>1</b> needs help to attain position but able to stand 15 seconds feet together</p> <p><b>0</b> needs help to attain position and unable to hold for 15 seconds</p>			
Lift arm to 90 degrees. Stretch out your fingers and reach forward as far as you can. When possible, ask subject to use both arms when reaching to avoid rotation of the trunk.)	<p><b>4</b> can reach forward confidently 25 cm (10 inches)</p> <p><b>3</b> can reach forward 12 cm (5 inches)</p> <p><b>2</b> can reach forward 5 cm (2 inches)</p> <p><b>1</b> reaches forward but needs supervision</p> <p><b>0</b> loses balance while trying/requires external support</p>			

Pick up the shoe/slipper, which is place in front of your feet. (STANDING)	<p><b>4</b> able to pick up slipper safely and easily</p> <p><b>3</b> able to pick up slipper but needs supervision</p> <p><b>2</b> unable to pick up but reaches 2-5 cm(1-2 inches) from slipper and keeps balance independently</p> <p><b>1</b> unable to pick up and needs supervision while trying</p> <p><b>0</b> unable to try/needs assist to keep from losing balance/falling</p>	
Turn to look directly behind you over toward the left shoulder. Repeat to the right.	<p><b>4</b> looks behind from both sides and weight shifts well</p> <p><b>3</b> looks behind one side only other side shows less weight shift</p> <p><b>2</b> turns sideways only but maintains balance</p> <p><b>1</b> needs supervision when turning</p> <p><b>0</b> needs assist to keep from losing balance or falling</p>	
360 DEGREES INSTRUCTIONS: Turn completely around in a full circle. Pause. Then turn a full circle in the other direction.	<p><b>4</b> able to turn 360 degrees safely in 4 seconds or less</p> <p><b>3</b> able to turn 360 degrees safely one side only 4 seconds or less</p> <p><b>2</b> able to turn 360 degrees safely but slowly</p> <p><b>1</b> needs close supervision or verbal cuing</p> <p><b>0</b> needs assistance while turning</p>	
Place each foot alternately on the step/stool. Continue until each foot has to touch the step/stool four times.	<p><b>4</b> able to stand independently and safely and complete 8 steps in 20 seconds</p> <p><b>3</b> able to stand independently and complete 8 steps in &gt; 20 seconds</p> <p><b>2</b> able to complete 4 steps without aid with supervision</p> <p><b>1</b> able to complete &gt; 2 steps needs minimal assist</p> <p><b>0</b> needs assistance to keep from falling/unable to try</p>	
Place one foot directly in front of the other. If you feel that you cannot place your foot directly in front, try to step far enough ahead that the heel of your forward foot is ahead of the toes of the other foot. (To score 3 points, the step should exceed the length of the other foot and the width of the stance should approximate the subject's normal stride width.)	<p><b>4</b> able to place foot tandem independently and hold 30 seconds</p> <p><b>3</b> able to place foot ahead independently and hold 30 seconds</p> <p><b>2</b> able to take small step independently and hold 30 seconds</p> <p><b>1</b> needs help to step but can hold 15 seconds</p> <p><b>0</b> loses balance while stepping or standing</p>	
Stand on one leg as long as you can without holding on.	<p><b>4</b> able to lift leg independently and hold &gt; 10 seconds</p> <p><b>3</b> able to lift leg independently and hold 5-10 seconds</p> <p><b>2</b> able to lift leg independently and hold <math>\geq</math> 3 seconds</p> <p><b>1</b> tries to lift leg unable to hold 3 seconds but remains standing independently.</p> <p><b>0</b> unable to try of needs assist to prevent fall</p>	
	TOTAL SCORE (Maximum = 56)	

**Appendix 2 – Statistical calculation of the relationship between diagnosis and change in BBS (Significance and power)**

Condition (Yes compared to No)	Mean difference in BBS Improvement Yes compared to No	P value	Lower CI (99%)	Upper CI (99%)
Stroke	-4.696356	0.1322	-12.83387	3.441156
# Proximal Femur	3.654968	0.4437	-6.812958	12.43796
# Pelvis * n=1 not able to perform test	24.80682	NA	NA	NA
Lower Limb Joint Replacement	1.329167	0.7177	-8.321698	10.98003
Fall	3.910714	0.0767	-1.837933	9.659362
Medical (eg Heart, respiratory disease)	.1650433	0.9427	-5.863281	6.193368
Delirium	.1652174	0.9504	-6.81086	7.141295
Depression	.5283401	0.8664	-7.715148	8.771828
Dementia	-1.183442	0.6059	-7.202679	4.835796
Other Neuro	.0022556	0.9993	-7.1039	7.108412
Musculoskeletal	3.712319	0.1599	-3.184725	10.60936
Palliative Care	-4.437751	0.3142	-15.983	-7.107497
Infection	-4.183333	0.0914	-10.63757	2.270908

Power calculations have been performed using STATA to assess the sample size required to be exclude a clinically significant difference in how much people’s BBS changes with and without various conditions:

Assumptions:

- Future studies will have the same proportions of clinically relevant conditions
- The same variability of change in BBS in the condition present and absent will be present in future studies.

Power=0.8

Alpha = 0.01

Sample size required to exclude a statistically significant change assuming there is a real difference of 6/56 between how much BBS changes for condition=yes and condition = no

Condition	Number Required
CVA	280
# Proximal Femur	393
Lower Limb Joint Replacement	391
Fall	139
Cardiac/Respiratory/Vascular	152
Delirium	203

Depression	284
Dementia	152
Other Neurological	210
Musculo-skeletal	199
Receiving Palliative care	576
Infection	173

\* Power calculation for fractured pelvis was not performed as there was only 1 fractured pelvis in the study.