Correlates of post-hospital physical function at 1 year in skilled nursing facility residents

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Abstract

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Aim. This paper is a report of a study to examine the relationship between health-related admission factors and post-hospital physical function at 3, 6, 9 and 12 months in older adult nursing facility residents.

Background. Physical functional decline is a significant health problem for older adults and has far-reaching effects. In particular, the immediate post-hospital period is a high-risk time, because shortened hospital stays make it likely that older patients are discharged in a state of incomplete recovery.

Method. Data spanning from July 2002 to June 2005 were extracted from a comprehensive assessment tool, the Minimum Data Set, for 38,591 beneficiaries of a federal health insurance programme covering older adults in the Midwestern region of the United States of America. We investigated relationships between admission factors and post-hospital physical function at 3, 6, 9 and 12 months. The admission factors were health-related variables assessed at the time of skilled nursing facility admission from an acute care hospital.

Findings. The most important admission factors related to post-hospital physical function at 3, 6, 9 and 12 months were baseline physical function, urinary incontinence and pressure ulcer. Cognitive impairment at admission demonstrated a stronger relationship with poor physical function as resident length of stay increased.

Conclusion. Nurses in skilled nursing facilities should screen post-hospital older adults for risk of physical functional decline at admission using identified admission factors. For continuous nursing care, older adults need to be assessed at least once a month during the first 3 months after hospital discharge.

Keywords: admission assessment, minimum data set, physical function, post-hospital nursing care, skilled nursing facility

Introduction

The world is facing rapid demographic changes as the population ages. By 2020 the global population will include more than 1000 million people aged ≥60 years, with more than 700 million living in developing countries (International Council of Nurses, 2007). As the population ages, we need to know more about ageing-related nursing

issues to improve quality of care for older adults. Physical functional decline is a significant health problem for older adults and has far-reaching effects. It reduces independence and quality of life, and increases caregiver responsibilities and hospitalization rates, risk of falls and healthcare expenses, nursing home admissions and mortality (Buttar *et al.* 2001, Samsa *et al.* 2001). Although general patterns of age-related physical functional decline are well-understood, less is known about patterns of decline in certain subgroups, including patients recently discharged from acute care settings.

Specifically for older adults, the immediate post-hospital period is an especially high-risk time, because shortened hospital stays make it likely that these patients are discharged in a state of incomplete recovery. For example, in a study of 660 older adult patients, a total of 13% died within 1 year of hospital discharge (Liu *et al.* 2002). Older adult patients may transfer from acute care hospitals to short-stay skilled nursing facilities (SNF) or rehabilitation centres for intensive rehabilitation therapy, and then be discharged home or to long-term care facilities. For nurses taking care of post-hospital older adults in SNF, to improve physical function using early targeted interventions, evidence is needed about admission factors of facilities that influence trajectories of post-hospital physical function.

Background

Theoretical framework

We developed a theoretical framework of post-hospital physical function in SNF to guide this study. Previous studies were reviewed using combinations of the following keywords from CINAHL, MEDLINE, PubMed and PsycINFO: physical function, functional decline, recovery, predictors, predicting, elderly, older adults, hospital, skilled nursing facility and nursing home. Seven admission factors were identified through integrative literature review of 36 papers published between 1996 and 2006: baseline physical function, pressure ulcer, urinary incontinence, malnutrition, pain, history of falls and cognitive impairment. The dependent variable was physical function at 3, 6, 9 and 12 months after discharge from acute care hospitals. Age, gender and co-morbidity were controlled as covariates.

Admission factors

Baseline physical function
Baseline physical function is a strong predictor of future physical function in older adult patients, particularly after acute medical illness such as respiratory tract infection or hip fracture (Binder *et al.* 2003, Lee 2006).

Pressure ulcer
Pressure ulcer is predictive of physical functional decline or delayed recovery of pre-morbid physical function, specifically in nursing home residents or older adult patients receiving rehabilitation therapy (Johnson *et al.* 2000).

Urinary incontinence
Urinary incontinence affects 15–30% of older adults in the community and more than 50% in hospitals and long-term care (Mezey & Fulmer 1999). Poor physical function is strongly associated with incontinence (Lee 2006, Huang *et al.* 2007).

Malnutrition
Malnutrition, including as under nutrition and weight loss, is a prevalent problem among nursing home residents, affecting 40–80% (Guigoz *et al.* 1996, Saletti *et al.* 1999). Malnutrition often causes physical deterioration during hospitalization and can contribute to physical functional decline (Incalzi *et al.* 1996). Severe disability in physical function is strongly associated with anthropometric and biochemical indicators of malnutrition (Romagnoni *et al.* 1999).

Pain
Pain is one of the most common clinical conditions in older adults and has a negative relationship with physical activity in daily life and changes patients' lifestyles. Specifically, pain of severe or greater intensity is shown to be statistically significantly associated with physical disability (Scudds & Robertson 2000).

History of falls
History of falls also is a consideration as one of every three older adults falls each year (Hausdorff *et al.* 2001). Of those with a history of falls, 20–30% suffer moderate to severe injuries that reduce mobility and independence (Fox *et al.* 2000).

Cognitive impairment
Cognitive impairment is relatively common in older adults, with an estimated 4–5 million older experiencing cognitive disorders such as acute confusion, delirium and dementia (Mezey & Fulmer 1999). Cognitive impairment is consistently associated with difficulties in physical performance in older adults (Lynch *et al.* 2005).

Covariates

Age

Physical functional decline is more prevalent with increasing age (Binder *et al.* 2003). In a study conducted by Mezey and Fulmer (1999), 20% of people >65 years of age required assistance with activities of daily living (ADL) and 45% of those >85 years of age required such assistance; difficulty with instrumental activities of daily livings (IADL) also increased with age. However, age may not influence physical functional decline directly. Rather, it may accelerate the effects of other risk factors on change in physical function.

Gender

Many studies have shown that older women report statistically significantly higher rates of physical functional difficulties than older men (Rahman & Liu 2000, Sharkey & Branch 2004). Although the mechanisms behind gender discrepancy in physical functional limitation are unclear, it may have confounding effects on the relationship between risk factors and physical functional outcomes.

Co-morbidity

Severe co-morbid conditions decrease physical functional autonomy (Di Libero *et al.* 2001). In a prospective cohort study of 367 older people with all with hip fractures, it was found that higher levels of co-morbidity were associated with increased risk of physical functional dependence (Cree *et al.* 2001). Co-morbid conditions may independently affect outcomes or confound the effect of treatment or primary disease (Nitz 1997).

The study

Aim

The aim of the study was to examine the relationship between health-related admission factors and post-hospital physical function at 3, 6, 9 and 12 months in older adult nursing facility residents.

Design

We adopted a retrospective correlational design to examine the relationships among the study variables. The admission factors from the theoretical framework and their relationships with physical function were measured at 3, 6, 9 and 12 months using the Minimum Data Set (MDS). The MDS is a part of the US federally mandated process for clinical assessment of all residents in SNF, and provides a comprehensive assessment of each resident's functional capabilities and helps nursing home staff identify health problems.

Participants

The participants were all Medicare admissions to SNF who met the following inclusion criteria: (1) 65 years of age or older and (2) admitted to short-stay skilled nursing units from acute care hospitals as indicated by MDS information, admission assessment (MDS code: AA8a = 1) and Medicare 5 day assessment (AA8b = 1). Medicare is a health insurance programme administered by the US government, covering people who are either ≥65 years of age or who meet other eligibility criteria. There were a total of 53,946 admissions. Many individuals had multiple admissions, and for them only the most recent admission was selected, leaving a sample of 40,272 individuals. Of those, 1781 (4%) were excluded because of missing data on the admission assessment, resulting in a final sample size of 38,591 patients admitted to 458 SNFs in the Midwestern region of the United States of America (USA). We included admission and continuous assessment data on residents up to 12 months in the post-hospital period.

Data collection

Data were accessed in 2006 from the MDS data of all relevant Medicare admissions between July 2002 and June 2005. As this analysis is based on the MDS data, the study variables were those available in the MDS data set: physical function at admission, 3, 6, 9 and 12 months, pressure ulcer, urinary incontinence, malnutrition, pain, history of falls, cognitive impairment, age and gender and co-morbidity.

Physical function

Physical function was measured at admission, 3, 6, 9 and 12 months using the 7-item MDS-ADL Scale. Consistent with this scale, performance scores were rated from independent (0) to total dependence (4) on items including bed mobility, transfer and locomotory capability on the unit, dressing, eating, toileting and personal hygiene. This scale reliably measures ADL performance with a range of scores from 0 to 28 (Morris *et al.* 1994). For this study, we used the admission sample and calculated coefficient alpha, item-total correlations and inter-item correlations. Coefficient alpha for the scale was 0·92, item-total correlations were all between 0·57 and 0·86 and inter-item correlations ranged from 0·45 to 0·84, thus indicating a psychometrically sound scale.

Pressure ulcers

Ulcers were measured by stage and type according to the MDS Skin Condition Scale (MDS-SCS). This has four categories of ulcer from stage I (a persistent area of skin redness without a break in the skin) to stage IV (a full thickness of skin and subcutaneous tissue is lost, exposing muscle or bone). The total score was summed after multiplying the number of ulcers by the staging scores of each (Berlowitz *et al.* 2001).

Urinary incontinence

Urinary incontinence was evaluated with the MDS Bladder Continence Scale. This scale assesses control of urinary bladder function, including dribbles of a volume insufficient to soak through underpants, and takes into consideration any appliances being used by the patient (e.g. Foley catheter) or continence programmes that may be employed. Scores range from 0 = continent: complete control to 4 = incontinent: inadequate bladder control with multiple daily episodes.

Malnutrition

Malnutrition was measured by body mass index (BMI) and one MDS item of weight loss (5% or more in last 30 days or 10% or more in last 180 days). The MDS item is dichotomous, with 0 = no or 1 = yes. The BMI was calculated from weight and height based on MDS data. Bivariate analysis with the dependent variable – physical function at 3 months – was used to determine which of these indicators would enter the regression analysis of the model. The MDS indicator with the highest statistical correlation was used because of its strongest effect. Only one indicator entered the regression analysis so as not to violate the assumption of mulitcollinearity.

Pain

Pain was measured using the MDS Pain Scale. Intensity of pain was coded as 1 = mild pain, 2 = moderate pain and 3 = pain is horrible or excruciating. In a validity study of 95 post-acute nursing home patients, there was good agreement between the MDS and the Visual Analogue Scale (VAS) on the presence of pain; that is, of those who were assessed with no pain on the MDS, 93% had a VAS score of 0 ($\kappa = 0\cdot71$; Fries *et al.* 2001).

History of falls

History of falls was measured with the 2-item MDS Accidents Scale. Falls items were: (1) fell in past 30 days and/or (2) fell in past 31–180 days. The two items were scored dichotomously and then summed. A positive fall report in either two periods was scored as '1' and a negative report as a '0'.

Cognitive impairment

Cognitive impairment was measured by the 7-category MDS Cognitive Performance Scale (CPS), with an average interrater reliability of $0\cdot85$ (Morris *et al.* 1994). Items used to construct the CPS were taken from the cognitive domain of the MDS and involved questions about short-term memory, long-term memory, ability to make oneself understood and cognitive skills for decision-making. The CPS classifies all residents into seven categorical levels of cognitive performance (0–6), with 0 and 1 representing no or minimal cognitive impairment; 2, 3 and 4 representing moderate impairment; and 5 and 6 representing severe impairment.

Comorbidity

For co-morbidity, diabetes mellitus (DM), heart disease, cancer and renal disease, stroke or other neuropathy, pulmonary disease, musculoskeletal and sensory problems were measured by the MDS-Section I. After bivariate analysis with physical function, heart disease, pulmonary disease, musculoskeletal disease and sensory problems were excluded in the models because they were non-significant ($P > 0\cdot05$).

Ethical considerations

The study was approved by the appropriate university ethics committee. The de-identified MDS data were used under the auspices of state/federal regulations. MDS data are considered to be a part of the resident's clinical record and, as such, are protected from improper disclosure under the 42 Code of Federal Regulations 483.10. A facility may not release resident identifiable information to the public. Providers pursuing the release of aggregate data must insure that it is not resident identifiable.

Data analyses

Regression methods were used to examine the association between physical function and admission factors. Ordinary linear regression assumes complete independence between observations on different. This assumption is often not tenable when participants are clustered in common environments such as in this study, where each skilled nursing facility contributes multiple residents to the sample. Exposure to the unmeasured but real effects of a common environment and care practices can induce a dependency between observations on individuals within the same facility. If ignored, the clustering can result in downwardly biased standard errors for the regression parameters, resulting in too many statistically significant regression parameters. The method of

Generalized Estimating Equations (GEE) was used to provide an appropriate analytic approach for clustered data (Liang & Zeger 1986).

Data from the 6-month time-point was used to select covariates without consideration of the primary variables (pressure ulcer, urinary incontinence, weight loss, pain and history of falls). Age, gender, heart disease, pulmonary disease, musculoskeletal disease and sensory disorder were excluded because of $P > 0.05$. Because the variances of the primary variables were divided into almost two groups, the variables were dichotomized, with 0 = no or 1 = yes.

The method of GEE with the GENMOD procedure in SAS (version 9; SAS Institute Inc., Carry, NC, USA) was run. Initially, admission physical function, cognitive impairment and DM, cancer, stroke, renal disease and other neuropathy were included in the model and subsequently the primary variables were added to estimate their impact on physical function scores. Separate regressions were performed for outcomes at 3, 6, 9 and 12 months. The level of statistical significance was set at $P < 0.05$.

Findings

Descriptive analyses

The characteristics of residents admitted to skilled nursing units are shown in Table 1. Older adults ranged in age from 65 to 102 years, with a mean of 82·3 years (SD = 7·7, range

Table 1 Admission characteristics

Variables	M (SD)	Range	%
	Admission total (n = 38,591)		
Gender (female)	–	–	67
Age (years)	82·34 (7·7)	65–102	–
Activity of daily living	15·02 (6·7)	0–28	–
Cognitive Performance Scale	1·68 (1·7)	0–6	–
Diabetes mellitus	–	–	28
Heart disease	–	–	79
Cancer	–	–	12
Stroke	–	–	18
Renal disease	–		1
Neuropathy	–	–	19
Pulmonary disease	–	–	22
Musculoskeletal disease	–	–	45
Sensory disorder	–	–	11
Pain	–	–	28
Urinary incontinence	–	–	21
Pressure ulcer	–	–	19
Weight loss	–	–	10
History of falls	–	–	39

65–102). The majority was female (67%). Admission mean score on the CPS was 1·68 (SD = 1·7), indicating mild cognitive impairment. Level of physical function measured by seven MDS-ADL items was 15·0 (SD = 6·7), indicating limited or extensive assistance. The most frequently encountered pathology in this sample was heart disease, including hypertension (79%), followed by musculoskeletal disease (45%), DM (28%), pulmonary disease (22%), neuropathy (19%) and stroke (18%).

In terms of primary variables, of the 38,491 participants, 39% experienced falls in the 3 months previous to SNF admission. Approximately 28% reported pain on admission, and almost one-quarter had urinary incontinence and pressure ulcer at the time of admission.

Regression analyses

Table 2 shows the results of the regression analysis employed to assess the association between admission variables related to post-hospital physical function and physical function at 3, 6, 9 and 12 months. The regression coefficients for pressure ulcer, urinary incontinence, weight loss, pain and history of falls (primary variables) for the various groups of residents who remained in nursing homes at a given time-point indicate an increase in ADL scores (poorer physical function). For example, holding other baseline characteristics constant, a positive score at admission for urinary incontinence will increase the 3-month ADL score by about four points over those without urinary incontinence (on the MDS-ADL score, which ranges from 0 independence to 28 total dependence). For those who remain in the nursing home for 12 months, having urinary incontinence at admission will increase ADL score by nearly six points as compared with those without urinary incontinence. Similarly, holding other characteristics constant, a positive score for pressure ulcer will increase the 3-month ADL scores by nearly four points. For patients who remain in the nursing home for 12 months, having pressure ulcers at admission will increase the ADL score by 4·5 points compared with those without pressure ulcers. Weight loss at admission will increase the ADL score nearly three points among those who remain in the nursing home for 12 months as compared with those admitted without weight loss. The primary variables (pressure ulcer, urinary incontinence, weight loss, pain and history of falls) are statistically significant ($P < 0.05$) at every time-point, and their magnitudes are similar. Fisher's z transformation scores indicated that the effects of the primary variables decreased by length of facility stay, while cognitive impairment on admission had a stronger relationship with physical function as resident length of stay increased.

Table 2 Admission factors predicting post-hospital physical function at 3, 6, 9 and 12 months

Predictors	MDS-ADL score at 3 months (n = 11,398)				MDS-ADL score at 6 months (n = 8241)				MDS-ADL score at 9 months (n = 6531)				MDS-ADL score at 12 months (n = 5245)			
	Estimate	95% CI	z score	P values	Estimate	95% CI	z score	P values	Estimate	95% CI	z score	P values	Estimate	95% CI	z score	P values
Intercept	1·23	0·91–1·54	7·61	<0·0001	1·25	0·88–1·59	6·83	<0·0001	1·55	1·10–1·95	7·18	<0·0001	1·90	1·44–2·34	8·26	<0·0001
ADL	0·58	0·56–0·60	56·00	<0·0001	0·52	0·49–0·54	45·01	<0·0001	0·50	0·48–0·53	39·21	<0·0001	0·47	0·45–0·50	35·56	<0·0001
CPS	0·20	0·13–0·28	5·34	<0·0001	0·36	0·27–0·45	7·90	<0·0001	0·34	0·24–0·44	6·70	<0·0001	0·37	0·26–0·48	6·88	<0·0001
DM	0·19	−0·04–0·40	1·70	0·1087	0·15	−0·11–0·37	1·17	0·2883	0·14	−0·16–0·43	0·93	0·3813	0·28	−0·07–0·16	1·59	0·1224
Cancer	0·27	−0·10–0·64	1·46	0·1542	0·42	−0·02–0·86	1·87	0·0629	−0·07	−0·56–0·44	−0·27	0·8114	0·05	−0·54–0·70	0·18	0·8045
Stroke	0·54	0·33–0·78	4·65	<0·0001	0·76	0·48–1·10	4·83	<0·0001	0·76	0·45–1·12	4·43	<0·0001	0·48	0·10–0·89	2·41	0·0138
Renal	0·73	0·31–1·10	3·64	0·0005	0·56	0·07–1·04	2·27	0·0242	0·53	−0·05–1·08	1·81	0·0776	0·47	−0·25–1·05	1·44	0·2292
Neuropathy	0·52	0·27–0·75	4·18	<0·0001	0·47	0·18–0·75	3·17	0·0016	0·59	0·28–0·91	3·73	0·0002	0·66	0·28–1·04	3·36	0·0007
Pain	1·85	1·53–2·18	11·21	<0·0001	1·92	1·54–2·28	10·06	<0·0001	2·01	1·54–2·46	8·59	<0·0001	1·72	1·23–2·24	6·70	<0·0001
UI	4·20	3·92–4·47	30·25	<0·0001	4·79	4·46–5·11	28·95	<0·0001	5·42	5·04–5·77	28·81	<0·0001	5·72	5·30–6·13	27·26	<0·0001
PU	3·69	3·39–4·04	22·66	<0·0001	4·56	4·16–5·02	20·68	<0·0001	4·66	4·16–5·16	18·46	<0·0001	4·49	3·91–5·00	16·28	<0·0001
Weight loss	1·64	1·36–1·94	11·10	<0·0001	2·25	1·88–2·65	11·52	<0·0001	2·23	1·79–2·66	9·94	<0·0001	2·79	2·27–3·31	10·62	<0·0001
Fall	0·62	0·38–0·88	4·84	<0·0001	0·83	0·54–1·15	5·39	<0·0001	0·79	0·42–1·16	4·19	<0·0001	0·63	0·23–1·05	3·01	0·0021

MDS, Minimum Data Set; ADL, activity of daily living; CPS, Cognitive Performance Scale; DM, diabetes mellitus; UI, urinary incontinence; PU, pressure ulcer.

Discussion

We investigated relationships between admission factors and post-hospital physical function in 38,591 skilled nursing facility admissions in the Midwestern region of the USA. The Midwestern area faces a rapidly ageing rural population because younger people have left, looking for better employment elsewhere. Therefore, we addressed characteristics of older adults in rural areas. According to the theoretical framework, potential admission variables would be related to post-hospital physical function in SNF: baseline physical function, pressure ulcer, urinary incontinence, weight loss, pain, history of fall and cognitive impairment. Using the MDS data, admission factors in the framework were tested as correlates of post-hospital physical function at 3, 6, 9 and 12 months.

For post-hospital older adults, baseline physical function, urinary incontinence and pressure ulcer at the time of admission to skilled nursing units were strong correlates of future physical function at each 3, 6, 9 and 12 months. These variables seem to be good candidates for targeted interventions immediately on admission to a skilled nursing unit. As their effects decreased by length of facility stay, early interventions may be crucial among those residents with poor admission physical function, urinary incontinence or pressure ulcer to accelerate/maintain post-hospital physical functional recovery and to prevent physical functional decline.

Early intervention for urinary incontinence on admission for all skilled nursing unit residents may also help those whose lengths of stay in nursing homes extend to 3 months or more, as the relationship with physical functional decline continued to strengthen with length of stay. Addressing this problem at an early point in their nursing home residency may help some residents to become independent enough to be discharged back to the community.

Based on the findings of the present study, healing and preventing pressure ulcers may also have a major impact on improving physical function. It is imperative that pressure ulcer prevention and treatment be an on-going emphasis in all nursing facilities. Specifically, collaborative teamwork could bring an improvement in practice by allowing the staff to reflect on the way they work, and develop and implement strategies (Kennedy 2005).

Cognitive impairment on admission had a stronger relationship with physical function as resident length of stay increased. That is, the more severe cognitive impairment is on admission to the skilled nursing unit after hospitalization, the longer the nursing home stays patients are likely to experience; this will require staff to plan for the probability of

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What is already known about this topic

- Physical functional decline is a significant health problem for older adults and has far-reaching effects.
- The immediate post-hospital period is a high-risk time for physical functional decline among older adults.

What this paper adds

- For older adults after hospital discharge, poor physical function, urinary incontinence and pressure ulcer at the time of admission to skilled nursing units were strong correlates of future physical functional decline.
- Nurses in hospitals planning to discharge to skilled nursing facilities need to develop discharge plans separately for older adult patients.
- The discharge plan should be clearly communicated to nurses in skilled nursing facilities.
- For continuous nursing care, patients need to be assessed at least once a month during the first 3 months after hospital discharge using variables related to post-hospital physical function such as physical function, urinary incontinence and pressure ulcers, weight loss, pain, history of falls and cognitive impairment.

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long-term stays. Cognitive impairment is an important factor in older adults and is associated with physical function, both on admission to a nursing home and throughout the stay (McConnell *et al.* 2002). However, nurses in short-stay skilled nursing units need first to identify at the admission assessment the type of confusion patients are experiencing as either acute or chronic. Residents might have developed delirium during hospitalization, and it is important to detect delirium and correct it with appropriate treatment to restore the person to their normal cognitive function. In a study of 126 post-surgical older adult patients with hip fracture, delirium was common, persistent, and independently associated with poor physical functional recovery 1 month after hip fracture. This was so even after adjusting for pre-fracture frailty (Marcantonio *et al.* 2000).

Study limitations

This study has several limitations. First, although the data were based on assessments of all post-hospital residents in skilled nursing units in a state in the Midwestern region of the USA, this geographical limitation reduces the generalizability of these results to other regions. Secondly, as the MDS data do not present the reason for patient discharge, neither we could

determine the impact of discharged residents on the study results, nor could we determine exact discharge disposition. However, the data from this study do reveal that approximately 70% of 38,491 older adults admitted to skilled nursing units from acute care hospitals were discharged from the facilities within 3 months. Discharge dispositions are likely to include returning home, readmission to the hospital, transferring to other facilities, or death. Discharge disposition before or after 3 months may have different meanings. If older adults are discharged home from short-stay SNF within a month, it is presumed that they are recovering (Lee 2006). However, if people are discharged home from nursing homes, they may have opted to be discharged to prepare for death.

Conclusion

Nurses in hospitals need to develop discharge plans separately for older adult patients planning to become resident in SNF. This discharge plan should be readily communicated to nurses in SNF. When older adult patients are admitted to SNF, nurses should screen them for risk of physical functional decline using admission factors related to post-hospital physical function such as physical function, urinary incontinence and pressure ulcers, weight loss, pain, history of falls and cognitive impairment. Nurses need to plan and implement targeted interventions for identified older adults. In particular, early interventions for urinary incontinence and pressure ulcers are imperative.

In general, the MDS assessment is conducted quarterly. However, vulnerable post-hospital older adults may experience changes within 3 months. For continuous nursing care, these patients need to be assessed at least once a month during the first quarter, using the above variables. This simple, regular assessment will help nurses create more effective care plans to improve or maintain physical function.

Additional research on other aspects of the model is needed to help older adults improve and maintain physical function. Subsequent studies are also necessary to provide a more robust test of the model, and intervention studies are needed to advance knowledge of how to care for these patients to promote recovery.

Author contributions

JL and MR were responsible for the study conception and design. JL performed the data collection, data analysis and drafting of the manuscript. MR made critical revisions to the paper for important intellectual content. JL provided statistical expertise. JL and MR supervised the study.

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