JAN JOURNAL OF ADVANCED NURSING

ORIGINAL RESEARCH

Persistent cognitive decline in older hospitalized patients in Taiwan

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Accepted for publication 8 May 2010

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CHEN C.C.-H., CHANG Y.-C., HUANG G.-H., PENG J.-H. & TSENG C.-N. (2010) Persistent cognitive decline in older hospitalized patients in Taiwan. *Journal of Advanced Nursing* **66**(9), 1991–2001. **doi: 10.1111/j.1365-2648.2010.05382.x**

Abstract

Aim. This paper is a report of a study conducted to determine the prevalence and predictors of persistent and transient cognitive decline in older hospitalized patients over 6 months after hospital discharge.

Background. Cognitive decline occurs in 16–35·5% of older hospitalized patients, but this decline may be persistent rather than transient. Distinguishing persistent from transient cognitive decline is clinically useful.

Methods. For this prospective cohort study, 291 older patients were recruited from five medical and surgical units at a tertiary medical centre in Taiwan between 2004 and 2006. Participants were assessed for cognitive status by scores on the Mini-Mental State Examination at admission, discharge, 3 and 6 months post-discharge. Persistent cognitive decline was defined as continuing score reduction and ≥3-point reduction 6 months postdischarge. Transient decline was defined as ≥3-point reduction at some stage, with a total decline <3 points 6 months postdischarge.

Findings. The cognitive status of the majority of participants (57·4%, $n = 167$) decreased ≥3 points during follow-up. Of these decliners, 59 (35·3%) had persistent cognitive decline, with an average 5·32-point reduction 6 months postdischarge. Forty-six (27·5%) participants experienced transient cognitive decline. After multiple adjustments in logistic regression analysis, persistent decline was predicted by *no* in-hospital functional decline (OR = 0·16, $P = 0·002$), more re-admissions after discharge (OR = 2·42, $P = 0·020$), and older age (OR = 1·09, $P = 0·048$).

Conclusion. A new perspective is needed on discharge planning on patients at risk for persistent cognitive decline. Nurses can oversee the delivery of care, identify cognitive decline, refer patients, and educate families on strategies to enhance cognitive functioning for their aging relatives.

Keywords: acute care, cognitive decline, cognitive impairment, nursing, older hospitalized people

Introduction

In adults aged 65 years and older, the onset of acute illness and hospitalization often initiates a cascade of events leading to a decline in cognitive functioning. Statistically significant cognitive decline, defined as a 3-point drop in Mini-Mental State Examination (MMSE) score, frequently signals an underlying impairment (Wayne *et al.* 2005, Hensel *et al.* 2007), particularly in older patients during and after hospitalization.

While the deleterious effects of hospitalization on cognition have been reported in older Irish patients (Hickey *et al.* 1997), other studies suggest that cognitive decline in some older US patients may be transient rather than persistent (Wayne *et al.* 2005, Inouye *et al.* 2006). As very few researchers have followed older patients long enough (mostly less than 1–3 months) after hospital discharge, the risk profiles of those who decline cognitively and recover have not been well defined. Furthermore, these cognitive declines have not been studied in the Taiwanese context, specifically in terms of prevalence, recovery course, and predictors. Identification of predictors would allow care to be redirected or modified to prevent persistent decline; therefore, distinguishing between persistent and transient cognitive decline is clinically useful.

To fill these gaps in knowledge, we designed the cohort study reported in this paper to describe the prevalence of cognitive decline, recovery course of cognitive functioning 6 months following hospitalization, and predictors of persistent vs. transient cognitive decline in a sample of older hospitalized patients in Taiwan. Our long-term goal was to develop a clinically usable, predictive model for identifying persistent vs. transient cognitive decline within 6 months after hospitalization as a guide for clinical practice with Taiwanese and Asian populations.

Background

The brains of older people have recently been suggested to be able to respond to environmental demands by creating new functional synapses, neurons and networks (Burke *et al.* 2007). These findings raise the possibility of interventions that prevent cognitive decline and promote cognitive functioning. At the end of the cognitive spectrum is dementia, defined as a decline in cognitive functioning to an extent that interferes with daily life (Kester & Scheltens 2009). Dementia afflicts over 700,000 people in the United Kingdom (UK), a number that will soar to 1·7 million people by 2051. The cost of dementia alone in the UK is estimated at £17 billion, a figure predicted to treble in the next 30 years (Alzheimer's Society 2009). This trend is similar in Taiwan, where over 116,000 people were reported to have dementia in 2004, with 220,000 estimated by 2025 (Taiwan Dementia Society 2006). To address the care needs of this fast- growing population, clinicians and policymakers in Taiwan increasingly recognize the need for early detection of cognitive decline among older people in the community and during medical encounters such as hospitalization (Fuh & Wang 2008).

Cognitive decline frequently occurs among older people hospitalized for medical and surgical conditions (Hickey *et al.* 1997). Such cognitive decline exacts an enormous toll on older people, their families, and society. Declining MMSE scores have also been shown to predict mortality, even after adjusting for dementia and specific diseases (Lavery *et al.* 2009). Knowing the prevalence and course of cognitive decline, identifying risk groups, and developing strategies to enhance cognitive functioning are ways to help older people today and reverse the long-term trend towards ever-increasing rates of cognitive decline.

Mini-Mental State Examination scores of 25·9–35·5% of older hospitalized patients in the United States of America (USA) have been shown to decrease more than 1 point (Huber & Kennard 1991), and scores of 16–23% of US patients decreased more than 2 points by hospital discharge (Fitzpatrick *et al.* 2004). A systematic review has shown that such cognitive dysfunction accompanying hospitalization of older patients did not recover, and in some cases declined further after discharge (Cole *et al.* 2009). Cognitive decline and impairment in older patients lead to their inability to perform activities of daily living (ADL). For example, cognitive impairment has been shown to predict functional decline in US patients (Mehta *et al.* 2002). Similarly, older Italian patients who developed cognitive decline during hospitalization were found to be 15·96 times more likely to develop ADL functional decline than non-cognitive decliners (Pedone *et al.* 2005).

To date, most cognitive studies have had a disease approach and focused on evaluating the epidemiology, risk factors, and prognostic outcomes specific to dementia or hospital-acquired delirium (McCusker *et al.* 2003, Marcantonio *et al.* 2005, Inouye *et al.* 2007, Lin *et al.* 2007, Cole *et al.* 2009). Much less is known about the degrees of cognitive decline identified by a screening instrument in older hospitalized patients admitted for either medical or surgical conditions. Furthermore, study findings suggest that cognitive decline in some patients may be transient rather than persistent (Wayne *et al.* 2005, Inouye *et al.* 2006). As older patients may take longer to recover, dichotomizing cognitive decline (yes/no) over two closely-spaced time points, as in most previous studies, underestimates the recovery potential of these patients. If cognitive decline following acute hospitalization cannot be

totally avoided, clinicians need to understand better the distinction between persistent and transient cognitive decline during and 6 months after acute hospitalization. This understanding would inform future studies on the aetiology, prevention, and prompt, targeted intervention of cognitive decline associated with acute hospitalization.

To predict persistent vs. transient cognitive decline accurately, we need a combination of predictors with sufficient prognostic value. The onset of cognitive decline has been found to be predicted by several factors, but most studies were conducted with community-dwelling older people with a few on acutely ill patients (e.g. Fitzpatrick *et al.* 2004, Price *et al.* 2008). The strongest predictors were age, gender, socioeconomic status (Koster *et al.* 2005), gait speed (Alfaro-Archa *et al.* 2007), physical activity and functional status (Taaffe *et al.* 2008), genetic factors (such as the apolipoprotein ϵ4 allele) (Glymour 2007), memory loss (Grober *et al.* 2000), depressive symptoms (Paterniti *et al.* 2002, Wilson *et al.* 2004), certain morbidities (including cardiovascular events, Parkinsonism, and diabetes) (Nguyen *et al.* 2002, Anstey & Low 2004), and treatment-related parameters including surgery (Price *et al.* 2008).

These factors might not have the same predictive power in acute care settings, and some might not even be clinically accessible, for example, gait speed or genetic testing. Most importantly, no study has been conducted on cognitive decline in older patients following hospitalization in Taiwan. Although Taiwan shares certain demographic characteristics with Western countries, such as similar cause-of-death structure and longer life expectancy, it differs substantially in its healthcare system, clinical practice, and cultural context. For example, unlike the USA, Taiwan has national health insurance that covers most hospital and follow-up outpatient services and referral to other specialists for thorough cognitive evaluation and treatment. However, Chinese culture emphasizes the responsibility of adult children to respect and care for older parents (Dai & Dimond 1998). Families and care providers, therefore, might have greater tolerance for cognitive decline of older people, and be less likely to report it when they are hospitalized. Much cognitive decline or impairment of older hospitalized patients goes unrecognized by family or hospital staff in both Taiwan (Taiwan Dementia Society 2006) and the USA (Naylor 2003).

The study

Aim

The aim of this study was to determine the prevalence and predictors of persistent and transient cognitive decline in older hospitalized patients over 6 months after hospital discharge.

Design

In this prospective, interview-based cohort study with older hospitalized patients we used cluster sampling to randomly and proportionally select three surgical and two medical units from 24 units at a 2200-bed medical centre in northern Taiwan as previously described (Chen et al. 2008, 2009).

Participants

Participants were recruited from patients consecutively admitted to any of the five study medical-surgical units between August 2004 and May 2006 and who met four inclusion criteria: (1) age 65 years or older, (2) without underlying cognitive dysfunction defined as MMSE score <20 based on culturally-adjusted norms (Shyu & Yip 2001), (3) expected length of stay (LOS) >5 days, and (4) able to communicate. The criterion for LOS was chosen to exclude patients with very low risk of cognitive changes (average hospital LOS in Taiwan was 9·5 days).

Of the 439 eligible patients, 351 (80·0%) agreed to participate. The reasons given for not participating were 'not interested' ($n = 57$), 'not feeling well ($n = 20$), and 'declined to consent' ($n = 11$). Of the 351 participants enrolled, 291 (82·9%) completed all assessments and their data are the focus of this report. Primary reasons for attrition were death ($n = 44$), intubation ($n = 3$), isolated for tuberculosis ($n = 1$), missed appointments ($n = 9$), and withdrew consent ($n = 3$). Participants not included in the analysis ($n = 60$) did not differ statistically significantly from those in our analysis ($n = 291$) with respect to age ($P = 0·07$), education ($P = 0·32$), and MMSE score at admission ($P = 0·94$). However, the sample included more females ($P = 0·01$).

Data collection

Data on cognitive function and its predictors were collected from participants in face-to-face assessments by two trained research nurses using validated instruments, as described below, at four points: admission (T0), before discharge (T1), and 3 (T2) and 6 (T3) months after discharge.

Dependent variable: cognitive function

Cognitive function was assessed using the MMSE, which measures global cognitive function in five domains: memory, attention, language, praxis, and visual-spatial ability. The

summed scores range from 0 to 30, with higher values denoting better cognitive status (Folstein *et al.* 1975, Shyu & Yip 2001). Cronbach's α of the MMSE in this study was 0·68.

A 3-point drop in MMSE score has been shown to be a clinically significant and reliable index of cognitive decline (Wayne *et al.* 2005, Hensel *et al.* 2007, Yaffe *et al.* 2007). Thus, participants whose MMSE scores were ≥3 points from baseline (at admission) were defined as having a statistically significant cognitive decline (decliner group). Among these decliners, persistent cognitive decline was defined as: (1) continued MMSE score reduction over four time points, and (2) cognitive decline (≥3-point MMSE reduction) 6 months after discharge relative to baseline [i.e. MMSE at T0 ≥ T1 ≥ T2 ≥ T3 and (T0–T3) ≥3 points]. Transient cognitive decline was defined as (1) statistically significant cognitive decline at discharge or 3 months after discharge and (2) *no* statistically significant decline (< 3-point MMSE reduction) 6 months after discharge [i.e. (T0–T1) or (T0–T2) ≥3 points and (T0–T3) < 3 points]. In other words, 'rebounding' was the key for differentiating the two types of cognitive decline.

Predictor variables

Predictors of cognitive decline were selected from the literature (Park *et al.* 2003, Wilson *et al.* 2004, De Ronchi *et al.* 2005, Koster *et al.* 2005, Inouye *et al.* 2006, Lin *et al.* 2007, Price *et al.* 2008) and included demographics (e.g. age, gender, education level, living status), comorbidities (sensory, cardiovascular, neurological, diabetic, and anaemic comorbidities, and medication taken *currently*), in-hospital functional changes (performance of ADLs and depressive symptoms), and treatment-related markers (LOS, surgery, and readmission). Data on these variables were collected using instruments described below.

Demographics. A demographic form was designed to collect data on age, gender, marital status, living status, income, and education.

Comorbidities. Comorbidities were assessed by a standardized comorbidity checklist. Sensory morbidities were visual and hearing impairments. Cardiovascular morbidities were coronary heart disease, hypertension, congestive heart failure, and hyperlipidaemia. Neurological morbidities included stroke and Parkinsonism. Diabetes was studied as a known factor for cognition (Nguyen *et al.* 2002). Comorbidity data were coded as present or absent and are reported as prevalence rate (%). Serum haemoglobin levels at admission were collected from patients' medical records. Anaemia (yes/no) was defined as a serum haemoglobin level < 12 g/dL for females and < 13 g/dL for males (World Health Organization 1994).

In-hospital functional changes. In-hospital functional changes included performance of ADLs and depressive symptoms.

In-hospital decline in performance of ADLs was measured using the 10-item Barthel Index (BI) (decline in BI from T0 to T1; yes/no). This assesses function on 10 ADLs, with summed scores ranging from 0 to 100; higher scores indicate better functional status. Satisfactory reliability and validity have been reported (Mahoney & Barthel 1965). Cronbach's α of the BI in this study was 0·83.

In-hospital rise in depressive symptoms was measured using the 15-item Chinese version of the Geriatric Depression Scale Short-Form (GDS-15) (increase in GDS-15 from T0 to T1; yes/no). Higher GDS-15 scores indicate more perceived depressive symptoms (Yesavage *et al.* 1983, Wong *et al.* 2002). Cronbach's α of the GDS-15 in this study was 0·86.

Treatment-related markers. Treatment-related markers were length of hospital stay, surgery, and readmission. LOS was obtained from the hospital computer system by a trained research nurse. To account for potential differences in cognition between surgical and medical patients, surgery was coded as a dichotomous variable (yes/no). The number of hospital readmissions 6 months after the index discharge was collected at follow-up and was treated as a continuous variable.

Ethical considerations

The study was approved by the research ethics review committee of the study site. At the beginning of all contacts with patients, research nurses explained the purpose and confidential nature of the study, benefits and risks to voluntary participation, and the right to refuse to answer all or some questions. Written consent was obtained from patients or their legal guardians. If necessary, data were collected in two sessions to alleviate potential response burden.

Data analysis

Data were double-entered to ensure accuracy. Statistical significance was set at $P < 0{\cdot}05$. The total sample ($n = 291$) was first analysed for demographics and disease-related characteristics and distribution of cognitive changes. Participants with ≥3-point decline in MMSE score over the course of the study (decliners) were further identified as persistent and transient cognitive decliners.

Persistent and transient cognitive decliners were analysed for differences in demographics, comorbidities, in-hospital functional changes, and treatment-related markers using chi-square test and Fisher's exact test (for categorical data). The Wilcoxon rank sum test was used for continuous variables that were not normally distributed. To assess the likelihood of in-hospital functional changes predicting types of cognitive decline, we categorized functional decline (lower BI) and increased depressive symptoms (higher GDS-15) based on the standard deviation (SD) of the difference in scores between T1 and T0 (σ). If this decreased score was more than one SD [(T1–T0) $< -\sigma$], it was coded as 'decline'. Conversely, (T1–T0) $> \sigma$ and $-\sigma \leq$ (T1–T0) $\leq \sigma$ were both coded as 'no decline'. Factors that were statistically significant in univariate analysis were then entered into the logistic regression analysis to identify predictors of persistent decline, using transient decline as a reference group. Analyses were performed using statistical program language R (Version 2.8.0, http://www.r-project.org/).

Table 1 Participant demographics (n = 291)

Characteristic	Mean	SD	n	%
Age (years)	71·6	5·6		
Female			138	47·4
Marital status				
Married			201	69·1
Widowed			82	28·9
Living with others			278	95·5
Retired			222	91·1
Education				
Illiterate			83	26·9
Elementary/middle school			132	45·4
High school and above			76	26·1
Monthly income (NTD*)				
≤10,000			171	58·8
>10,000			120	41·2
Surgery			182	62·5
Length of stay	15·7	9·8		
Readmission	0·5	1·0		

*New Taiwan Dollar, 33 NTD = 1 USD = 0·56 GBP (British Pound).

Results

Participant demographics

The study sample was relatively diverse in age, gender, and educational level. Most participants were married and retired, and the majority was living with others. They had a mean age of 71·6 years (SD = 5·6, range = 65–89). Details of the sample demographics are presented in Table 1.

Prevalence and course of cognitive decline

Mean MMSE score declined over time from 25·3 at admission, to 24·2 at discharge, to 24·0 at 3 months, and 23·4 at 6 months after discharge. Cognitive decline was highly prevalent; 167 participants (57·4%) experienced a ≥3-point decline in MMSE score at some point during follow-up. The changes in mean MMSE score for decliners (n = 167) and non-decliners (n = 124) are shown in Figure 1. MMSE scores of decliners decreased statistically significantly and of non-decliners increased slightly over time.

For the 167 decliners, the prevalence of cognitive decline over time compared to admission baseline (≥3-point MMSE reduction) was statistically significant; 25·1%, 30·2% and

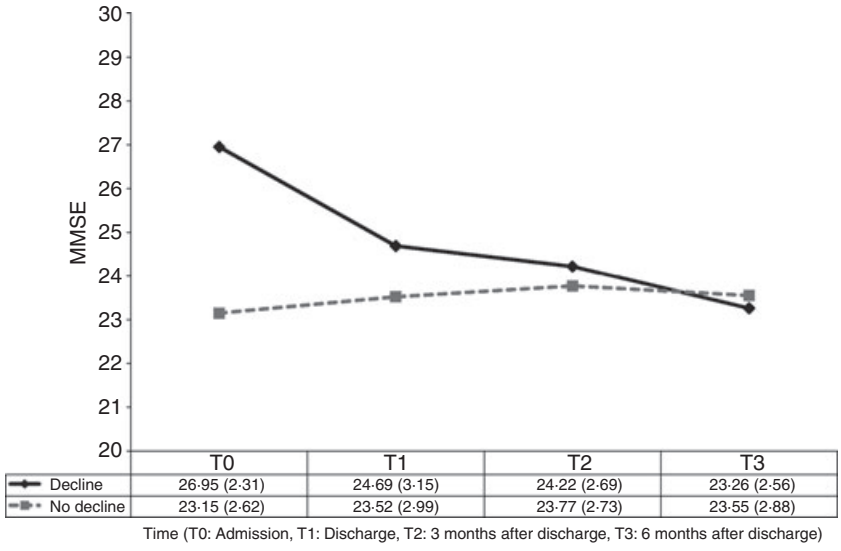

Figure 1 Changes in global cognitive function (Mini-Mental State Examination scores) for decliners (n = 197) and non-decliners (n = 124).

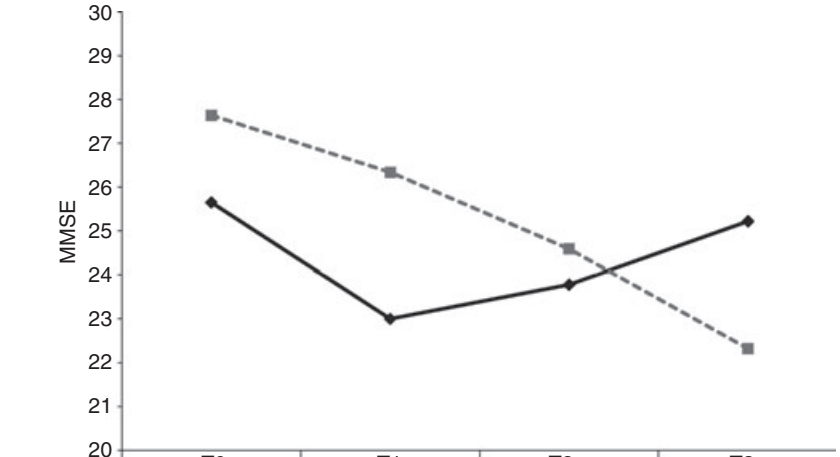

Figure 2 Changes in global cognitive function (Mini-Mental State Examination scores) for transient (n = 46) and persistent cognitive decline groups (n = 59).

41·6% of the sample had declined by discharge, 3 months, and 6 months after discharge, respectively. Among these 167 decliners, 59 (35·3%) met the definition of persistent decline, 46 (27·5%) had transient decline, and the rest (n = 62) showed a variable pattern.

Characteristics of persistent vs. transient cognitive decliners

Mean MMSE score at baseline was statistically significantly lower in participants identified as having transient cognitive decline (Figure 2). These transient decliners also had a sharper cognitive decline during the course of hospitalization. As shown in Table 2, those who experienced transient decline were relatively younger and were living with others. On the other hand, they stayed in the hospital slightly longer (15·5 vs. 13·9 days) than persistent decliners. This group also had statistically significantly fewer readmissions than participants classified as persistent decliners (0·2 vs. 0·5). For in-hospital functional changes, transient decliners were more likely to experience in-hospital decline in ADL performance and a rise in depressive symptoms. At discharge, 67·4% and 58·7% of transient decliners experienced >1 SD decrease in BI and increase in GDS-15 score, respectively. Among persistent decliners, the corresponding numbers were only 25·4% and 28·8%.

Table 2 Demographics and predictors of participants with cognitive decline by subgroup (n = 105)

Characteristic/factor	Transient decliners (n = 46)	Persistent decliners (n = 59)	P value
Age (years), mean (SD)	70·4 (5·4)	72·8 (5·9)	0·028†
Female, n (%)	20 (43·5)	27 (45·8)	0·815*
Education (years), mean (SD)	7·3 (5·7)	7·3 (5·4)	0·804†
Living with others, n (%)	46 (100·0)	53 (89·8)	0·026‡
Cardiovascular morbidities, n (%)	24 (52·2)	38 (64·4)	0·206*
Neurological morbidities, n (%)	6 (13·0)	4 (6·8)	0·278*
Sensory morbidities, n (%)	30 (65·2)	40 (67·8)	0·781*
Diabetic morbidity, n (%)	12 (26·1)	24 (40·7)	0·118*
Anaemia upon admission, n (%)	23 (50·0)	42 (71·2)	0·027*
Surgery, n (%)	32 (69·6)	35 (59·3)	0·279*
Length of stay, mean (SD)	15·5 (7·5)	13·9 (10·3)	0·045†
Readmission, mean (SD)	0·2 (0·5)	0·5 (1·0)	0·028†
In-hospital functional decline, n (%)	31 (67·4)	15 (25·4)	<0·001*
Rise in depressive symptoms, n (%)	27 (58·7)	17 (28·8)	0·002*

Anaemia was defined as Hb < 12 g/dL for females and <13 g/dL for males; function was measured by the Barthel Index; depression was measured by the Geriatric Depression Scale-short form.
*Chi-square test, †Wilcoxon rank sum test, ‡Fisher's exact test.

Table 3 Odds ratios in favour of persistent over transient cognitive decline from logistic regression models (n = 105)

	Adjusted full model[§]	
Predictor[†]	OR	95% CI
Age (for every 1 year increase)	1·09*	1·00–1·20
In-hospital functional decline (yes/no[‡])	0·16**	0·05–0·50
Number of readmission within 6 months (for every one time increase)	2·42*	1·15–5·10

[†]Information in parentheses refers to the unit of increase or reference group for the odds ratio.
[‡]No decline includes one subject classified as 'improved', *P < 0·05; **P < 0·01.
[§]Model was adjusted for gender, education, anaemia defined as Hb < 12 for females and < 13 for males (yes/no), rise in depressive symptoms [increased GDS from T0 to T1(yes/no)], and length of hospital stay.

Odds of persistent vs. transient cognitive decline

Factors that were statistically significant in the preceding analysis (Table 2) were used in logistic regression to estimate the odds ratios (OR) for persistent vs. transient decline. The factors entered into the regression model were age (years), gender, education (years), anaemia at admission (yes/no), in-hospital decline in ADL performance (yes/no), increase in depressive symptoms (yes/no), length of stay, and number of readmissions. Although the variable of living with others was statistically significant, it was not included because none of the transient decliners lived alone, which violated the large sample assumption and might have affected estimates of other factors in the model.

This analysis revealed that, compared to participants in the transient group, those with persistent decline tended to be older (P = 0·048), re-admitted more often after discharge (P = 0·020), and experienced *no* in-hospital ADL functional decline (P = 0·002) (Table 3). Specifically, the fully adjusted model revealed that for each 1-year increment in age, the odds of being a persistent decliner increased by 9% (OR = 1·09, 95% CI: 1·00–1·20); for *each* hospital re-admission after the index discharge, the odds of being a persistent decliner increased 2·42 times (OR = 2·42, 95% CI: 1·15–5·10); and for those who experienced in-hospital ADL decline, the odds of being a persistent decliner decreased 84% (OR = 0·16, 95% CI: 0·05–0·50).

Discussion

Study strengths and limitations

A major strength of the present study is that a rigorous prospective approach was used to gather MMSE data longitudinally from a fairly large cohort of older hospitalized patients. Nonetheless, the study had some limitations. First, as MMSE is a screening measure of global cognition, the possibility cannot be excluded that cognitive domains such as attention and memory have different patterns of decline. Second, attrition was 17·1% (n = 60), which included 44 deaths. As deaths were excluded from the analysis, the predictive ability of variables is therefore conditional on survival. Besides death as a reason for attrition, cognitive decline was a reason for dropping out, refusing to participate and being excluded, thus reducing the effect size (Levin *et al.* 2000). Third, our study was observational, limiting the ability for causal interpretations. While our participants were patients of a single medical centre in a metropolitan area, the participation rate was close to 80%, enhancing generalizability. It is also important to note that repeated administration of cognitive tests is likely to improve test performance, which might bias our results toward underestimating the rate of cognitive decline (Wilson *et al.* 2006).

Cognitive decline

The most important finding of this study is that over half of older hospitalized patients experienced ≥3-point MMSE reduction during the 6-month follow-up, a clinically significant decline. Among these decliners, over 35% showed persistent cognitive decline. Two points need to be emphasized. First, a ≥3-point decrease in MMSE score within 6 months after hospitalization is unlikely to be the result of normal decline or measurement error (Hensel *et al.* 2007). Indeed, the overall annual decline in older people's MMSE scores was found in a review of the literature to range from 0·1 to 1·3 points, and the mean annual decline for studies excluding patients with dementia ranged from 0·2 to 0·6 MMSE points (Park *et al.* 2003). Even for patients diagnosed with Alzheimer disease, the annual decline in MMSE was approximately 2·3 points (Suh *et al.* 2004). Second, cognitive impairment, particularly if it persists, may interfere with a patient's self-management of medical illnesses, e.g. poor compliance with medication, which might in turn contribute to adverse outcomes. Indeed, faster recovery from cognitive impairment has been associated with better outcomes (McCusker *et al.* 2003). Therefore, our findings highlight the need to recognize cognitive decline promptly so that timely investigations can be initiated.

Furthermore, our finding that 35·3% of participants continued to decline cognitively after hospital discharge indicates a strong need for transitional care. Such care encompasses a broad range of services and environments

What is already known about this topic

- High rates of cognitive decline during and following hospitalization have been reported in Western samples of older patients.
- Some older patients might have persistent rather than transient cognitive decline, but the detailed risk profiles of those who decline and recover have not been well defined.

What this paper adds

- Over half of older hospitalized patients experienced statistically significant cognitive decline postdischarge, with more than 35% of this decline being persistent, suggesting that cognitive impairment persists well beyond discharge.
- While cognitive impairment persisted well beyond discharge, 27·5% of older patients showed strong rebound in cognitive function 6 months after discharge.
- Persistent cognitive decline was predicted by being older, having more readmissions after discharge, and having no in-hospital functional decline.

Implications for practice and/or policy

- Cognitive assessment needs to be included as part of routine follow-up to facilitate early identification of cognitive decline and prompt interventions.
- There is a need for a new perspective in discharge planning on who is at risk for persistent cognitive decline, particularly patients of advanced age and those more often readmitted to hospital.
- Nurses can oversee the delivery of care, identify cognitive decline, refer patients, and educate families on strategies to enhance cognitive functioning for their aging relatives.

designed to promote safe and timely passage of patients between levels of health care and across care settings (Coleman & Boult 2003). High quality transitional care is especially important for older patients following hospitalization. Poor handover of these older hospitalized patients from hospital to home has been linked to adverse events and increased disability (Forster *et al.* 2003). Thus, nurses working in the community must be aware of the prevalent postdischarge cognitive decline of older patients and have the ability to screen, identify and refer older patients presenting with cognitive decline.

Contrary to expectations, in-hospital ADL functional decline was more frequent in participants with transient cognitive decline, underscoring the need to delineate the underlying mechanism of cognitive changes during and right after acute hospitalization. If this finding is verified by other studies, discharge planning for older hospitalized patients needs a new perspective. During discharge planning in the clinical setting, resources tend to be allocated to patients who experience greater declines (i.e. transient decliners would receive more attention/resources in this case). Our findings raise the possibility that this practice overlooks the needs of older patients on the edge of failing cognition. Nevertheless, the impact of acute illness and hospitalization on cognition needs to be more explicitly described and understood in future studies involving a larger and more diverse sample of older hospitalized patients.

The policy literature has emphasized the need for healthcare policies and research that ensure the highest level of physical, social and mental functioning as individuals age (World Health Organization 2001). This call compels nurses and other care providers to explore models of care that are tailored to meet the needs of older people, particularly during and after an acute hospitalization event (Hickman *et al.* 2007). No mechanism currently exists in Taiwan, as in many other countries, to screen for and detect older patients with persistent cognitive decline during and after acute hospitalization. Many of these patients experience delays in treatment, which might lead to high morbidity and nursing home placement (Joray *et al.* 2004). On the other hand, global cognitive function measured by the MMSE returned to admission level by 6 months for the transient group (approximately 27·5% of decliners), suggesting that in-hospital cognitive impairment recovers on its own after discharge. Both persistent and transient cognitive decline support the notion of including cognitive assessment as part of routine follow-up to enable early identification and prompt intervention. Such a mechanism might work best when it is incorporated into the transitional care model, which is currently lacking in many Asian counties, including Taiwan.

In this regard, cognitive assessment and intervention led by advanced practice nurses is a feasible alternative. Nurse-led interdisciplinary interventions have consistently improved care quality and led to cost savings, particularly during transitions to and from acute care hospital (Naylor *et al.* 1999, Coleman *et al.* 2006, Naylor & Keating 2008). With more advanced practice nurses taking a lead in hospital, transitional care settings, and in the community, it is imperative to increase their awareness of the high rates of cognitive decline and the distinction between transient vs. persistent decline. Nursing professionals have increasingly

realized that if clinical care is to be improved, nurses need to take proactive public roles in making and implementing health policy at local, state, and national levels (Cohen *et al.* 1996). With raised awareness, nurses can enhance communication among patients, their families, healthcare providers, and government officials on the need to identify and prevent cognitive decline. Nurses can also oversee the delivery of care, identify cognitive decline, refer patients, and educate families on strategies to enhance cognitive functioning for their aging relatives. Nurses can convey to policymakers the great impact of high quality hospital and transitional care on cognitive function. Finally, research is needed to understand how interventions should be structured in these care settings to include, but not be limited to, reality-orientation protocols or cognitive-stimulation activities (Spector *et al.* 2008), such as reminiscence (Wang 2007) and environmental modification (Inouye *et al.* 2000).

Conclusion

Cognition is the cornerstone to function, independence, and quality of life for patients and their families, for whom cognitive decline brings losses of many kinds. Older people with cognitive decline are at higher risk of developing functional disability. Thus, cognitive decline cannot be considered a benign variant of normal aging.

The high prevalence of cognitive decline over 6 months following hospitalization is troubling. The prevalence of persistent decline in this study suggests that cognitive impairment persists well beyond discharge. It is surprising that older patients who developed persistent cognitive decline experienced less in-hospital functional decline. Clearly, the red flag signs of persistent cognitive decline need to be better recognized to assist care provision. Use of protocols to detect and treat cognitive decline that persists at discharge or later may improve longer-term outcomes of cognitive decline in older hospitalized patients. If verified, the results of this study suggest the need for a new perspective on older patients at risk for persistent cognitive decline, with special attention paid to those who are older and re-hospitalized more often after index discharge.

Future studies could combine these clinical measures in intervention protocols that refine the predicted likelihood of cognitive decline accompanying acute hospitalization and progression to persistent cognitive impairment after discharge. Trials that target patients with persistent cognitive decline upon or after hospital discharge and use interventions specific to persistent cognitive decline may have a greater impact on outcomes. As the first step, approaches are needed that better anticipate progression to persistent cognitive impairment, thus enhancing current efforts to prevent cognitive decline and delayed recovery, particularly among older hospitalized patients. Nurses have much to offer in the deliberations surrounding this and other aspects of promoting cognitive functioning for older patients.

Acknowledgement

The authors thank Ms. Hui-Jane Tu, Hui-Lin Chen, & Charlotte Wang for their assistance with data collection and analysis.

Funding

This study was supported by the Taiwan National Science Council Grants # 93-2314B002-293 & # 94-2314B002-226 and in part, by the career development grant funded from the National Health Research Institute (Grant # NHRI-EX98-9820PC).

Conflict of interest

No conflict of interest has been declared by the authors.

Author contributions

CCH & YC were responsible for the study conception and design. CCH, JP & CT performed the data collection. CCH, YC & GH performed the data analysis. CCH, JP & CT were responsible for the drafting of the manuscript. CCH, YC & GH made critical revisions to the paper for important intellectual content. YC & GH provided statistical expertise. CCH & GH obtained funding. JP & CT provided administrative, technical or material support. CCH, YC & GH supervised the study.

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