Residents with Alzheimer's Disease in Long-Term Care Facilities in Hong Kong: Patterns of Hospitalization and Emergency Room Use

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Abstract

Objectives: This study examined the frequency and predictors of hospitalization and emergency room use among residents with Alzheimer's disease at admission and after 1 year in a long-term care facility. Method: This secondary analysis used data collected with the Chinese version of the Residential Assessment Instrument Minimum Data Set 2.0 during the Hong Kong Longitudinal Study on Long-Term Care Facility Residents. Results: A sample of 169 residents with Alzheimer's disease who were newly admitted between 2005 and 2010 were included in the analysis. Mixed-effects modeling was adopted to assess the associations between risk factors and the frequency of hospitalization and emergency room use. At admission, 27 (15.98%) respondents had been hospitalized and 19 (11.24%) required emergency room services during the previous 90 days. At admission, polypharmacy ($\beta = .081$, $p < .01$) and use of psychotropic drugs ($\beta = -.506$, $p < .05$) were significantly associated with frequency of hospitalization. At 1-year follow-up, cognitive impairment ($\beta =$

.088, $p < .05$) and polypharmacy ($\beta = .058$, $p < .001$) had significant positive associations with frequency of hospitalization, as well as use of ER services ($\beta = .084$, $p < .01$; $\beta = .077$, $p < .001$, respectively). Use of psychotropic drugs had a negative association with frequency of emergency room use at both time points. Conclusion: Practitioners should periodically observe cognitive ability, polypharmacy, and use of psychotropic drugs among long-term care residents with Alzheimer's disease.

Keywords: Alzheimer's disease, long-term care facilities, Hong Kong, hospitalization, emergency room

Residents with Alzheimer's Disease in Long-Term Care Facilities in Hong Kong: Patterns of Hospitalization and Emergency Room Use

As the Asian population ages, the demand for health care services has dramatically increased. Special attention has been given to acute health care services such as hospitalization and emergency room (ER) use. However, both hospitalization and ER use have been linked to negative consequences for older adults, such as functional decline, loss of independence and mobility, worsening of activities of daily living (ADL) status, and increased risk of drug toxicity (Haynes et al., 2009; Mudge, O'Rourke, & Denaro, 2010; Wakefield & Holman, 2007). From a financial perspective, utilization of acute care services has increased the overall cost of care (Cypress, 2010; Pitts, Niska, Xu, & Burt, 2008). Authorities have called for the reduction of unnecessary and inappropriate ER use and hospitalization (Saliba et al., 2000).

Identification of risk factors leading to hospitalization and ER use is one strategy to address this issue. Previous studies have investigated risk factors of both hospitalization and ER use among different populations, including patients with asthma (Fernandes et al., 2003; Ivey, Simeon, & Monteil, 2003), community-dwelling

older adults (Chou & Chi, 2004; Inouye et al., 2008), insured home-care patients (Fortinsky, Madigan, Sheehan, Tullai-McGuinness, & Fenster, 2006), frail older adults living in nursing facilities (Saliba et al., 2000), short-stay nursing home residents (Hutt, Ecord, Eilertsen, Frederickson, & Kramer, 2002), and the old-old (Walter-Ginzburg et al., 2001). However, little is known about the risk factors of hospitalization and ER use for people with dementia. To our knowledge, only 3 studies (Miller, Rosenheck, & Schneider, 2012; Phelan, Borson, Grothaus, Balch, & Larson, 2012; Rudolph et al., 2010) have been conducted on this topic, all of which explored risk factors among community-dwelling people with dementia.

A retrospective study using medical records from 1998 to 2003 found dementia was diagnosed and documented in 40,482 cases of hospitalization (Guijarro et al., 2010). Patients with dementia had longer hospital stays and greater mortality than those without dementia, and had different reasons for hospitalization, including respiratory disease, diabetes, infectious diseases, and neurologic and psychiatric concerns (Guijarro et al., 2010). The prevalence of hospitalization among patients with dementia increased with age and was more frequent among women (Guijarro et al., 2010). Other studies found that older adults with dementia were more likely to be hospitalized than peers without dementia (Lyketsos, 2012; Phelan et al., 2012). For

nursing home residents with advanced dementia, hospitalization has been viewed as an aggressive treatment (Maust, Blass, Black, & Rabins, 2008).

The weighted percentage of ER use among residents with dementia in long-term care facilities (LTCFs) was about 7% (Luo, Fang, Liao, Elliot, & Zhang, 2010). Measures have been developed to reduce the frequency of ER use; for example, setting up specialized care units (SCUs) for the residents with dementia. Recent studies found that the odds ratio of ER use among residents in SCUs was significantly lower than their counterparts in facilities without SCUs (Luo et al., 2010).

The prevalence of dementia is escalating and the disorder is expected to affect 63 million people worldwide by 2030 (Wimo, Winblad, Aguero-Torres, & von Strauss, 2003). In Hong Kong, more than 10% of adults aged 70 or older suffer from dementia, and that figure is expected to increase in the coming years (Kwok, Loke, Hale, Potter, & Myint, 2011; Lam et al., 2008). Alzheimer's disease accounts for between 60% and 65% of patients with dementia (Sheng, Law, & Yeung, 2009). It is therefore worthwhile to investigate the patterns of hospitalization and ER use among patients with Alzheimer's disease living in long-term care facilities in Hong Kong.

Evidence of risk factors of ER use among residents in LTCFs is relatively sparse (Tang et al., 2010). Several studies reported on the relationship between ER

use and prescribed medications (Tang et al., 2010), use of psychotropic drugs (Centers for Disease Control and Prevention, 2010; Nejtek, Hardy, Hall, & Winter, 2011), and cognition (Nejtek et al., 2011). Previous studies also found that polypharmacy and declines in cognitive functioning and ADL (e.g., O'Malley, Caudry, & Grabowski, 2011; Tang et al., 2010) were positively associated with hospitalization among residents in LTCFs. Yet, previous studies have not distinguished between cognitively intact residents and residents with Alzheimer's disease. Little is known about hospitalization and ER use among patients with Alzheimer's disease living in LTCFs and the factors affecting such use.

Study Objectives

The current study had two goals. One was to investigate the frequency of hospitalization and ER use among residents with Alzheimer's disease upon admission to an LTCF and observe any changes 1 year later. The other goal was to identify factors associated with the use of these medical services and observe those associations after 1 year. Findings of the current study may be useful in illuminating the underlying mechanisms between the selected factors (cognitive impairment, ADL dependence, polypharmacy, and use of psychotropic drugs) and acute medical services utilization (hospitalization and ER use). The findings of the current study not

only enhance our knowledge of dementia care, but also can inform the development and tailoring of interventions to reduce hospitalization and ER use among patients with Alzheimer's disease.

Methods

Data and Samples

Data were obtained from the Hong Kong Longitudinal Study on Long-Term Care Facility Residents, a study that investigated the profile, treatment regime, and well-being of older adults living in 10 residential LTCFs managed by a large nongovernmental organization in Hong Kong. Residents were assessed by trained assessors using the Resident Assessment Instrument Minimum Data Set 2.0 at admission and 12-month intervals. During the study period (2004 to 2010), 1,577 residents completed all annual assessments and remained in one of the care facilities. Of these participants, 169 were residents with Alzheimer's disease who were newly admitted to the care facilities during the study period. This subgroup was extracted from the data set for analysis in the current study. Approval was obtained from the Ethical Approval Board of the University of Hong Kong.

Independent Variables

Cognitive impairment. Cognition was measured using the cognitive performance scale (CPS; Morris et al., 1994), which features 5 items related to comatose status, short-term memory, cognitive skills for decision making, making oneself understood, and self-performance in eating. The scale ranged from 0 to 6, with higher scores reflecting significant cognitive impairment. The internal consistency of the scale (Cronbach's $\alpha = .82$) was satisfactory (Lou, Chi, Kwan & Leung, 2012).

Activities of daily living. ADL was measured using the ADL hierarchy (Morris, Fries, & Morris, 1999), which consists of 4 items related to personal hygiene, locomotion, toilet transfer, and self-performance in eating. The scale ranged from 0 to 6, with higher scores indicating significant dependence. The internal consistency of the scale (Cronbach's $\alpha = .97$) was satisfactory (Lou et al., 2012).

Polypharmacy. The number of medications taken by each participant during the previous 7 days was recorded by nurses in each LTCF. This measure ranged from 0 to 20 in the current sample.

Use of psychotropic drugs. Psychotropic drug use was also recorded by nurses and indicated whether any antipsychotic, antianxiety, or antidepressant drugs had been taken by each resident during the previous 7 days.

Covariate

Time spent in an LTCF was included in the model. A dummy variable representing a 1-year stay was added in the analysis.

Dependent Variables

A hospitalization measure indicated the number of times each resident was admitted to the hospital during the previous 90 days. Emergency room use was measured by noting the number of times each resident received ER services without an overnight stay in the hospital during the previous 90 days. Annual assessments were conducted for all residents (regardless of the diagnosis of dementia); therefore the 2 dependent variables were assessed every 12 months. If a resident had abrupt change in health status, an additional assessment was performed. In the current data set, only 3 assessments (0.62%) were made due to changes in health conditions.

Statistical Analyses

Descriptive statistics including mean, standard deviation, frequency, and percentages were calculated for the sample characteristics and dependent and independent variables. Mixed-effects modeling (MEM) was used to handle the longitudinal nature of the data set (Moinpour et al., 2012). MEM can differentiate between fixed risk factors and random subject factors and improves precision when testing factor effects because all sources of variability between subjects are excluded.

Linear mixed-effects modeling was used to assess the associations of risk factors (cognition, ADL and polypharmacy) with the frequency of hospitalization and ER use after 1 year in an LTCF. Nonlinear mixed-effects models were used to assess changes in the use of psychotropic drugs after 1 year. MEM was also used to test changes in the frequency of hospitalization and ER use after 1 year based on cognition, ADL, polypharmacy, and psychotropic drug use. We examined the plots of the residuals and found no significant violation of the model assumptions. The residuals varied randomly around zero and were not related to the predicted values of the dependent variables. MEM was conducted using SAS 9.3 (SAS Institute, 2010).

Results

Sample Characteristics

A sample of 169 newly admitted residents with Alzheimer's disease were included in this study. The mean age was 82.74 (*SD* = 8.07). A significant majority of participants were female (72%), widowed (64%), and had no formal or primary education (88%). Approximately 9% lived alone before being admitted to an LTCF. Health problems among participants included cardiac dysrhythmia (1.78%), chronic obstructive pulmonary disease (2.37%), pneumonia (2.37%), and shortness of breath (1.18%). These health conditions are known risk factors of hospitalization and ER use.

Because the percentage of residents with these health conditions was very small, these variables were not controlled for in the analysis. After 1 year, about one third of the residents had died. Comparisons between remaining participants and deceased individuals in terms of cognition (M = 3.39, SD = 1.67 vs. M = 3.25, SD = 1.67, respectively), ADL (M = 3.10, SD = 2.28 vs. M = 3.88, SD = 2.26), polypharmacy (M = 5.37, SD = 3.28 vs. M = 5.57, SD = 2.97), and use of psychotropic drugs (M = 16 [14.68%] vs. M = 5 [8.33%]) revealed no significant differences. Table 1 includes the demographics of the subjects at admission and their health conditions at both time points.

[Insert Table 1 here]

Change in Independent Variables after 1 Year

After 1 year in an LTCF, the cognitive level of residents with Alzheimer's disease deteriorated from 3.34 (SD = 1.67) to 3.66 (SD = 1.76; $p < .001$; see Table 1). ADL dependence increased slightly from 3.20 (SD = 2.27) to 3.42 (SD = 2.32; $p < .001$). The number of medications taken by participants also increased, from 5.44 (SD = 3.17) to 5.78(SD = 3.55; $p < .05$). The percentage of residents taking psychotropic drugs increased from 12.43% to 14.29%. Cognitive impairment ($\beta = .275$, $p < .01$), ADL ($\beta = .358$, $p < .01$), and polypharmacy ($\beta = .431$, $p < .05$) significantly increased

over 1 year. There was no significant change in the use of psychotropic drugs (β = .161, $p > .05$).

Hospitalization: Predictors and Change in Frequency

At admission, 27 (15.98%) residents with Alzheimer's disease had been hospitalized during the previous 90 days; 25 residents were admitted once, 1 was admitted twice, and 1 experienced 3 admissions. At 1-year follow-up, 21 (18.75%) residents had been hospitalized during the previous 90 days; 18 residents were admitted once and 3 were admitted twice. Considering the risk factors individually, the change in frequency of hospitalization after 1 year in an LTCF was significantly different among those with less ADL dependence (ADL ≤ 4; $p < .05$) and those who used psychotropic drugs ($p < .001$; see Table 2).

[Insert Table 2 here]

When all risk factors were considered simultaneously, at admission, polypharmacy (β = 0.081, $p < .001$) was positively associated with the frequency of hospitalization, whereas use of psychotropic drugs (β = -.506, $p < .01$) had a negative association with the frequency of hospitalization (Table 3). Cognitive impairment and ADL had no significant associations with hospitalization. After 1 year, cognitive

impairment (β = .088, $p < .05$) and polypharmacy (β = .058, $p < .001$) had significant associations with the frequency of hospitalization. Use of psychotropic drugs and ADL had no significant associations with hospitalization after 1 year. Table 3 shows the factors affecting frequency of hospitalization at admission and after 1 year. Residents with less cognitive impairment experienced greater decreases in frequency of hospitalization after 1 year, whereas those with more cognitive impairment had smaller decreases. Additionally, residents taking fewer medications experienced lower frequencies of hospitalization over 1 year, whereas those taking more medications experienced increased frequencies of hospitalization.

[Insert Table 3 here]

ER Use: Predictors and Change in Frequency

At admission to an LTCF, 19 (11.24%) residents with Alzheimer's disease had received ER services during the previous 90 days; 17 had 1 ER visit and 2 had 2 visits. One year later, 17 (15.18%) residents had received ER services during the previous 90 days, including 12 with 1 ER visit, 4 with 2 visits, and 1 with 3 visits. Individual risk factors had significant associations with changes in ER use; specifically, lack of polypharmacy ($p < .001$) and use of psychotropic drugs ($p < .001$; see Table 2).

Taking all risk factors into account, at admission, polypharmacy (β = .091, p < .001) had a significant positive association with ER use, whereas use of psychotropic drugs (β = -.349, p < .05) had a significant negative association with the frequency of ER visits. After 1 year, cognitive impairment (β = .084, p < .01) and polypharmacy (β = .077, p < .001) had significant positive associations with the frequency of ER use, whereas use of psychotropic drugs had a significant negative association (β = -.295, p < .05; Table 3).

Discussion

The findings of this study indicate that the frequency of hospitalization and ER use among residents with Alzheimer's disease changed inconsistently over 1 year after admission to an LTCF, based on ADL, number of drugs taken, and the use of psychotropic drugs. The results of bivariate analyses showed that those with less ADL dependence (ADL ≤ 4) had a higher frequency of hospitalization after 1 year. However, those who used psychotropic drugs had a lower frequency of hospitalization after 1 year. This might reflect that LTCF staff (nurses, visiting medical officers, physiotherapists, personal care workers) was successful in closely observing and providing essential medical treatments, therapies, and supports to residents with

Alzheimer's disease. Sufficient staffing (such as more nurses) in LTCFs has been found to be a protective factor against hospitalization (O'Malley et al., 2011).

Three factors had significant associations with the frequency of hospitalization and ER use: polypharmacy, use of psychotropic drugs, and cognitive impairment. The number of medications used by residents is a crucial factor that LTCF staff should observe. Number of drugs was associated with the frequency of hospitalization not only at admission but also during the subsequent year. The likelihood of experiencing hospitalization increased as the LTCF residents used more medications. A similar pattern was observed with regard to ER use—polypharmacy also had a positive association with ER use both at admission and during the subsequent year. Polypharmacy is a well-known risk factor for morbidity and mortality (Hajjar, Cafiero, & Hanlon, 2007). Caution should be taken when prescribing multiple medications to residents with Alzheimer's disease, and periodical review of their medications is recommended.

It is also worthy to note that excessive polypharmacy has been associated with declines in nutritional status, functional ability, and cognitive status among older adults (Jyrkkä, Enlund, Lavikainen, Sulkava, & Hartikainen, 2011). It is possible that the polypharmacy we observed reflected the poor health conditions of the residents;

that is, the poor health of residents may have led to more hospitalizations (or ER use) and prescription of multiple medications. The complex relationships among polypharmacy, poor health, and hospitalization (or ER use) warrant further investigation.

Use of psychotropic drugs also affected the frequency of hospitalization and ER use in an interesting pattern. It had a negative association with hospitalization at admission, but after 1 year, this association did not seem to continue. Practitioners should be aware of the association between psychotropic drugs and hospitalization among residents with Alzheimer's disease. However, use of psychotropic drugs had a negative association with ER use both at admission and 1 year later. Use of psychotropic drugs by patients with Alzheimer's disease seemed to have a negative relationship with acute medical care such as ER services.

Cognitive impairment was found to have no significant association with the frequency of hospitalization and ER use at admission; however, after 1 year, deterioration of cognition was associated with an increased frequency of hospitalization and ER use. Thus, observing changes in residents' level of cognition over time is crucial.

Limitations

Despite the significance of the findings, the current study has several limitations. First, the sample came from one nongovernmental organization in Hong Kong. Although the residents of the 10 LTCFs included in the study were allocated by a central waiting list from the Social Welfare Department of Hong Kong, caution should be taken when generalizing our findings to other facilities. Second, only newly admitted residents with Alzheimer's disease were included in this study; those who developed Alzheimer's disease during the assessment period were excluded. The pattern of hospitalization and ER use of residents with onset dementia was not investigated. Third, given the small sample size of this study, the number of independent variables that could be analyzed was limited. Shortness of breath, congestive heart failure, pneumonia, chronic obstructive airway disease, and cardiac dysrhythmia have been found to be associated with hospitalization and ER service use among residents of LTCFs without dementia (Chan Carusone, Walter, Brazil, & Loeb, 2007; O'Malley et al., 2011). We originally planned to include these variables in the analysis, but preliminary descriptive analysis revealed less than 2% of the residents had these health conditions or diseases during the assessment period. In view of the small sample size, these health-related variables were not considered. Future research with larger samples could investigate these health-related variables.

Lastly, we investigated the frequency of hospitalization and ER use among this specific group of residents in LTCFs for 1 year only. Future studies could further explore the trend of hospitalization and ER use during a longer period, such as 3 to 5 years.

Conclusion and Implications

Given the findings of this study, the following measures are recommended to prevent hospitalization and ER use among residents with Alzheimer's disease. Practitioners should periodically observe the cognitive level, polypharmacy, and use of psychotropic drugs among residents with Alzheimer's disease. Measuring cognitive level with a reliable tool, such as the cognitive performance scale of the MDS, is crucial and provides a greater understanding of whether the residents' cognitive levels are changing over time. Interventions that can reduce the deterioration of cognition among residents with Alzheimer's disease could be helpful. In addition, physicians should be responsible for periodically reviewing prescribed medications and nurses should be cautious about the number of medications administered to residents with Alzheimer's disease and proactively consult with doctors concerning medications when necessary. Interdisciplinary consultation (including doctors, nurses, and pharmacists) could help resolve issues related to polypharmacy (Burns & McQuillan,

2011). Use of psychotropic drugs was found to be negatively associated with hospitalization and ER use; however, caution should be used regarding the dosage of psychotropic drugs to avoid the possibility of overdose and other side effects (Toblin, Paulozzi, Logan, Hall, & Kaplan, 2010). In addition, prescription of psychotropic medications must be appropriate and targeted towards specific symptoms.

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Table 1

Sample Characteristics and Health Conditions

Variable	Admission	1 Year	β
Age at admission, *M* (*SD*)	82.74 (8.07)		
Gender, *n* (%)			
Male	47 (27.81)		
Female	122 (72.19)		
Marital status, *n* (%)			
Never married	12 (7.10)		
Married	46 (27.22)		
Widowed	108 (63.91)		
Divorced	3 (1.78)		
Education, *n* (%)			
No formal education	81 (47.93)		
Primary education	69 (40.83)		
Secondary education	14 (8.28)		
Tertiary education	5 (2.96)		
Live alone prior to admission, *n* (%)	15 (8.88)		
CPS, *M* (*SD*)	3.34 (1.67)	3.66 (1.76)	.275***
ADL, *M* (*SD*)	3.20 (2.27)	3.42 (2.32)	.358***
Polypharmacy, *M* (*SD*)	5.44 (3.17)	5.78 (3.55)	.431*
Psychotropic drug use, *n* (%)	21 (12.43)	16 (14.29)	.161

Note. CPS = cognitive performance scale (range = 0–6; higher scores indicate increased

cognitive impairment); ADL = activities of daily living (range = 0–6; higher scores indicate increased dependence).

*$p < .05$, **$p < .01$, ***$p < .001$

Table 2

Frequencies of Hospitalization and ER Use among Patients with Alzheimer's Disease in Long-Term Care Facilities Based on Cognition, ADL, Polypharmacy, and Use of Psychotropic Drugs

	Hospitalization		**ER Use**	
	M (*SD*)		*M* (*SD*)	
	Admission	**1 Year**	**Admission**	**1 Year**
Overall	0.18 (0.41)	0.21 (0.47)	0.12 (0.37)	0.21 (0.54)
CPS ≤ 3	0.20 (0.42)	0.20 (0.44)	0.16 (0.41)	0.20 (0.48)
CPS > 3	0.13 (0.47)	0.23 (0.52)	0.05 (0.23)	0.21 (0.62)
ADL ≤ 4	0.13 (0.34)	0.24 (0.50)*	0.16 (0.43)	0.25 (0.60)
ADL > 4	0.24 (0.54)	0.19 (0.44)	0.07 (0.26)	0.15 (0.46)
No polypharmacy	0.08 (0.27)	0.15 (0.36)	0.10 (0.30)	0.09 (0.29)***
Polypharmacy	0.22 (0.49)	0.24 (0.51)	0.13 (0.39)	0.26 (0.61)
No use of psychotropic drugs	0.19 (0.46)	0.25 (0.50)	0.11 (0.36)	0.22 (0.57)
Use of psychotropic drugs	0.10 (0.30)	0.00 (0.00)***	0.19 (0.40)	0.13 (0.34)***

Note. ER = emergency room; CPS = cognitive performance scale (range = 0–6; higher scores indicate increased cognitive impairment); ADL = activities of daily living (range = 0–6; higher scores indicate increased dependence); polypharmacy = use of more than 3 drugs.

*$p < .05$, **$p < .01$, ***$p < .001$

Table 3

Factors Affecting Frequency of Hospitalization and ER Use among Patients with Alzheimer's Disease at Admission and After 1 Year in Long-Term Care Facilities

Variable	Admission		1 Year	
	Hospitalization	ER Use	Hospitalization	ER Use
	B	β	β	β
CPS	-.045	-.012	.088*	.084**
ADL	-.044	-.035	-.036	-.033
Polypharmacy	.081***	.091***	.058***	.077***
Psychotropic drug use	-.506**	-.349*	-.193	-.295*

Note. ER = emergency room; CPS = cognitive performance scale (range = 0–6; higher scores indicate increased cognitive impairment); ADL = activities of daily living (range = 0–6; higher scores indicate increased dependence).

*$p < .05$, **$p < .01$, ***$p < .001$