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Original Article

Hospital admission risk in community dwelling elderly dementia subjects

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ABSTRACT

Background/Objective: To examine the frequency of hospitalization and old age home placement in a cohort of community-dwelling elderly patients with mild to moderate dementia and to describe the principal diagnosis for admission and evaluate risk factors for hospitalization.

Methods: Prospective cohort of new cases attending memory clinics of 3 regional hospitals was followed up for 1 year with record of acute hospital admission and nursing home placement. Incidence of acute hospital admission were recorded from the territory-wise electronic record system. Risk factors variables including demographics, co-morbidity as measured by Charlson comorbidity index CCI and diagnoses were retrieved.

Results: Among 267 eligible elderly with a mean age of 79.97 (SD 15.96) and 86 (32.7%) male were included. During the 1 year follow up, 96 (36%) were hospitalized at least once. Among them 41 (42.7%) were hospitalized 2 or more times with a median duration of hospital stay of 3 days per person year. The 5 leading reasons for hospitalization were sepsis (22.2%), neurological problem (17.5%), fall (12.7%), cardiac problem (7.9%) and GI disorder (6.3%). The only significant predictors for hospitalization were age (OR 1.11, 95% CI 1.06, 1.17) and CCI (OR 1.34, 95% CI 1.08, 1.67). Among those who have been hospitalized, 4 out of 10 were discharged directly to old age home. Compared with those who have not been hospitalized, 10% of the ever hospitalized subjects will be send to old age home subsequently within 1 year (0 vs. 10%, p <0.001).

Conclusion: In community-dwelling dementia outpatients, acute hospitalization occurred in one third of patients over a period of 1 year and 10% of them will subsequently be placed in old age home. With these results, clinicians may be able to identify dementia patients at risk of hospitalization.

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INTRODUCTION

Retrospective studies have reported that dementia is associated with hospital admissions.[1,2] Managing co-existing chronic diseases in dementia patients are more difficult which may

lead to hospitalization for acute exacerbation of comorbid conditions.[1,3] Hospital admissions of older people especially those with dementia are known to be associated with adverse outcome. Frail elderly including those with dementia are at increased risk of delirium, functional decline and iatrogenic complications during hospital stay,[4] prolonged length of stay, institutionalization and death.[5] The health care costs and utilization of patients with Alzheimer's disease are 2-5 times as high than those without, even after adjusting for comorbidity.[1,6] It has been reported that hospitalization costs are 2-8 times as high in patients with Alzheimer's disease as age matched control in US Medicare beneficiaries.[7]

Despite its clinical and economic effect, limited local studies have examined hospitalization in patients with dementia and have not explored risk factors that predispose patients to hospitalization especially in the early stage of disease which is more common. Identifying the conditions that precipitate hospitalization of elderly individuals with dementia could prioritize clinical focus as secondary and tertiary prevention in the outpatients setting and improve health care for this vulnerable and increasing population.

The aim of this study is to examine the frequency of hospitalization in a community dwelling cohort of patients with newly diagnosed dementia followed up at the memory clinics of regional hospitals, to identify the principal diagnosis for admission and to evaluate risk factors for hospitalization. We hypothesize that dementia patients are at a higher risk of hospital admission. Secondary aim is to detect old age home placement within the 1 year period upon first attendance at the memory clinics.

METHODS

New cases of dementia subjects during the period of September 2013 to March 2015 who were referred to the memory clinics of 3 regional hospitals were recruited. Inclusion criteria were aged >65, has a diagnosis of dementia according to DSM-IV and NINCDS and community dwelling. Baseline demographic data including age, sex, living arrangement, presence of carer and medical comorbidities as measured by Charlson comorbidity index (CCI) were collected. Cognitive function was measured by MMSE. Functional status was measured by modified Barthel Index (mBI). Presence of behavioual and psychological symptoms of dementia (BPSD) was defined by usage of anti-psychotics and/or history of psychiatric clinic follow up. Each subject was followed for at least one year. The primary outcome was rate of hospitalization as measured by the mean number of admissions per year of follow up. An admission was defined as an unplanned hospital admission requiring an overnight stay. Pre-arranged clinical admission, psychiatric, long term care and rehabilitation admissions were not included as hospitalization. Discharge summaries were studied by the authors and principal causes for admission were recorded. The principal diagnosis was recorded according to ICD-9 code, length of stay and discharge destinations were also recorded. Classification of admission causes was based on body system. The secondary outcome was rate of old age home admission. Descriptive statistics on baseline demographic data were collected. Student t test or Mann Whitney U test was used for continuous variables and Chi's square test for categorical variables. Time to hospitalization was defined as time for first visit through index hospitalization visit. Time to old age home placement was defined as time from first visit through old age home placement. Univariate analysis was used to detect risk factors for hospital admission. Multivariate logistic regression model were conducted after adjusted for age and medical comorbidity. P value of <0.05 was considered as statistical significant.

RESULTS

There were 267 new cases of dementia patients recruited. All of them were followed up for at least 1 year after first attendance. The mean age was 79.9 (SD 5.98) and 86 (32.2%) were male. The median MMSE was 17 and majority of them were functionally independent with a median mBI of 99. The median duration of cognitive impairment before first attendance at the memory clinic was 2 years.

For the etiology of dementia, 171 (64%) were Alzheimer' disease (AD), 40 (15%) were vascular dementia (VaD), 50 (18.7%) were mixed dementia and 2 (0.7%) was Parkinson's disease dementia (PDD). Majority of the subjects were either living with their children [151 (56.6%)] or their spouse [88 (33%)]. Sixteen (6%) of them were living alone. During the 1 year follow up, 98 (36.7%) has been admitted to hospital once and among them, 41 (41.8%) were hospitalized 2 or more times. The median duration of hospitalization was 3 days. The primary diagnosis associated with hospitalization was shown in Figure 1. Patients were most commonly admitted for sepsis (22%), nervous system disorder (17.5%), fall (12.7%), cardiovascular system disorder (7%) and gastrointestinal system disorder (6.3%).

Figure 1. Reasons for hospitalization

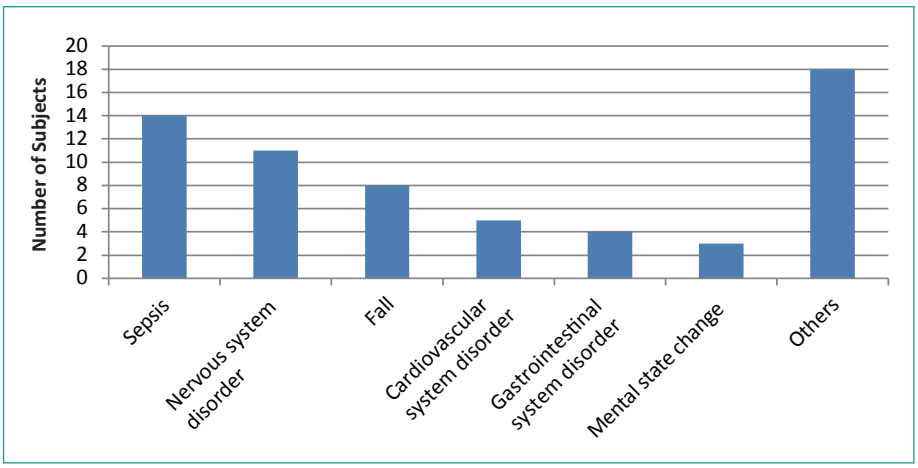

Table 1. Univariate analysis of risk factors for hospitalization

	Ever Admitted N=98	Never Admitted N=169	p value	95% CI
Age (years)	82.16 (SD 4.98)	78.66 (SD 6.14)	<0.001	-4.87, -2.15
Male sex	30.2%	35%	0.498	
Dementia type				
AD	64%	64%		
VaD	15.4%	14.3%		
mixed	18.9%	18.4%	0.972	
CCI (median)	2	2	0.009	
MMSE (median)	17	18	0.13	
mBI (median)	98	100	0.17	
Duration of symptoms (days)	3.01(SD 2.28)	2.78 (SD 2.0)	0.392	
Presence of carer	94.1%	93.9%	0.57	
BPSD presence	27.8%	26.5%	0.821	
On antipsychotics	6.5%	7.1%	0.842	
On anti-depressant	5.9%	7.1%	0.693	

AD=Alzheimer's disease; VaD=vascular dementia; CCI=Charlson co-morbidity index; MMSE=Mini Mental State Examination; mBI=modified Barthel Index; BPSD=behavioural and psychological symptoms of dementia.

The average number of hospital admission was 1.5 (SD 1.1). 3 subjects died by the end of 1 year.

Ten (3.7%) out of the 267 subjects were admitted to old age home during the 1 year period. Among them, 4 were discharged directly to old age home after hospitalization. The median time to old age home placement upon discharge from hospital was 92.8 (SD 97.2) days.

Table 1 show the univariate analysis of hospital admission with risk factors. It was found that age (82.2 vs. 78.65, p <0.001) and CCI (2.37 vs. 1.88, p=0.006) was associated with hospital admission. Logistic regression adjusted for age, sex, MMSE, mBI and dementia types found that only age (OR 1.11, 95% CI 1.06, 1.17, p <0.001) and CCI (OR 1.34, 95% CI 1.08, 1.67, p <0.001) were independent predictors for hospital admission. When we define multiple hospital admissions as >1, it was found that only age alone (p=0.001, 95% CI 1.13, 4.63) was statistically significant. Multiple hospital admissions were not related to types of dementia, place of residence, presence of carers, MMSE, presence of BPSD and mBI.

Among the 10 who has been admitted to old age home, 4 of them were directly discharge to old age home after hospitalization. It was found that old age home placement was not related to presence of carer, dementia type, age, sex, CCI, MMSE and mBI. Only male sex, use of antipsychotics and history of hospitalization were associated with nursing home placement (Table 2). Logistic regression found that only the use of antipsychotics (OR 10.15, 95% CI 1.6, 64.08, p=0.014) was independent predictor for old age home placement.

DISCUSSION

The study showed that hospitalization is not uncommon among elderly dementia persons attending our memory clinics. One third of this population of community-dwelling elderly was hospitalized at least once during the 1 year follow period. Near half of them have 2 or more hospitalization with an average of 1.75 hospital admission within one year. This result was much higher than Rudolph[8] who reported the annual risk of hospitalization was 16.3 per 100 person-years and Albert[9] who found that 17% of AD subjects were hospitalized over the 21 months reporting period. When stratified for dementia severity, the annual risk of hospitalization was 11.1% among non-AD patients, 14.1% among all AD patients and 21.2% for subjects with severe AD as defined by a clinical dementia rating score CDR (Clinical Dementia Rating) of 3+. We cannot found any significant relationship between MMSE and hospital admission. Mental state alone cannot explain the elevated hospitalization rate in our study sample. The elevated risk of hospitalization could be explained by the older age and higher comorbidity index among our study population. This was supported by other study of AD in primary health care setting.[10,11] We have found a relatively short duration of symptoms onset before diagnosis of dementia with a median of 2 years. We could not exclude the reason of this short duration of symptoms of cognitive impairment before diagnosis of dementia may imply that our patients were on a rapid or accelerated trajectory of decline before presenting to us for dementia evaluation and thus may be more likely to be hospitalized. In our study, the severity of dementia as reflected by the MMSE score and behavioural and psychological symptoms of dementia (BPSD), which is believed to be common among severe dementia subjects has not been shown to be a significant predictor of hospital admission. Some studies have found that more severe dementia is a predictor of hospital admission, however, the severity index is not always systematically.[9,12,13] We did not have assessment of dementia severity at the time of hospital admission and we only relied on the latest MMSE before hospitalization as a surrogate of disease severity. The change in psychological status as a result of superimposed medical condition may precipitate delirium and lead to patient admission. However, neither the presence of BPSD nor the use of antipsychotics was associated with hospital admission. Also the diagnosis of mental state changes only account for 4.8% of all admission. Even though, we cannot exclude the reason that use of antipsychotics might have their BPSD symptoms settled and thus will not contribute or trigger an admission to hospital.

Many of the conditions identified in this study were potentially reversible. With early intervention at home and

Table 2. Univariate analysis of factors associated with old age home placement

	Admit old age home N=10	Not admit old age home N=257	p value
Age (mean) years	80.3 (SD 2.87)	79.93 (SD 6.07)	0.713
Male sex	70%	30.7%	0.033
Dementia type			
AD	70%	63.8%	
VaD	10%	15.2%	
mixed	0%	18.7%	0.976
CCI (median)	2	2	0.944
MMSE (median)	16	18	0.267
mBI (median)	98.5	99	0.885
History of hospital admission	100%	34.2%	<0.001
Presence of carer	100%	93.8%	0.416
BPSD presence	40%	26.8%	0.469
On antipsychotics	30%	5.8%	0.023
On anti-depressant	0%	6.6%	0.4

AD=Alzheimer's disease; VaD=vascular dementia; CCI=Charlson co-morbidity index; MMSE=Mini Mental State Examination; mBI=modified Barthel Index; BPSD=behavioural and psychological symptoms of dementia.

hospital; post-discharge education; and home care planning can serve to reduce unplanned hospital admission. The 5 common reasons for hospitalization were sepsis, neurological problems such as dizziness or syncope, fall, cardiovascular problem and digestive system disorder which include poor oral intake and constipation. This were similar to previous work[14] in that pneumonia and febrile episodes are frequent complications in patients with advanced dementia and are associated with high 6 months mortality rate. Pneumonia accounts for 38% of all sepsis admission while urinary tract infection contributes to 33% of infection episodes in our study population. Strategies for prevention of pneumonia such as precautious measures for aspiration, provision of seasonal flu and pneumococcal vaccination and appropriate use of anti-viral agents during the flu endemic season may help to reduce admission due to respiratory problems.[15] Neurological system disorder is the second common cause for hospital admission. These include patients presented as dizziness or vertigo, stroke or stroke-like symptoms or transient ischemic attack. Proper management of risk factors such as diabetes and hypertension help to reduce neurological complications of these diseases. Fall is also a common presenting symptom for hospitalization. Fall prevention program have already shown to be effective in reducing fall related injury and hospitalization.[16] Moreover, optimal risk factors control and physical activity[17] would also help to reduce the 4th leading cause of cardiovascular system disorder for hospitalization. Digestive system disorder is the fifth leading cause for admission. Although gastroenteritis is reported to be the commonest cause, we do encounter cases admitted for gastrointestinal bleeding. Preventive strategies should be reinforced for prevention of gastrointestinal bleeding and peptic ulcer disease.[18]

The important research question of why dementia patients have more hospital admission is postulated to be multi-factorial. Underlying medical conditions that lead to an increase risk of dementia (e.g. stroke) or those conditions that developed as a result of dementia (e.g. aspiration pneumonia) may increase hospitalization risk. Dementia itself also has deleterious effect on cognition, executive function, language problem, deficits in awareness and perception of symptoms. These patients have an impaired ability to self-manage chronic conditions and alert others of their presence. This will then create diagnostic and treatment challenges to health care workers.[19] Furthermore, it is suggested that the threshold for hospitalization is lowered among dementia patients. It increases vulnerability of the central nervous system to the metabolic effects of acute illness.[20] For a comparable illness severity, dementia subjects are much sicker and more likely to develop delirium and functional impairment.[21]

In our study, the independent predictors for hospitalization were age and CCI. It is well known that age alone is an important factor leading to hospital admission. As one grows older, there will be more functional problem and development of medical comorbidies that will precipitate hospitalization.

The rate of old age home placement is not excessive. Only 10 out of the 267 subjects were admitted to old age home within 1 year. It is interesting to note that among these 10 subjects, 4 of them were discharged directly from the hospital. The only predictor for old age home placement was the use of anti-psychotics whereas functional status, MMSE score nor presence of care can explain for old age home placement. However it is worth noticed that since the number of old age home placement was relatively small, we cannot make any conclusion on the significance of this risk factor.

The median length of stay among our study sample is 3 days. Older studies in the last century[9] have showed that the average length of hospital stay vary from 14.4 among mild to moderate AD and 14.9 among patients with severe AD. In a more recent study[8] among a prospective cohort of older community-dwelling patients with AD, the median length of stay is only 3 days, which is comparable with our results. This showed the change in trend of hospital care management with time. Although dementia patients were more likely to be admitted to hospital, they were not more likely to have longer length of stay when compared with the general population once they were admitted.

Understanding the potential risk factors for hospital admission in dementia patients is important to health care workers and administrators on the development of intervention to prevent admission, cost saving and also quality of life of both the patients and their carers. The risk factors identified help us to detect a high risk group. The results obtained provide important information. As

suggested by Rudolph,[8] early stage patients with AD are more likely to be hospitalized than the age-matched persons because of increasing problems related to their cognitive deficits. There will be judgment errors resulting in fall, medication errors or non-adherence, decrease in thirst or appetite leading to dehydration or malnutrition. It is likely that subtle cognitive problems may have adverse effects on health and medical care.

Limitations do exist in our study. We were not able to fully assess acute indications for hospitalization such as delirium, medications and social factors. We were also unable to identify those subjects who have been admitted elsewhere outside Hong Kong since it is not an uncommon practice for our elderly population to reside in Mainland China and only return Hong Kong for medical clinic attendance. The principal diagnosis was obtained from the medical records. Misclassification bias does exist if one cannot put in the most likely cause for admission.

We only assess admission rate in 1 year. This figure will be much higher if these groups of subjects are observed for a longer period of time. The longer term observation over dementia subjects can be more accurately reflect the nature of the chronic, multi-year course of dementing illness.

In this study, we were not able to determine how many of our subjects who were hospitalized were preventable. Verification of preventability requires the review of hospital charts, notes and adjudication of the preventability of each admission require numerous manpower and resources which is difficult to attain and beyond the scope of our study.

In summary, the findings of this study here indicate a higher rate of hospitalization among dementia outpatient population. Majority of them were admitted for sepsis, neurological problems and fall. Four out of the 10 who has been hospitalized were discharge directly to nursing home. Future preventing efforts should be targeted so as to prevent development of comorbidity and resulting in institutionalization. Development of better strategies to provide anticipatory, proactive primary care to this population should be done. Given the high frequency of hospitalization among the dementia population, an intervention to prevent or shorten hospitalization would have important implication on health care costs.

CONFLICTS OF INTEREST STATEMENT

No potential conflicts of interest were disclosed.

REFERENCES

01. Zhao Y, Kuo TC, Weir S, Kramer MS, Ash AS. Health care costs and utilization for Medicare Beneficiaries with Alzheimer's. *BMC Health Ser Res.* 2008;**8**:108

02. Natalwala A, Potiuri R, Uppal H, Heun R. Reasons for hospital admission in dementia patients in Birmingham UK during 2002-2007. *Dement Geriatr Cogn Disord.* 2008;**26**(6):499-505.

03. Hill J, Fillit H, Shah SN, del Valle MC, Futterman R. Pattern of healthcare utilization and costs for vascular dementia in a community-dwelling population. *J Alzheimer's Dis.* 2005;**8**(1):43-50.

04. Inouye SK. Delirium in older persons. *N Eng J Med.* 2006;**354(11)**:1157-65.

05. Pedone C, Ercolani S, Catani M, Maggio D, Ruggiero C, Quartesan R, et al. Elderly patients with cognitive impairment have a high risk for functional decline during hospitalization. The GIFA study. *J Gerontol A Bio Sci Med Sci.* 2005;60A:1576-80.

06. Rice DP, Fillit H, Max W, Knopman DS, Lloyd JR, Duttagupta S. Prevalence, costs and treatment of Alzheimer's disease and related disorder: A managed care perspective. *Am J Manage Care.* 2001;**7**:809-18.

07. Bynum JP, Rabins PV, Weller W, Niefeld M, Anderson GF, Wu AW. The relationship between a dementia diagnosis, chronic illness, Medicare expenditures and hospital use. *J Am Geriatr Soc.* 2004;**52**:187-94.

08. Rudolph JL, Zannin NM, Jones RN, Marcantonio ER, Fong TG, Yang FM, et al. Hospitalization in community-dwelling persons with Alzheimer's disease: frequency and causes. *J Am Geriatr Soc.* 2010;**58**:1542-8.

09. Albert SM, Costa R, Merchant C, Small S, Jenders RA, Stem Y. Hospitalization and Alzheimer's disease: Results from a community-based study. *J Gerontol A Bio Sci Med Sci.* 1999;**54A**:M267-71.

10. Malane DC, McLaughlin TP, Wahl PM, Leibman C, Arrighi HM, Cziraky MJ, et al. Burden of Alzheimer's disease and association with negative health outcomes. *Am J Manage Care.* 2009;**15**:481-8.

11. Inouye SK, Zhang Y, Jones RN, Shi P, Cupples LA, Calderon HN, et al. Risk factors for hospitalization among community-dwelling primary care older persons: Development and validation of a predictive model. *Med Care.* 2008;**46**:726-31.

12. Andrieu S, Reynish E, Nourhashemi F, Shakespeare A, Moulias S, Ousset PJ, et al. Predictive factors of acute hospitalization in 134 patients with Alzheimer's disease: A one year prospective study. *Int J Geriatr Psychiatry.* 2002;**17**:422-6.

13. Nourhashemi F, Andrius S, Sastres N, Ducassé JL, Lauque D, Sinclair AJ, et al. Descriptive analysis of emergency hospital admission in patients with Alzheimer's disease. *Alzheimer's disease Assoc Disord.* 2001;**15**:21-5.

14. Mitchell SL, Teno JM, Kiely DK, Shaffer ML, Jones RN, Prigerson HG, et al. The clinical course of advanced dementia. *N Eng J Med.* 2009;**361**:1529-38.

15. Loeb M. Community-acquired pneumonia in older people. The Need for Broader Perspective. *J Am Geriatr Soc.* 2003;**51**:539-43.

16. Gillepsie LD, Robertson MC, Gillepsie WJ, Lamb SE, Gates S, Cumming RG, et al. Interventions for preventing fall in older people living in the community. *Cochrane Database Syst Rev.* 2009:CD007146.

17. Smith SC Jr, Allen J, Blair SN, Bonow RO, Brass LM, Fonarow GC, et al. AHA/ACC guidelines for secondary prevention for patients with coronary and other atherosclerotic vascular disease: 2006 update: endorse by the National Heart, Lung and Blood Institute. *Circulation.* 2006;**113**:2363-73.

18. Bhatt DL, Scheiman J, Abraham NS, Antman EM, Chan FK, Furberg CD, et al. ACCF/ACG/AHA 2008 expert consensus document on reducing the gastrointestinal risks of anti-platelet therapy and NSALD use. *Am J Gastroenterol.* 2008;**103**:2890-907.

19. Harris DP, Chodosh J, Vassar SD, Vickrey BG, Shapiro MF. Primary care providers' vision of challenges and rewards of dementia care relative to other conditions. *J Am Geriatr Soc.* 2009;**57**:2209-16.

20. Phelan EA, Borson S, Grothaus L, Balch S, Larson ED. Association of incident dementia with hospitalization. *JAMA.* 2012;**307**:165-72.

21. Inouye SK, Bogardus ST Jr, Charpenter PA, Leo-Summers L, Acampora D, Holford TR, et al. A multicomponent intervention to prevent delirium in hospitalized older patients. *N Eng J Med.* 1999;**340**:669-76.