Original Article

A Subacute Model of Geriatric Care for Frail Older Persons: The Tan Tock Seng Hospital Experience

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Abstract

Introduction: The subacute care unit in Tan Tock Seng Hospital (TTSH) was set up in May 2009. We examined its impact on the transitions at the nexus between hospital and community sectors, patients' discharge destination and functional performance. Materials and Methods: We studied patients admitted during the initial 6-month period (May to October 2009). Differences in demographics, length of stay (LOS), comorbidity and severity of illness measures, functional outcomes (modified Barthel Index (MBI)) according to discharge destinations were obtained. We also studied the impact of LOS on the geriatric department and the bill size over the pre- and post-subacute implementation periods. Results: Majority of the subacute patients' hospital stay was in subacute care. Of these patients, 44.9% were discharged home, 24.2% to a slow stream rehabilitation (SSR) setting and 29.2% to nursing homes. 16.9% consisted of a subgroup of dementia patients requiring further behavioural and functional interventions, of which 50% managed to be discharged home. Functional gains were seen during subacute stay; with greatest gains observed in the SSR group. There were no differences in overall LOS nor total bill size (DRG-adjusted) for the geriatric medicine department during the first 6 months of operating this new subacute model compared with the prior 4-month period. Conclusion: We propose this subacute model of geriatric care, which allows right-siting of care and improved functional outcomes. It fulfills the role easing transitions between acute hospital and community sectors. In particular, it provides specialised care to a subgroup of dementia patients with challenging behaviours and is fiscally sound from the wider hospital perspective.

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Key words: Administration, Geriatrics, Organisation, Rehabilitation

Introduction

The number of persons aged over 65 will increase from 8.4% in 2005 to 18.7% in 2030, which translates to absolute numbers of 296,900 in 2005 to 873,300 of older persons in Singapore by 2030. The life expectancy at birth has also increased from 79.1 years (2003) to 80.6 years (2007) at birth with expected life expectancy at age 65 years from 83 years (2003) to 84.1 years (2007). The ageing demographics as well as longer life expectancy have put more pressure on the busy public healthcare system given the increasing demands of hospital admissions, especially for frail older persons.

These older persons often develop functional decline after the acute hospital episode, requiring some form of rehabilitation to maximise function. There is an increased risk of institutionalisation if functional issues are not addressed. Problems often arise at the transitions between the acute hospital and community aged care sectors where older persons move from the acute hospital back to the community. To complement acute medicine, intermediate or post-acute care is often necessary for them.

There is a rapidly growing demand for post-acute care management services as exemplified by some companies linking up with Healthcare Management Organisations (HMO) and other insurers to effectively use medical services outside of the acute hospital settings.[1,2] Up to one quarter to half of acute admissions have been shown to require post-acute intermediate care.[3,4] This concept of subacute care has been described in various programmes,[4-8] with reports of incorporation of hospice care in these subacute models.[9] Of note, the Transition Care Program has been set up by the Australian Government in 2004 and noted to be a priority area of the National Action Plan 2004

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to 2008 for improving care of older persons across the acute-aged care continuum.[8] It aims to optimise patients' functional capacity, ease transitions at the nexus between the hospital and aged care sector through improved service integration, and minimise inappropriate extended hospital stays, and avoid premature admission to residential care. It is usually provided at the conclusion of an inpatient hospital episode and involves intensive short-term support (up to 12 weeks) for older persons who need additional time and assistance to complete the restorative process, optimise functional capacity and finalise longer term care arrangements. Approximately 19.7% of patients could be admitted directly to a subacute ward and that 40.2% of subsequent bed days required subacute care.[6] While cost-effectiveness of subacute model with lower post-acute length of stay with economic benefits and increased satisfaction has been demonstrated,[7] there is still insufficient data to define the characteristics of inpatient geriatric rehabilitation programmes.[10] Other challenges include case definition of subacute care, the uneven distribution of acute and subacute hospital services and aged care services with no evidence in the coordination and allocation of the resources.[11-13] In addition, the different stages of development of aged care services across the continuum of aged care and funding structure of the different healthcare systems over the world requires modification for local adoption of the subacute care model.

The subacute ward was established in Tan Tock Seng Hospital (TTSH) in May 2009 as a separate unit in the adjacent Renci Community Hospital. This subacute ward was managed both clinically and operationally by TTSH. If the patient in subacute ward setting was scheduled or deemed to require slow stream rehabilitation, they were then discharged from the subacute ward and physically admitted to the community hospital setting for slow stream rehabilitation. Prior to this period, all the patients spent their stay in the acute hospital setting until discharge to community hospital setting or back into the community or institution. This subacute ward is equipped with the capability to deal with acute medical problems should they arise. This model differs from the previous operational understanding of "subacute care" in the community hospital in Singapore. The latter model was mainly for closer monitoring of parameters and blood glucose level, administration of longer-term antibiotics, patients with oxygen supplementation and wound care. Figures 1 and 2 delineate the conceptual model of subacute geriatric care with dynamic functional and care requirements following the disease trajectory of functional dependence in a frail older person. The current proposed model describes the management of subacute patients with unresolved medical issues who would otherwise have remained in the acute care

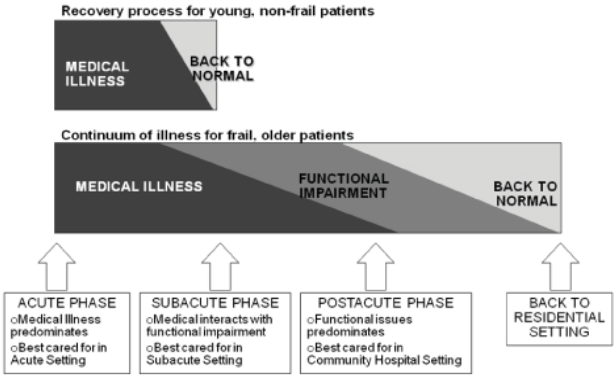


Fig. 1. A figure showing the continuum of illness for frail, older patients and the right-siting of care. Older patients, especially those who are frail, respond to acute illnesses differently from the younger adults, and often have protracted recovery. After the acute phase, a subacute phase emerges where the active medical issues intertwine with functional impairment, during which the elderly is at high-risk of iatrogenic injury. During this phase, the management focus should not only be on careful titration of medical management to prevent iatrogenesis, but also on paying attention to functional needs to prevent complications, such as those related to immobility. This will usually require multi-dimensional approach with interdisciplinary teamwork. This phase is often the period during which safe and effective discharge planning can be formulated. Based on available evidence, older patients in the subacute phase are best managed in a setting where appropriate skillsets and care processes match these special needs, such as in a Geriatric Evaluation and Management Unit (GEMU).

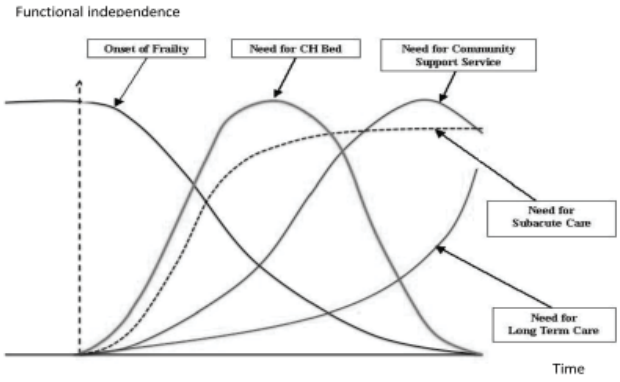


Fig. 2. A hypothetical model of geriatric care for frail older persons in the aged care community, intermediate and long-term care setting across the disease trajectory with increasing functional dependence. With increasing frailty and decreased functional independence in older persons, they are at risk of frequent hospitalisations and re-admissions. There would be increased requirements for subacute care, slow stream rehabilitation services following the acute hospital episode and a concomittant rise in the community support services needed post-discharge. The community support services required include social care services (home help services, befriender services, meals on wheels, escort services), medical care services (home nursing foundation care, home medical care) and daycare services (social daycare, day rehabiliation centres and dementia daycare services). The requirements for subacute care and slow stream rehabiliation are most during the early to intermediate phase of functional dependence to rehabilitate the frail older persons back to their premorbid status back into the community. As their functional dependence progresses, those with no/poor social support would then subsequently require admission into long-term care facility. Subacute care may remain relevant at the end-of-life for symptom control and management of related biopsychosocial issues during the final disease process.

setting and not deemed suitable for community hospital setting. In this new model, the subacute care unit is staffed with a medical team (geriatricians), nursing team (geriatric-trained nurses), allied health specialists, care co-ordinators and medical social workers to actively address the needs of the frail elderly patients. Unique to this model of care was the inclusion of management of patients with behavioural issues in a subset of patients with dementia.

The study thus aims to examine the impact of subacute model of care on the overall length of hospital stay, transitions at the nexus between the hospital and community sectors, patients' discharge destination and functional performance. We also looked at the secondary effects of this model on the cost of care (reflected by the bill size) for inpatients of the department of geriatric medicine in the acute hospital setting prior to and after implementation.

Materials and Methods

This was a retrospective cohort study that examined geriatric patients transferred from the acute ward to the subacute ward in the initial 6-month period of implementation from 1 May to 31 October 2009. We examined the impact of the subacute care in terms of hospital stay, functional improvements and eventual discharge destination. This was a quality improvement project in the department and was reviewed by NHG Domain Specific Review Board (DSRB) and was determined not to require formal review.

Patients were carefully selected for transfer to the subacute ward after fulfilling the following criteria:

1. Patients who were considered medically stable and no longer required acute hospital care but still needed continued medical management of their illness. Relevant examples include patients recovering from their recent active acute illness but still required medical attention; management of postural hypotension and titration of medications; completion of course of intravenous antibiotics who were not suitable for outpatient antibiotic therapy or home outpatient antibiotic therapy services; acute urinary retention complicated by post-obstructive diuresis; patients with significant pain symptoms requiring pain medication titration to determine their functional status; and adjustments of enteral feeding regime.
2. Patients who were deemed to benefit from short course of functional rehabilitation (1 to 2 weeks) to address deconditioning following their medical illness rather than in a community hospital setting.
3. Patients who were medically stable and awaiting bed at the community hospital facility.
4. Patients who were admitted for behavioural problems or had concomitant behavioural problems with their medical illness requiring monitoring and medication titration for manageable behavioural control.
5. Patients who were identified needing comprehensive management to establish discharge care plans via multidisciplinary meetings with the medical, nursing, therapist, pharmacist, care co-ordinators and social workers inputs.

Patients excluded for transfer to the subacute ward include those:

1. On dangerously ill list.
2. On intranasal oxygen (except when patient was on long term therapy (LTOT) and the O2 requirement had remained stable for the last 48 hours.
3. With unstable parameters.
4. Awaiting urgent surgical procedures.

We obtained data from medical records on patient demographics, length of stay (LOS) (total LOS, acute LOS and subacute LOS), medical diagnoses, acuity of medical illness (using modified Charlson co-index,[15] severity of illness index[16]), functional performance (modified Barthel Index (MBI)[17]) and discharge destination. We subsequently analysed differences in demographics, LOS, medical comorbidities, functional status (premorbid, upon admission, admission to subacute care, upon discharge from subacute care) and functional gains according to discharge destination (home versus community hospital versus institutionalisation).

We also studied the impact of LOS prior to implementation of subacute unit (January 2009 to April 2009) compared to LOS with subacute care. We compared the mean bill size of patients admitted to the geriatric medicine department in the 4 months prior to development of subacute care model (January 2009 to April 2009) and the period after initiation of subacute care unit (May 2009 to October 2009). We only studied the costs across a short-time period to minimise the changes in billing which might occur with other factors such as inflation or global changes in practices etc.

Statistical analysis was performed on SPSS 17.0 statistical programme using appropriate statistical methods (ANOVA for multiple group comparisons with Bonferroni correction for continuous variables; and chi-square test for categorical variables). Statistical significance was taken to be $P < 0.05$.

Results

Among 1781 patients who were admitted to the geriatric

department during the time period between 1 May to 31 October 2009, 183 (10.3%) patients were admitted to the geriatric subacute unit. Only 5 patients (2.7%) were transferred back to the acute ward from subacute geriatric unit for suspected acute coronary syndrome (n = 1), gastrointestinal bleeding (n = 2), acute left deep vein thrombosis (n = 1) and new stroke (n = 1). We focused the initial analysis of the 183 geriatric patients who were managed in the subacute geriatric care unit.

The main categories of reasons for these patients' admission to the acute geriatric care setting included sepsis (32.6%), geriatric syndromes of falls (19.6%), functional decline (8.4%), impaired cognition (2.2%), pain with vertebral compression fractures (2.8%), postural hypotension (1%) and others (33.4%). The major reasons for transfer to the subacute ward included continued medical management (completion of antibiotics) (10.7%), titrating of feeding regime (1.7%), management of medical conditions (such as hydration, controlling pain, monitoring platelet trends, post-obstructive diuresis, managing postural hypotension, blood sugar control, transitional feeding) (3.4%), awaiting slow stream rehabilitation (21.9%), awaiting arrival of maid (7.7%), short rehabilitation stint in subacute setting before home (16.9%), functional assessment to determine discharge placement (29.2%), titration of behavioural medications (6.0%). There were 4.5% (n = 10) patients who were managed for H1N1 during this pandemic period. We have termed short rehabilitation stint in the subacute setting as patients who only require1 to 2 weeks of rehabilitation, compared to the longer 1 month rehabilitation period (termed as slow stream rehabilitation) provided in the community hospital setting. The rehabilitation periods for patients are determined by their attending geriatric team.

The demographic profile of subacute patients is presented in Table 1. Of note, the patients have a mean age of 81.1 years. Of them, 28.4% were married, with the rest being single, divorced or widowed. The mean (standard deviation) (SD) LOS at the acute hospital and subacute unit were 9.4 (9.3) and 12.7 (10.4) respectively. This indicated that more of the hospital stay was in subacute care unit rather than acute care hospital. The majority (45.4%) of the subacute patients were discharged home, with 23.5% discharged to slow stream rehabilitation (SSR) facility and 29.5% discharged to nursing homes. There was also a small group of patients (1.1%) where extent of care and end-of-life issues were discussed and managed. The patients passed away in the subacute setting without a need for transfer back to the acute hospital setting. These were not patients under palliative care but geriatric patients with end-of-life issues managed by the primary team.

Comparing these 3 major discharge outcomes (home, SSR and institutional care) (n = 175) , there were no significant differences in age, gender, comorbidities or illness severity (Table 2). Those patients who were institutionalised were mainly single (26.9%) or widowed (55.8%), evidencing care issues being a major factor resulting in institutionalisation. Importantly, we can see that all patients achieved functional improvements, evidenced by increase in MBI scores. The functional gains are seen especially so in the group of patients going for SSR, followed by those going home and to a long-term care setting (in a decremental fashion accordingly). The differences were seen despite no differences in their medical comorbidities and severity of illness.

Table 1. Demographics and Profile of Patients in Geriatric Subacute Care Setting (n = 183 Subjects)

Demographics	
Age (mean ± SD)	81.1 ± 8.1
Gender (%)	
Male	83 (45.4%)
Female	100 (54.6%)
Race	
Chinese	153 (83.6%)
Malay	15 (8.2%)
Indian	13 (7.1%)
Others	2 (1.2%)
Marital status	
Single	24 (13.1%)
Married	52 (28.4%)
Divorced	4 (2.2%)
Widowed	103 (56.3%)
Length of stay (LOS) (mean ± SD)	
Total LOS	21.6 ± 15.0
Acute LOS	9.4 ± 9.3
Subacute LOS	12.7 ± 10.4
Medical comorbidities (mean ± SD)	
Modified Charlson comorbity index	1.6 ± 1.3
Severity of illness score index	2.0 ± 0.7
Functional status (mean ± SD) (range)	
Admission MBI*	45.6 ± 23.5 (0 to 85)
Subacute transfer MBI	41.3 ± 21.6 (0 to 85)
Discharge MBI	52.9 ± 26.9 (0 to 100)
Discharge destination	
Home	83 (45.4%)
Slow stream rehabiliation (community hospitals)	43 (23.5%)
Sheltered home or nursing home	54 (29.5%)
Death	2 (1.1%)
Others	1 (0.5%)

*MBI: Modified Barthel Index

Table 2. Demographics and Profile of Patients in Subacute Geriatric Setting According to Discharge Destination (Excluding 5 Transfer Backs, 2 Deaths and 1 Discharged Against Advice) (n = 175)

	Home (n = 80)	Community hospital (n = 43)	Sheltered home/NH (n = 52)	*P* value
Demographics				
Age (mean ± SD)	82.5 (7.5)	80.0 (8.5)	79.8 (8.3)	0.07
Gender (%)				
Male	41.3%	48.8%	51.9%	0.52
Race				
Chinese	81.3%	81.4%	88.5%	0.62
Malay	11.3%	9.3%	3.8%	
Indian	6.3%	9.3%	7.7%	
Others	1.3%	0%	0%	
Marital Status				
Single	5.0%	9.3%	26.9%*	0.01
Married	28.6%	44.2%	17.3%	
Divorced	3.8%	2.3%	0%	
Widowed	62.5%	44.2%	55.8%	
Length of stay (LOS) (mean ± SD)				
Total LOS	19.5 (15.3)	17.7 (7.9)	27.4 (17.9)	0.01
Acute LOS	8.4 (10.2)	9.3 (5.8)	11.1 (10.6)	0.28
Subacute LOS	11.0 (9.8)	8.6 (5.7)	17.9 (12.1)	0.0
Medical comorbidities (mean ± SD)				
Modified Charlson Comorbity index	1.6 (1.1)	1.7 (1.7)	1.6 (1.0)	0.83
Severity of illness score index	2.0 (0.6)	2.0 (0.8)	2.1 (0.6)	0.82
Functional status (mean ± SD)				
Premorbid MBI†	63.9 (25.1)	77.4 (15.4)	54.3 (30.9)	0.01
Admission MBI	48.6 (22.1)	50.9 (16.4)	37.3 (27.3	0.01
Subacute MBI	43.6 (22.1)	46.9 (14.5)	33.8 (23.3)	0.01
Discharge MBI	55.4 (26.7)	63.6 (17.7)	41.3 (28.1)	0.01
Change in MBI‡	6.8 (16.0)	12.6 (19.8)	3.9 (16.8)	0.04

**P* <0.05

†MBI = Modified Barthel Index

‡Change in MBI = Subacute MBI – Discharge MBI

NA = not applicable

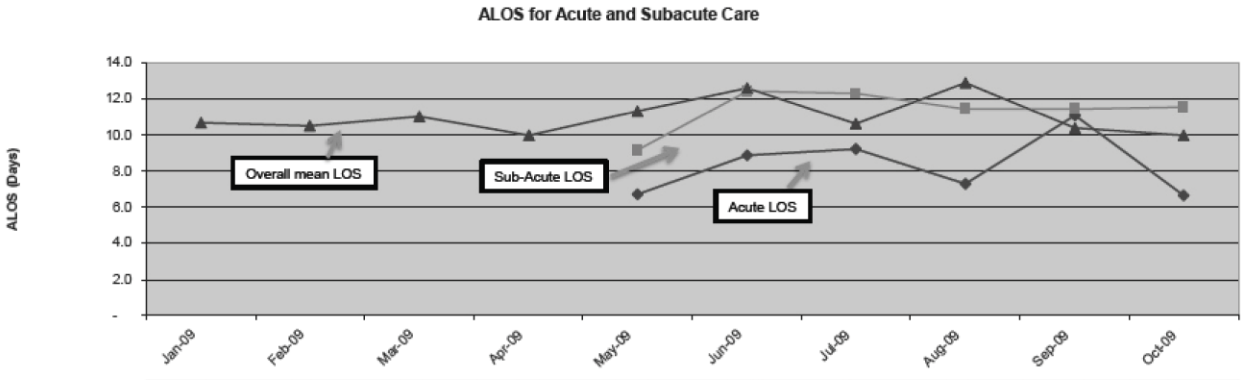
Unique to this model of care is the subset of patients dealt with at the subacute ward whereby the patients exhibits challenging behavioural problems (n = 31, 16.9%)—patients with dementia with significant neuropsychiatric symptoms (agitated depression, agitation, delusions, night-time behaviours, aberrant motor behaviour) which were difficult to control. The subacute geriatric unit is an open concept ward and the environment is more conducive for these behaviourally disturbed patients. This group of patients received both non-pharmacologic and pharmacological approach for management for their behavioural problems, with the help of psychogeriatrician who is available for consultation for medical titration for those with difficult and disruptive behaviours. Among these behaviourally disturbed dementia patients, 50% were discharged home, while 10% of them attended SSR (after control of their behaviours) and 40% were admitted to a long-term care facility.

Overall Length of Stay (LOS)

Overall, the LOS had remained similar even with the establishment of the subacute geriatric unit (overall LOS) 10.7 ± 0.6 and 11.3 ± 1.2 during the periods of January 2009 to April 2009 and May 2009 to October 2009 respectively (no statistical significance) (Fig. 3).

Fiscal Perspective

We compared the mean bill size of subsidised patients admitted to the geriatric medicine department prior to this development of subacute care model in the period of



	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09
Acute LOS					6.7	8.9	9.2	7.3	11.1	6.6
Sub-Acute LOS					9.2	12.4	12.3	11.4	11.4	11.5
Overall MEAN	10.7	10.5	11.0	10.0	11.3	12.6	10.6	12.9	10.4	10.0

Fig. 3. A graph showing the length of stay in the geriatric medicine department before and after implementation of subacute geriatric care unit.
* Last row of overall mean depicts the mean length of stay for all geriatric medicine department inpatients.

January 2009 to April 2009 and the period after initiation of the subacute care unit (May 2009 to December 2009). We only studied the costs within the year to minimise the changes in billing which might occur with other factors such as inflation or external costs, global hospital changes in practices etc. There was no overall increase in cost after institution of the subacute care model with the total bill size of $6103 and $6084 respectively over the 2 time periods in 2009. We looked at the top 70 Diagnosis Related Group (DRG) codes for patients admitted during these 2 time periods and found no differences in major disease states necessitating admission.

Discussion

We have described a subacute model of geriatric care based on the TTSH experience. It allows for appropriate siting of care for the frail older persons during the different phases during their recovery from acute illness episode, which might include transitions through the various care settings, depending on the acuity of their medical and functional and care needs; as well as the requirements of various care settings and community support services during the whole disease trajectory with increasing functional dependency (Fig. 2). This was previously being managed in the acute care setting and is unique in the sense that they still had unresolved geriatric and medical issues which require geriatric sub-specialty evaluation. This is separate from the subacute care offered currently in the community care setting (continuation of medical therapy and rehabilitation).

This subacute geriatric care model is likely to remain relevant even if the availability of slow stream rehabilitation and long-term care bed shortages (accounting for the long LOS of subacute patients awaiting long-term care beds) were to be improved with many of the government's community-based initiatives to upscale the community services. Of the original 21.9% of patients who were sent to subacute care unit to await slow stream rehabilitation beds (Table 1), 29.2% of patients were assessed with regards to their function with reassessment of their rehabilitation potential, resulting in the final 24.2% of patients being discharge to a slow stream rehabilitation setting (Table 2). Hence, this model allows for flexibility in assessment of the patients' functional recovery, allowing appropriate care plans in facilitating discharge based on functional needs. This model of subacute care thus manages patient "further up" the spectrum of recovery process of the frail older persons prior to their discharge back into the community. This intermediate facility allows acute hospital beds to be available for acute medical and emergency management, and the provision of an intermediate geriatric care setting for patients who are not quite ready for community hospital care, thus supporting right-siting of geriatric care.

The subacute care model, focusing on managing geriatric issues with rehabilitation principles of managing impairment to prevent or minimise disability and handicap via a multidisciplinary geriatric team approach, is able to demonstrate good functional outcomes. This study evidences the benefits of this even in the old-old population as 61.2% patients were equal or more than 80 years old.[18,19] We are able to clear demonstrate the continuum of illness requiring different care setting outlined in detail in Figure 1 to help integrate frail older persons back into the community. In Table 2, we showed functional decline during their acute illness episode, both from their premorbid state and upon transfer to subacute care with improvement in functional MBI scores in an incremental fashion in the

patients who were institutionalised, discharged home and community hospital respectively. The LOS differences in the 3 discharge destinations also shows the ability of the geriatric team in identifying patients with modest benefits from rehabilitation over a 2-week course (as in the home discharge group) versus those with greater potential for improvement (12.6 point MBI improvement) even with a shorter subacute stay before transfer. Furthermore, patients who were eventually institutionalised had lower function at premorbid and admission with less functional recovery upon discharge. Their longer LOS may reflect the longer period given for the geriatric team to assess their functional gains, other than just the long waitime for a residential care bed. A recent systematic review has shown the major predictors for nursing home placement being underlying cognitive and/or functional impairments and associated lack of support and assistance in daily living.[20] Unique to our subacute care model is inclusion of specialised geriatric care for the dementia patients with challenging behaviours. These patients had difficult to control behaviours and who might otherwise be institutionalised. We demonstrated that the majority of them could be discharged back into the community.

This model of care caters to the subacute nature of illness in frail elderly persons and offers initial evidence on its ability to carry out post-acute care without increase in resource use. This subacute model has not increased the LOS for geriatric medicine department inpatients. From the fiscal perspective, the concerns regarding increased costs was also not demonstrated (cost equivalence demonstrated). In fact, it allowed the patient to spend 12.7 (mean) patient bed-days in the subacute care setting, hence allowing the acute care beds to be used for emergency cases. This current small percentage (10.3%) of geriatric patients receiving subacute geriatric setting in a single ward could be further expanded with the anticipated increase in older hospitalised persons given the ageing demographics. Such a model of care might also benefit elderly inpatients admitted outside the geriatric medicine department, suggesting a wider role with potentially greater impact. However, detailed cost-effectiveness or cost-utility analyses is required to evaluate more completely this model of care, given the complexity of needs of the frail elderly persons in a complex healthcare system. The other limitations of this retrospective study include the exclusion of detailed measures of caregiver stress, caregiver availability and willingness, as well as other social and financial support measures which might contribute to reasons for (so as to provide more insights) institutionalisation.

Conclusion

We propose this subacute model of care that is founded on the principles of geriatric medicine with good functional outcomes. It fulfills its role in right-siting patients, easing transitions from acute care to community setting. It also provides specialised care to a group of dementia patients with challenging behaviours. Moreover, it is fiscally sound from the hospital perspective, at least in the short-term. We envision that this subacute geriatric model can play an important role in care of the frail elderly persons in the Singapore healthcare system.

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