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## GERIATRIC MEDICINE | RESEARCH ARTICLE

# Healthcare service utilization in the first year after admission into home medical care among elderly patients in Singapore

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**Abstract:** *Introduction:* The main aim of present study is to determine the trend of healthcare service utilization during the first year of admission of home medical patients. *Materials and Methods:* Records of 1,069 patients were examined. *Results:* Scheduled visits [IRR (95% confidence interval, 95% CI), 0.77 (0.75–0.79)], un-scheduled visits [IRR (95% CI), 0.82 (0.75–0.86)] and phone calls [IRR (95% CI), 0.77 (0.74–0.81)] had significant decreasing linear trend from the first to fourth quarter. Doctor encounters [IRR (95% CI), 0.64 (0.61–0.68)], nurse encounters [IRR (95% CI), 0.81 (0.78–0.83)] and therapist encounters [IRR (95% CI), 0.61 (0.28–1.32)] also had decreasing linear trend. *Conclusion:* Healthcare utilization of home medical patients declines from first to fourth quarter of admission.

**Subjects:** Aging and Health; Education; Gerontology; Health and Social Care; Medicine, Dentistry, Nursing & Allied Health

**Keywords:** healthcare utilization of elderly patients; home care; long term care; continuum of care

### 1. Introduction

Age and concurrent multi-morbidity are driving forces in the growing utilization of healthcare services (Schulz, Leidl, & König, 2004). The influence of an ageing population on healthcare sector is of key public health interest. In 2015, one in eight Singapore citizen was 65 year and above and by year 2030, there will be one in four Singapore citizen of 65 year and above (Older Singaporeans to double by 2030, 2016). While comprising 7% of the population in 1997, they utilized 20% of the public sector care and hospital services and there will be a four-fold increase in the utilization of health resources in 2030, based on the increased numbers of elderly and assuming the same utilization rate (Healthcare of the Elderly in Singapore, 2013). Globally, in trying to meet the care demands of large numbers of elders, healthcare

### ABOUT THE AUTHOR

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### PUBLIC INTEREST STATEMENT

Emphasis on caring for elderly in their own homes has gained momentum across healthcare systems in the developed world. Our study showed that there was a significant decline in HSU from first to fourth quarter from the date of admission into a home medical service from 2000 to 2009. The knowledge of these trends may help governments more accurately project resources needed for home medical services, a strategy to help elders to “age in place”.

systems which were originally designed to handle acute and episodic illnesses are facing various challenges such as shortage of healthcare professionals across medical sector (Kanchanachitra et al., 2011) with a sizeable waiting list for long term care institutions (Gan, 2012).

Recent decades have witnessed an increase in home healthcare utilization globally (Thumé, Facchini, Wyshak, & Campbell, 2011). However, the health service utilization (HSU) rates of home medical services by elderly population are not well studied. The HSU of home care sector holds particular value for primary healthcare as the majority of the older population would prefer to stay in their own homes compared to institutions (TNS Opinion & Social, 2007). Although the Government of Singapore is planning for a wide range of home and community based services, the capacity of these services remains relatively low because the number of Singaporeans aged 65 years and older is increasing (Ansah et al., 2014). Currently in Singapore, the oldest home medical service providers are Hua Mei Mobile Clinic and Code 4 Medical Service. Code 4 is a multi-disciplinary home medical service which provides medical, nursing and therapy services island-wide. The main objective of present study is to determine the trend of HSU of Code 4 medical patients during first year of admission from 2000 to 2009. Though these trends will present insights into the home medical care in Singapore, they may be useful to other countries experiencing similar ageing patterns.

## 2. Code 4 home medical care

Code 4 provides services through a team of doctors and nurses. Majority of the Code 4 patients are homebound, frail, and disabled older adults with chronic diseases. Needs of homebound patients are often complex with multiple medical problems that are closely intertwined with psychosocial problems. The care plan of Code 4 home includes range of services such as management of uncomplicated acute or sub-acute medical problems, patient and caregiver education with regard to various aspects of nursing care (prevention of pressure sores and proper feeding techniques), and performing nursing procedures such as wound care, care of enteric tubes, tracheotomies, enterostomies, urinary catheters, and so on. Usually caregivers take care of Code 4 patients. During early part of their admission, family members take care of their elders and subsequently foreign domestic worker (FDW). Hence, there is no need of other home personal services for Code 4 patients. The usual frequency of scheduled nurse visits was once every one to two months, depending on the condition of the patient. Follow-up visits made by doctor were usually once every three to six months unless there was any urgent medical issue (Mittal et al., 2016). Weekly Multidisciplinary meetings are conducted to discuss the treatment plan of patients. In Singapore, home healthcare model is still evolving and Government is trying to increase the scope of home healthcare by introducing new services such as home therapy. Recently, Singapore Government introduced new integrated Home and Day Care packages that allow seniors to receive mix of home and centre based services according to their needs (Yong, 2016).

## 3. Materials and methods

### 3.1. Design

Data extraction was performed retrospectively from non-computerized medical records of all patients admitted to Code 4 for home care services from 1 January 2000 to 31st December 2009. Two research nurses with gerontology training manually extracted the data using a standardized data collection form specifically designed for the study from January to July 2012. The medical records were kept in the offices of Ren Ci Community Hospital and Code 4 Medical Services (Code 4). Ethics approval for the study was obtained from the National University of Singapore Institutional Review Board. The final sample size obtained for the study was 1,069 patients.

The frequency of most common diagnosis at the time of admission was calculated to provide the information about the clinical characteristics of the study population at the time of admission. To analyse HSU, the first year of admission was divided into four quarters. Home visits were stratified according to their type (scheduled and unscheduled) and according to their profession (doctor, nurse and therapist). Additionally, the frequency of phone calls made by caregivers was also recorded. Most of the phone calls were received by nurses only.

### 3.2. Definitions

We examined three types of encounters patients had with Code 4: scheduled home visits, unscheduled home visits and phone calls. Scheduled visits were defined as pre-planned follow-up visits. The usual frequency of scheduled nurse visits was once every one to two months, depending upon the condition of the patient. Follow-up scheduled visits made by doctor were usually once every three to six months unless more frequent visits were medically warranted. Unscheduled visits were made to address urgent medical condition (e.g. acute high fever, breathlessness, etc.). Phone calls were of two types: those made by caregivers and those made by nurses. Caregivers called when they were uncertain about patients' treatment process or perceived deterioration in their ward's condition. Prior to home visits, nurse called to check whether patients were at home or not. In this study, only phone calls made by caregivers were included during analysis.

### 3.3. Procedure

Initial home visits were usually made by a nurse unless there was a medical urgency which needed to be addressed by doctor. Only a few visits were made by two healthcare professionals at same time (e.g. doctor-nurse and therapist-nurse). The allocation of healthcare professionals for the visit was based on the nature of procedures to be carried out at patients' home.

### 3.4. Statistical analysis

Only 9 patients were re-admitted into Code 4 and rest were admitted only once ( $n = 1060$ ). As this group of patients only formed 0.8% of admissions into Code 4, their second admission data was omitted from subsequent analysis and only first admissions were analysed. Home visits made by two healthcare professionals were merged as follows: doctor-nurse [ $n$  (%); 448 (1.7)] were merged into doctor and those by therapist-nurse [ $n$  (%); 10 (0.0)] were merged into therapist. This was done because the numbers were very small and moreover, nurses generally followed doctors and therapists to assist them.

Descriptive statistics were used to describe the overall population. LOS is a measure of the duration in which patient was served by Code 4. When analyzing LOS, only patients who had  $LOS \geq 30$  days ( $n = 917$ ) were included as those whose geometric mean LOS was  $< 30$  days were felt to be not representative of the typical home medical care patient whose LOS was more than 300 days. As LOS was skewed to the right, it was log transformed and geometric mean was reported. All statistical analyses were performed using SPSS version 20.

Poisson regression model was used to model encounter rates. To account for the correlation of the repeated total number of encounters at each quarter within the first year of admission, we used the generalized estimating equations (GEE) approach (Diggle, Heagerty, Liang, & Zeger, 2002) to fit the Poisson regression and included the offset term to factor in the varying follow-up times across individuals within a quarter. We specified a working correlation using an unstructured correlation matrix and the sandwich estimator was used to obtain robust standard errors. We included the variable, quarter, as a continuous variable to quantify the linear trend of the natural logarithm of the event rate over the four quarters, and reported the incidence rate ratio (IRR) and its corresponding 95% confidence interval (CI).  $P$ -value  $< 0.05$  was considered significant. The overall visit density per quarter was calculated by following formula:

Mean no. visits per patient day per unique patient  $\times$  90 days

## 4. Results

### 4.1. Socio-demographic characteristics

Of the 1,060 patients, 88.4% of patients were greater than 70 years of age, 64.7% were female and 77.8% were Chinese, similar to the national elderly population (Department of Statistics Ministry of Trade & Industry, 2010). 4.3% were single; 34.8% were married and more than half of the patients were widowed (59%). 82.9% of patients were eligible for claiming ElderShield or IDAPE at the time of admission but only 8.3% of patients claimed. 33.2% of patients were staying in 4 rooms HDB (Housing Development Board) flat and 17.1% in 5 room HDB flats. Only 1.8% of the patients were staying

alone, 7.5% with their spouse, 22% with children and 53.3% of the patients with their spouse and children. 58.2% of the patients were primarily cared for by FDWs and 41.8% by their children, spouse or others. 2.5% of patients were on PA or using the MFEC, 49.2% of patients depended on their children, siblings or grandchildren for all medical related expenditures. 4.5% had savings as a source of income. The LOS of patients was calculated in days and the geometric mean of LOS of Code 4 patients was 200.3 days (Mittal et al., 2016) (Table 1).

**Table 1. Socio-demographic, clinical and functional characteristics of study population at time of admission (N = 1,060)**

Characteristics	N (%)
<i>Socio-demographic characteristics</i>	
<i>Age</i>	
>70 years	937 (88.4)
≤70 years	123 (11.6)
<i>Gender</i>	
Male	374 (35.3)
Female	686 (64.7)
<i>Ethnicity</i>	
Chinese	825 (77.8)
Malay/Indian/Eurasian	235 (22.2)
<i>Marital status</i>	
Single	46 (4.3)
Married	369 (34.8)
Divorced	20 (1.9)
Widowed	625 (59.0)
<i>Religion</i>	
Buddhist	358 (33.8)
Taoist	218 (20.6)
Christian	213 (20.1)
Muslim	168 (15.8)
Hindu	26 (2.5)
No religion	44 (4.2)
Others	33 (3.1)
<i>Eldershield/IDAPE<sup>†</sup></i>	
Eligible for claims	879 (82.9)
Eligible but not claiming	656 (74.6)
<i>Housing type</i>	
1–3 rooms HDB flat	332 (31.3)
4 rooms HDB flat	352 (33.2)
5 rooms HDB flat	181 (17.1)
Private/landed property	195 (18.4)
<i>Living arrangement</i>	
Alone	19 (1.8)
With spouse	79 (7.5)
With children	233 (22)
With spouse and children	565 (53.3)

(Continued)

<b>Table 1. (Continued)</b>	
<b>Characteristics</b>	<b>N (%)</b>
Others	164 (15.5)
<i>Primary caregiver</i>	
Foreign domestic worker (FDW)	617 (58.2)
Spouse/children/others	443 (41.8)
<i>Total monthly income range</i>	
PA/MFEC**	27 (2.5)
≤\$2000	235 (22.2)
\$2001–\$3000	128 (12.1)
>\$3000	149 (14.1)
Uncertain***	521 (49.2)
<i>Source of income (savings)</i>	
Yes	48 (4.5)
No	1,012 (95.5)
<i>LOS (days)</i>	
Geometric mean LOS (inter-quartile range) in days	200.3 (613.5)
<i>Clinical characteristics</i>	
<i>Co-morbid conditions</i>	
Chronic lung disease	116 (10.9)
Dementia	507 (47.8)
Heart failure	222 (20.9)
Hemiplegia	277 (26.1)
Hypertension	695 (65.6)
Ischemic heart disease	394 (37.2)
Myocardial infarction	82 (7.7)
Peptic ulcer disease	213 (20.1)
Peripheral vascular disease	104 (9.8)
Stroke	694 (65.5)
<i>Diabetes mellitus</i>	
None	631 (59.5)
Without end organ damage	285 (26.9)
With end organ damage	144 (13.6)
<i>Renal disease</i>	
None	861 (81.2)
Mild	69 (6.5)
Moderate	49 (4.6)
Severe	81 (7.6)
<i>Charlson co-morbidity index</i>	
Mild (1–3)	569 (53.7)
Moderate (4–6)	352 (33.2)
Severe (≥7)	139 (13.1)
<i>Other past medical history</i>	
Parkinson's disease	126 (11.9)

(Continued)

**Table 1. (Continued)**

<b>Characteristics</b>	<b>N (%)</b>
Fractures	357 (33.7)
Arthritis	165 (15.6)
Thyroid disease	84 (7.9)
Falls	343 (32.4)
Depression	321 (30.3)
<i>Pressure ulcers</i>	
Pressure ulcers (yes)	392 (37.0)
Pressure ulcers, mean (SD)	0.75 (1.36)
<i>Oral cavity</i>	
Oral mucous lesions	644 (60.8)
Edentulous	615 (58.0)
Possess dentures	159 (15.0)
<i>Swallowing</i>	
Unable	525 (49.5)
Cough/choke	81 (7.6)
Able without difficulty	454 (42.8)
<i>Mode of feeding</i>	
Oral	540 (50.9)
Naso-gastric tube (NGT)	489 (46.1)
Percutaneous endoscopic gastrostomy (PEG)	31 (2.9)
<i>Per rectal exam</i>	
Faecal impaction	249 (23.5)
Blood	3 (0.3)
Normal soft stools	387 (36.5)
Empty rectum	302 (28.5)
Not done	104 (9.8)
Others	15 (1.4)
<i>Abbreviated mental test score</i>	
Cognitive impaired (score <7 out of 10)	682 (81.5)
<i>Functional characteristics</i>	
<i>Bowels</i>	
Incontinent	835 (78.8)
Occasional accident (<1/week)	46 (4.3)
Continent	179 (16.9)
<i>Bladder</i>	
Incontinent or catheterised	857 (80.8)
Occasional accident (max 1 per 24 h)	45 (4.2)
Continent for over 7 days	158 (14.9)
<i>Grooming</i>	
Needs help	929 (87.6)
Independent (face/ hair/ teeth/ shaving)	131 (12.4)
<i>Toilet use</i>	

(Continued)

**Table 1. (Continued)**

<b>Characteristics</b>	<b>N (%)</b>
Dependent	862 (81.3)
Need help but can do something	122 (11.5)
Independent	76 (7.2)
<i>Feeding</i>	
Unable	792 (74.7)
Needs help	137 (12.9)
Independent	131 (12.4)
<i>Transfer</i>	
Unable	635 (59.9)
Major help	170 (16.0)
Minor help	169 (15.9)
Independent	86 (8.1)
<i>Mobility</i>	
Immobile	860 (81.1)
Wheel chair dependent	19 (1.8)
Walks with the aid of untrained person	96 (9.1)
Independent	85 (8.0)
<i>Dressing</i>	
Dependent	863 (81.4)
Needs help	113 (10.7)
Independent	84 (7.9)
<i>Stairs</i>	
Unable	994 (93.8)
Needs help	37 (3.5)
Independent up and down	29 (2.7)
<i>Bathing</i>	
Dependent	989 (93.3)
Independent	71 (6.7)
<i>Barthel index (BI)</i>	
Totally dependent (BI = 0)	599 (56.5)
Not totally dependent (BI > 0)	461 (43.5)
<i>Mobility aids used during assessment</i>	
None	552 (52.1)
Walking frame	88 (8.3)
Wheel-chair	350 (33.0)
Quad stick	19 (1.8)
Walking stick	8 (0.8)
Other	43 (4.1)

\*Interim disability assistance program for the elderly (IDAPE).

\*\*Public assistance/medical fee exemption card.

\*\*\*Children/siblings or grandchildren were responsible for all medical related expenditure.

#### 4.2. Clinical characteristics

The top ten most common comorbid conditions of the Code 4 patients at admission were hypertension (65.6%); stroke (65.5%), dementia (47.8%), diabetes mellitus (40.5%), ischemic heart disease (37.2%), fractures (33.7%), depression (30.3%), hemiplegia (26.1), heart failure (20.9%) and peptic ulcer disease (20.1%) (Table 1). A third had moderate CCMI scores (4–6) while 13.1% had severe CCMI scores ( $\geq 7$ ). The mean (standard deviation) number of pressure ulcers at the time of admission was 0.75 (standard deviation = 1.36), 60.8% had oral mucous lesions and 49.5% were unable to swallow. 50.9% patients were on oral diet, 46.1% were on nasogastric tube (NGT) feeding and 2.9% were on percutaneous endoscopic gastrostomy (PEG) tube feeding. 23.5% had faecal impaction on admission and 81.5% of patients had an AMT score  $< 7$  (Mittal et al., 2016) (Table 1).

#### 4.3. Functional characteristics

Of the 1,060 patients, 78.8% were bowel incontinent, 80.8% were bladder incontinent, 87.6% needed help in grooming, 81.3% were dependent for toilet use, 74.7% were unable to feed themselves, 59.9% were unable to transfer, 81.1% were immobile, 81.4% were dependent for dressing, 93.8% were unable to climb stairs and 93.3% were dependent for bathing. More than half of the patients (56.5%) had Barthel Index score = 0 (i.e. totally dependent) at the time of admission (Mittal et al., 2016) (Table 1).

#### 4.3. Healthcare service utilization of study population

Total scheduled visits done by doctor, nurse and therapist in the first year after admissions into Code 4 were 2275 (30.8%), 4494 (60.8%) and 619 (8.4%) respectively. Total unscheduled visits done by doctor, nurse and therapist were 594 (50.1%), 587 (49.6%) and 3 (0.3%) respectively. Phone calls received by doctors, nurses and therapists were 124 (2.1%), 5806 (97.8%) and 3 (0.1%) respectively (Table 2).

Among 461 (43.5%) patients who left the home care service during first six months of admission, 325 (30.7%) were due to death and 136 (12.8%) were discharged from the service. Mean number of days patient were under home care service in each quarter decreased from first to fourth quarter (76 to 43). The frequency of all types of HSU was highest during first quarter and declined towards fourth quarter of admission. From first to fourth quarter, scheduled visits decreased from 3,524 to 1,000, unscheduled visits from 543 to 175, phone calls from 2,808 to 737, doctor visits from 1,755 to 331 nurse visits from 4,855 to 1,483 and therapist visits from 268 to 97 (Table 3 and Figure 1).

The mean encounter density per quarter for HSU also decreased from first to fourth quarter of admission: scheduled visits (4.5–0.9), unscheduled visits (0.9–0.0), phone calls (4.5 to 0.9), doctor encounters (2.7–0.0), nurse encounters (7.2–1.8) and therapist encounters (0.002–0.000) (Table 4).

**Table 2. Total number of encounters stratified by type and profession during first year of admission**

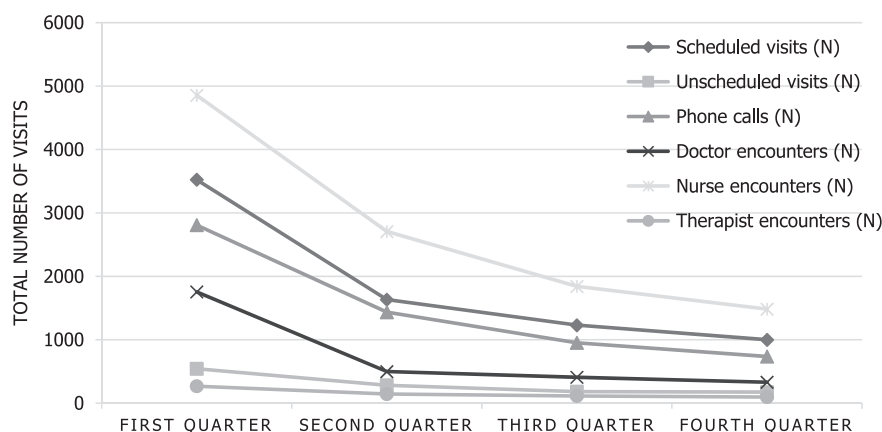
Professional group	Encounters, N (%)			
	Scheduled visits	Unscheduled visit	Phone calls	Total
Doctor	2,275 (30.8)	594 (50.1)	124 (2.1)	2,993 (20.6)
Nurse	4,494 (60.8)	587 (49.6)	5,806 (97.8)	10,887 (75.1)
Therapist	619 (8.4)	3 (0.3)	3 (0.1)	625 (4.3)
Total	7,388 (100)	1,184 (100)	5,933 (100)	14,505 (100)



**Table 3. Overall trend of healthcare service utilization during first year of admission**

	First quarter N = (1,060)	Second quarter (N = 756)	Third quarter (N = 599)	Fourth quarter (N = 512)
Patients discharged, n (%)	75 (7.1)	61 (5.7)	31 (2.9)	17 (1.6)
Patients died, n (%)	229 (21.6)	96 (9.1)	56 (5.3)	50 (4.7)
No. of days patients were in home care service in each quarter (Mean)	76	58	49	43
Total scheduled visits, n (Mean per quarter)	3,524 (3.32)	1,634 (1.54)	1,230 (1.16)	1,000 (0.94)
Total unscheduled visits, n (Mean per quarter)	543 (0.51)	283 (0.27)	183 (0.17)	175 (0.17)
Total phone calls, n (Mean per quarter)	2,808 (2.65)	1,436 (1.35)	952 (0.90)	737 (0.70)
Total doctor encounters, n (Mean per quarter)	1,755 (1.65)	498 (0.47)	409 (0.38)	331 (0.31)
Total nurse encounters, n (Mean per quarter)	4,855 (4.58)	2,707 (2.55)	1,842 (1.74)	1,483 (1.40)
Total therapist encounters, n (Mean per quarter)	268 (0.25)	145 (0.14)	115 (0.11)	97 (0.09)

**Figure 1. Overall trend of healthcare service utilization during first year of admission.**



There was a significant linear decline in encounter density from first to fourth quarter of admission for all types HSU: scheduled visits [IRR (95% CI), 0.77 (0.75–0.79)], unscheduled visits [IRR (95% CI), 0.82 (0.75–0.86)], phone calls [IRR (95% CI), 0.77 (0.74–0.81)], doctor encounters [IRR (95% CI), 0.64 (0.61–0.68)] and nurse encounters [IRR (95% CI), 0.81 (0.78–0.83)] (Table 5). Although therapist encounter density decreased from first to fourth quarter, the decline was not statistically significant [IRR (95% CI), 0.61 (0.28–1.32)].

**Table 4. Mean visits density (visits per patient day per unique patient × 90 days) of healthcare service utilization during first year of admission**

First admissions	First quarter	Second quarter	Third quarter	Fourth quarter
Scheduled visit density	4.5	1.8	0.9	0.9
Unscheduled visit density	0.9	0.0	0.0	0.0
Phone call density	4.5	1.8	0.9	0.9
Doctor encounter density	2.7	0.9	0.0	0.0
Nurse encounter density	7.2	3.6	1.8	1.8
Therapist encounter density	0.002	0.001	0.004	0.000

**Table 5. Linear trend of healthcare service utilization during first year of admission**

Type of healthcare service utilization	Incidence rate ratios per quarter (95% CI)	p-Value
Scheduled visits	0.77 (0.75–0.79)	<0.001
Unscheduled visits	0.82 (0.75–0.86)	<0.001
Phone calls	0.77 (0.74–0.81)	<0.001
Doctor encounters	0.64 (0.61–0.68)	<0.001
Nurse encounters	0.81 (0.78–0.83)	<0.001
Therapist encounters	0.61 (0.28–1.32)	0.21

## 5. Discussion

We believe this is the first detailed study in the world which reports the trend of HSU of patients admitted into a multi-disciplinary home medical service during their first year of admission. In our previous publication we explained the sociodemographic, clinical and functional characteristics of Code 4 patients in detail (Mittal et al., 2016). Majority of Code 4 patients were greater than 70 years of age and nurse visits were more frequent compared to doctor and therapist. Nurses, in Code 4 perform comprehensive geriatric assessment and liaise with doctors to perform healthcare plan. They function as a primary care manager and hence most of the visits were conducted by nurses. Code 4 doctors' prepare a treatment plan, addresses urgent medical needs such as high fever or breathlessness and alter the medications if needed. It should be noted that doctor visits are comparatively costlier than nurses and therapist visits. Hence, to avoid financial burden on informal caregivers, Code 4 doctors' visits patients with higher medical needs. The role of therapist in Code 4 is to address the safety concerns that may not be apparent in facility-based rehabilitation and instruct patients on how to use durable medical equipment to facilitate performance of activities of daily living (ADLs) within their own home environment. Besides their pivotal role in home healthcare, the recruitment and the funding of therapists, especially in home health, remains a challenge in Singapore as it is in the United States of America (Coke, Alday, Biala, Luna, & Martines, 2005). This may be one of the reasons why there are fewer therapist visits compared to doctors and nurses.

The common diagnoses at the time of admission were stroke, dementia and diabetes mellitus which is similar to those in Western countries (Sørbye, Finne-Soveri, Ljunggren, Topinkova, & Bernabei, 2005). As the population continues to age, the prevalence of chronic diseases will likely to increase and will need more long term healthcare resources. However, the shortage of healthcare resources to deliver primary care is a major issue worldwide. Task shifting is one of the option discussed by WHO (Task Shifting to Tackle Health Worker Shortages, 2007) to strengthen the workforce and rapidly increase access to healthcare resources, and has been implemented in several countries (Task Shifting: Global Recommendations & Guidelines, 2008). In addition, recent reviews of primary care interventions to manage high healthcare need patients emphasize that patients preferences, functional disabilities and prognosis should be considered while developing care plans (American Geriatrics Society Expert Panel on the Care of Older Adults with Multimorbidity, 2012; Grant, Adams,

Bayliss, & Heisler, 2013). Such policies in Singapore may alleviate the shortage of healthcare professionals involved and improve quality of home medical care delivered to the elderly population.

Overall HSU was higher during first quarter and declines thereafter to the fourth quarter. Increased HSU during first quarter may be because family members/caregivers experience the most stress after the patient is discharged from hospitals following a new illness or deterioration in their medical conditions (Report on the Ageing Population, 2006). Thus, when a patient is transferred to home medical service, extra care and medical attention is needed at the beginning. Moreover, family members/primary caregivers need time to adapt mentally and physically to meet the healthcare needs of their ward. Furthermore, almost one third of the population died during first quarter of their admission in home care service. Given the frailty and clinical condition of these patients it indicates that they were already eligible for nursing home or hospice care. Besides this Code 4 helped the patients to die with dignity at their own homes. Declining HSU after first quarter is most likely because either patient became more stable and required less medical attention or the patient/family members gradually became more confident with caring for the patient at home, reducing the necessity of encounters (Grumbach, Keane, & Bindman, 1993). Our findings also indicate that first three months are critical for home medical service with regards to allocation of healthcare resources. Further analysis should be done to determine the predictors of HSU, especially during first three months of admission to home medical service. A study done in Malaysia showed that a lack of confidence in community and home based medical services for elderly care lead to higher proportion of older adults attending emergency departments (Mohd Mokhtar, Pin, Zakaria, et al., 2014). These findings suggest that although there was higher HSU during first quarter of admission in present study, but may also reduce overcrowding of emergency departments in hospitals. Unfortunately, Code 4 medical records do not routinely capture information on emergency department visits. Further research should be done to assess the impact of home medical care on the utilization of emergency departments by elderly in Singapore.

Each country has different definition of home care, and the service provided by home care agencies varies according to the needs of older population. For example, in Australia during 2007–2008; out of the total assessments made by Home and Community Care (HACC), 31% of clients needed domestic assistance including house cleaning, washing and ironing, help with shopping, transport to and from banks and appointments, etc. (Australian Government Department of Health & Ageing, 2008). Hence, it was difficult to compare the findings of present study with Western countries.

There are a few limitations in our study. Data in this study was retrospective and limited to the 2000–2009 period, and hence may not reflect the current situation. Since then, there have been several additional measures adopted by Code 4 to improve their services across years; most notably 24 h emergency service. Moreover, the present study is not representative of the entire home care population of Singapore because these findings were based on only one home care provider in Singapore (the others being Hua Mei Mobile Clinic (Tsao Foundation), Home Nursing Foundation (HNF) and Touch Home Care). Different countries have varied definitions and standards of home care for elderly. Hence, it is difficult to compare the HSU with other studies conducted in different countries. Nevertheless, based on same ageing scenario in all countries, these findings should be helpful for policy makers during financial planning for home medical care provision.

## 6. Conclusion

Emphasis on caring for elderly in their own homes has gained momentum across healthcare systems in the developed world (Aronson & Neysmith, 1996). Our study showed that there was a significant decline in HSU from first to fourth quarter from the date of admission into a home medical service from 2000 to 2009. The knowledge of these trends may help governments more accurately project resources needed for home medical services, a strategy to help elders to “age in place”.

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### Competing Interests

The authors declare no competing interest.

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### References

- American Geriatrics Society Expert Panel on the Care of Older Adults with Multimorbidity. (2012). Guiding principles for the care of older adults with multimorbidity: An approach for clinicians. *Journal of the American Geriatrics Society*, 60, E1–25.
- Ansah, J. P., Eberlein, R. L., Love, S. R., Bautista, M. N., Thompson, J. P., Malhotra, R., & Matchar, D. B. (2014). Implications of long-term care capacity response policies for an aging population: A simulation analysis. *Health Policy*, 116, 105–113. <http://dx.doi.org/10.1016/j.healthpol.2014.01.006>
- Aronson, J., & Neysmith, S. M. (1996). "You're not just in there to do the work!": Depersonalizing policies and the exploitation of home care workers' labor. *Gender and Society*, 10, 59–77. <http://dx.doi.org/10.1177/089124396010001005>
- Australian Government Department of Health and Ageing. (2008). *Home and Community Care Program Minimum Data Set 2007–08 Annual Bulletin*. Canberra: Author.
- Coke, T., Alday, R., Biala, K., Luna, S., & Martines, P. (2005). The new role of physical therapy in home care. *Home Healthcare Nurse: The Journal for the Home Care and Hospice Professional*, 23, 594–599. <http://dx.doi.org/10.1097/00004045-200509000-00012>
- Department of Statistics Ministry of Trade and Industry. (2010). *Census of population 2010 statistical release 1: Demographic characteristics, education, language and religion—key indicators of the resident population*. Singapore: Author.
- Diggle, P., Heagerty, P., Liang, K. Y., & Zeger, S. (2002). *Generalized estimating equations, binary responses, marginal models*. In *analysis of longitudinal data* (2nd ed.). Oxford: Oxford University Press.
- Gan, K. (2012). *MOH 2012 Committee of Supply speech Healthcare 2020: Improving accessibility, quality and affordability for tomorrow's challenges*. Singapore: Singapore Ministry of Health.
- Grant, R. W., Adams, A. S., Bayliss, E. A., & Heisler, M. (2013). Establishing visit priorities for complex patients: A summary of the literature and conceptual model to guide innovative interventions. *Healthcare*, 1, 117–122. <http://dx.doi.org/10.1016/j.hjdsi.2013.07.008>
- Grumbach, K., Keane, D., & Bindman, A. (1993). Primary care and public emergency department overcrowding. *American Journal of Public Health*, 83, 372–378. <http://dx.doi.org/10.2105/AJPH.83.3.372>
- Kanchanachitra, C., Lindelow, M., Johnston, T., Hanvoravongchai, P., Lorenzo, F. M., Huong, N. L., ... dela Rosa, J. F. (2011). Human resources for health in southeast Asia: Shortages, distributional challenges, and international trade in health services. *The Lancet*, 377, 769–781. [http://dx.doi.org/10.1016/S0140-6736\(10\)62035-1](http://dx.doi.org/10.1016/S0140-6736(10)62035-1)
- Mittal R, Young M, Tan C, Chen C, Tham W. Y., Seong L. P., ... Koh G. C. H. (2016). Trends of patients' characteristics admitted into a multi-professional home medical care service from 2000 to 2009 in Singapore. *Home Health Care Management & Practice*. doi:10.1177/1084822316662196
- Mohd Mokhtar, M. A., Amin, M, Pin, T. M., Zakaria, M. I., Hairi, N. N., Kamaruzzaman, S. B., ... Hua, P. P. J.. (2014). Utilization of the emergency department by older residents in Kuala Lumpur, Malaysia. *Geriatrics & Gerontology International*, 15, 944–950.
- Older Singaporeans to double by 2013. (2016). Retrieved October 06, 2016, from <http://population.sg/articles/older-singaporeans-to-double-by-2030>
- Report on the Ageing Population. (2006). Retrieved February 25, 2016, from [http://app.msf.gov.sg/Portals/0/Summary/research/CAI\\_report.pdf](http://app.msf.gov.sg/Portals/0/Summary/research/CAI_report.pdf)
- Schulz, E., Leidl, R., & König, H.-H. (2004). The impact of ageing on hospital care and long-term care—The example of Germany. *Health Policy*, 67, 57–74. [http://dx.doi.org/10.1016/S0168-8510\(03\)00083-6](http://dx.doi.org/10.1016/S0168-8510(03)00083-6)
- Sørbye, L. W., Finne-Soveri, H., Ljunggren, G., Topinkova, E., & Bernabei, R. (2005). Indwelling catheter use in home care: Elderly, aged 65, in 11 different countries in Europe. *Age Ageing*, 34, 377–381.
- Task Shifting: Global Recommendations and Guidelines. (2008). Retrieved February 18, 2016, from <http://www.who.int/healthsystems/TTR-TaskShifting.pdf?ua=1>
- Task Shifting to Tackle Health Worker Shortages. (2007). Retrieved February 18, 2016, from [http://www.who.int/healthsystems/task\\_shifting\\_booklet.pdf](http://www.who.int/healthsystems/task_shifting_booklet.pdf)
- Thumé, E., Facchini, L. A., Wyshak, G., & Campbell, P. (2011). The utilization of home care by the elderly in Brazil's primary health care system. *American Journal of Public Health*, 101, 868–874. <http://dx.doi.org/10.2105/AJPH.2009.184648>
- TNS Opinion & Social. (2007). *Health and long-term care in the European Union*. Brussels, European Commission, Special Eurobarometer 283/Wave 67.3.
- Yong, G. K. (Speaker). (2016, August 20). *Futurescape: Home Healthcare—Local and International Perspectives*. Singapore: Ministry of Health, at Home Nursing Foundation.



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