

# Telegeriatrics

## *A Pilot Project to Reduce Unnecessary Hospital Admissions of Nursing Home Residents in Singapore*

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**Abstract:** Geriatric specialists have been scarce in Singapore and this has drawn attention to a rising need in providing quality care for the ageing society. Access to geriatric care could decrease nursing home to acute hospital transfers, thus improving residents' quality of life. A pilot project implemented by an acute hospital in Singapore aims to use videoconferencing systems to improve access to geriatric specialist care for nursing homes and thereby reduce unnecessary acute hospital admissions. We aim to assess the impact of the level of engagement with Telegeriatrics has on nursing home to hospital transfer rates. Two nursing homes were recruited from December 2010 to March 2014. A total of 379 telemedicine consultation episodes were conducted over this period. Hospital admission rates were monitored over a 2-year period and compared against the nursing home's level of engagement with Telegeriatrics. The more-engaged nursing home reported a significant decrease of 29% in hospital admission rates. In contrast, the less-engaged nursing home only reported a 6% decrease. The findings show a reduction in hospital admission rate for both nursing homes. When the two nursing homes were compared, the nursing home that was more engaged with Telegeriatrics had a lower rate of unnecessary hospital admission. Telegeriatrics has the potential to reduce unnecessary hospitalisation frequently experienced by nursing home residents. Furthermore, a decrease in hospital readmission rates enables hospital beds to be better utilised, reduces medical spending and relieves residents' distress.

## 1 INTRODUCTION

Older people often require complex healthcare treatment which may include hospitalizations. However, several studies have shown that a large percentage of people aged 65 years and above were sent to hospitals for potentially preventable conditions (Kim, et al., 2001; Wolff et al., 2002).

Singapore faces a rapidly ageing population and a greater prevalence of chronic diseases (Cheah and Heng, 2001; Cheah, 2001). Frequent hospitalizations of nursing home (NH) residents is a growing concern in Singapore as they result in increased healthcare costs, hospital-acquired infections, complications and morbidities. Furthermore, the hospitalizations exert pressure to the healthcare system's problem of severe bed crunch (Tan, 2013). Therefore, interventions involving frail NH residents

are needed to reduce unnecessary hospital admissions while improving quality of care.

The specialized field of geriatrics has improved diagnosis and treatment of common geriatric problems such as falls (Tinetti et al., 1994), urinary incontinence<sup>8</sup>, and delirium (Inouye, 1999). In order to develop comprehensive care plans for frail elderly, geriatricians also address social issues like economic and demographic issues, lifestyle choices, social isolation, and caregiver stress. Assessing and considering these factors into an integrated plan of care result in reduced rates of hospitalization, with some studies suggesting a reduction in medical care spending (Day and Rasmussen, 2004; Ellis et al., 2011).

Currently, care of NH residents is largely provided by the nursing staff and supplemented by occasional visits by general practitioner. Lack of

geriatric specialist care has led to sub-optimal care and potentially preventable NH to acute hospital transfers (Ouslander et al., 2009).

Videoconferencing is a possible method to provide telemedicine (Moehr et al., 2005; Casavant et al., 2014) and tele-education (Graham, 2002; Pedley, 2003). Telegeriatrics is an acute hospital's initiative to extend care from the acute hospital to the NHs in the northern part of Singapore. Initiated in December 2010, Telegeriatrics enabled the acute hospital to deliver geriatric medical care to two partnering NHs via videoconferencing. The aim of this intervention is to promote early identification of potential medical problems in NH residents so that appropriate and timely medical interventions can be carried out. Early medical interventions can reduce the deterioration of medical conditions and non-urgent use of emergency departments. In order to achieve this aim, two main approaches are used in Telegeriatrics: telemedicine consultation and Telegeriatrics Nurse Training Course (TNTC).

Telemedicine consultation is a live, interactive video technology that allows the NH nurse and resident to communicate with the geriatrician remotely. TNTC is a 9-months course that aims to enhance the knowledge and skills of NH nurses to carry out telemedicine-specific duties and improve the management of medical conditions. Activities that are necessary for the proper governance of NHs, for example, multidisciplinary meetings and mortality audits, are conducted regularly through the videoconferencing system.

This study was conducted to assess whether increased level of engagement with Telegeriatrics translates to lower hospital admissions.

## 2 METHODS

### 2.1 Ethics Approval

Ethics approval was obtained from the National Healthcare Group Domain Specific Review Board (DSRB).

### 2.2 Recruitment & Setting

Over the study period from December 2010 to March 2014, two non-profit NHs agreed to participate in the study. They were selected as they had existing partnership with the acute hospital.

*NH1* began its partnership with the acute hospital in December 2010 while *NH2* joined in April 2012. During the study period, both NHs were not

involved in any other interventions related to reducing residents' hospital admissions.

### 2.3 Telemedicine Consultation

The technology involved in this project included software, hardware, and infrastructure setups. The equipments used for carrying out two-way videoconferencing included a high-resolution camera and high-definition video monitor installed in the acute hospital and the two NHs. These equipments were mounted on a portable trolley enabling telemedicine consultations at different locations. For example, residents on wheelchairs are wheeled to the consultation room while bed-bound residents will have telemedicine consultations by their beds.

Before consultation, the TNTC-trained nurse identifies residents requiring specialist care for consultation. During consultation, the nurse presents the residents to the geriatrician, and conducts basic clinical assessments on the residents. The geriatrician discusses the medical problems with the nurse and recommends a treatment plan. The telemedicine consultation is documented in a telemedicine consultation form. After consultation, the form is endorsed by the geriatrician and emailed to the NH so that the nurses can follow up with the treatment plan. The form is then filed in the resident's case notes.

### 2.4 Continuous Nurse Training & Education

Before telemedicine consultations can be carried out, selected registered nurses from the NHs have to undergo the TNTC to equip them with the necessary skills and knowledge. This course is conducted by the acute hospital's clinical educators. The TNTC includes early identification of changes in residents' medical condition; presenting and documenting residents' case history in a systematic way; and management of basic medical conditions.

In addition, as a part of continuing nursing education, multidisciplinary meetings were held among the geriatrician, the TNTC-trained nurses, and other healthcare professionals. The purpose is to promote discussions and knowledge-sharing on the diagnostics and treatment aspects of resident care, allowing for collective, evidence-based recommendations, for better resident management.

In a mortality audit session, the geriatrician and the nurses review deaths of particular residents to identify and evaluate deficiencies of care in

practices, and make recommendations for improvement.

### 2.5 Data Collection

We measured and compared the hospital admission rate of two NHs from December 2010 to March 2014. The hospital admission rate was measured at two points: before joining Telegeriatrics and 2 years after joining Telegeriatrics. Hospitalization rates were obtained from the monthly data sent by the NHs to the acute hospital. Other data including demographics, health data and consultation details were collected from the Resident Assessment form (RAF), resident case notes and telemedicine consultation form.

### 2.6 Statistical Analyses

Factors that affect the NH’s extent of engagement with Telegeriatrics include number of scheduled and ad-hoc telemedicine consultations, multidisciplinary meetings and mortality audits. We defined the NH with the higher number of telemedicine-related activities as “more-engaged”, and the other NH as “less-engaged”.

In examining NH residents’ hospitalizations, a comparison of hospital admission rates before and during intervention was conducted. Univariate analysis was performed to study the differences between the more-engaged and the less-engaged NH. We also investigated whether the factors that influenced the level of engagement with telemedicine had any impact on the NH’s hospital admission rates.

Data was analyzed using SPSS version 22.0 for Windows (SPSS Inc., Chicago, IL, USA).

## 3 RESULTS

A total of 379 episodes of telemedicine consultation were conducted for 198 unique residents during the study period. The average consultation time per resident is 22 minutes (range 5-75 minutes). In 90% of the consultations, the resident had multiple comorbidities. Polypharmacy was present in 35% of the consultations. Recent history of admission (within the last 6 months) was present in 34%. The demography of residents who have undergone telemedicine consultation is summarised in Table 1.

The average age of residents of the two NHs requiring specialist telemedicine consultations was 75 years (range 15-103), with 78% aged 65 years

Table 1: Demography of residents (N = 198).

Characteristic	NH1 (N=101)	NH2 (N=97)
<b>Gender</b>		
Female	65 (64%)	38 (39%)
<b>Race</b>		
Chinese	87 (86%)	69 (71%)
Malay	5 (5%)	12 (12%)
Indian	4 (3%)	16 (16%)
Others	5 (5%)	0 (0%)
<b>Functional Category</b>		
I	0 (0%)	1 (1%)
II	3 (4%)	5 (5%)
III	46 (45%)	49 (51%)
IV	52 (51%)	42 (43%)

and older. Their average length of stay in the NH was 35 months (range 1-275). Majority were Chinese, and almost all belonged to the functional category III and IV. NH residents’ physical, psychological, social and emotional needs are assessed using the RAF and classified into 4 functional categories from I to IV. Those in category I are the least dependent on others for care while category IV residents are fully dependent on others for care.

Table 2: Factors affecting the level of Telegeriatrics engagement.

Factors	NH1	NH2
Scheduled consultations	72	52
Ad-hoc consultations	17	8
Residents seen at scheduled consultations	207	147
Residents seen at ad-hoc consultations	17	8
Multidisciplinary meetings	18	3
Cases reviewed during multidisciplinary meetings	37	4
Mortality audits	15	7
Cases reviewed during mortality audits	39	12

Table 2 presents the factors affecting the NH’s engagement level with Telegeriatrics. NH1 carried out more telemedicine-related activities when compared to NH2. Significant differences were found in factors such as the number of scheduled telemedicine consultation sessions, residents who have undergone telemedicine consultation and cases reviewed during multidisciplinary meetings.

The presenting complaints that led to telemedicine consultations are presented in Table 3.

The overall ranking of presenting complaints reveals that dementia-related behavioural problems

Table 3: Most common presenting complaints referred for telemedicine consultations.

<b>NH1 Presenting Symptom (%)</b>	<b>NH2 Presenting Symptom (%)</b>
Behavioural problem (32)	Behavioural problem (27)
Medication review (18)	Medication review (14)
Skin lesion / rash (8)	Management review (8)
Fever (6)	Oedema (7)
Poor appetite (4)	Skin lesion / rash (6)

were perceived by the nurses to be the most unmanageable. It was the top presenting problem referred for specialist telemedicine consultations.

The next most frequently referred presenting problem by the NHs was medication review. In a study conducted in NHs in Singapore (Mamun, 2004), a high prevalence of polypharmacy and inappropriate medication use is observed in the NHs. The current practice of medication use in the NHs may lead to adverse drug reactions and interactions. Review of medication on a timely basis is therefore a good practice for the geriatricians to adopt to reduce polypharmacy (Walsh and Cussen 2010; Finkers et al., 2007).

Skin-related problems such as rashes and cellulitis were also referred by the NHs for consultations. The other common presenting complaints were different for the two NHs. *NH1* prioritized fever and poor appetite as concerns which required specialist consultation, while the *NH2* tend to seek consultations for a follow-up review of previous management and oedema.

The most common diagnoses made by the geriatricians during telemedicine consultations are shown in Table 4.

Table 4: Most common category of primary diagnoses in telemedicine consultations.

<b>NH1 Diagnosis Category (%)</b>	<b>NH2 Diagnosis Category (%)</b>
General (31)	General (26)
Neurologic (23)	Psychiatric (19)
Skin rash (17)	Infectious (17)
Psychiatric (13)	Neurologic (12)
Neoplastic (7)	Skin rash (7)

The most common category of primary diagnoses made in telemedicine consultations for both NHs was general (mainly poor appetite, muscular pain, constipation, and nausea).

The other common diagnoses were neurologic-related (mainly vascular dementia and Alzheimer’s disease), psychiatric-related (mainly depression and anxiety) and skin rash. Other conditions in the NHs were more commonly diagnosed as infectious-

related (mainly cellulitis, infected wound and pressure ulcer), and neoplastic (mainly metastatic lung cancer).

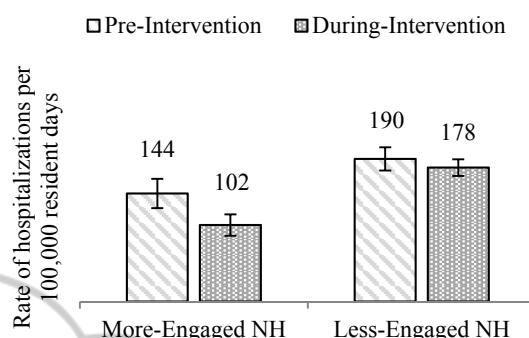


Figure 1: Average monthly rate of hospitalizations per 100,000 resident days.

The average monthly hospitalization rate for *NH1* before joining Telegeriatrics was 144 per 100,000 resident-days (Figure 1). At two years after joining Telegeriatrics, the hospitalization rate had significantly decreased by 29%. In *NH2*, a 6% decrease in hospitalization rate was observed 2 years after joining Telegeriatrics ( $P>0.01$ ).

## 4 DISCUSSION

*NH1* is categorized as “more-engaged” as it had a higher number of telemedicine-related activities, and *NH2* as “less-engaged”.

We observed a statistically significant effect with the use of telemedicine on hospitalization rates in the more-engaged NH. Similarly, in a study<sup>9</sup> where the 4 more-engaged skilled nursing facilities were compared with 2 less-engaged ones, a significant decline was found in the hospitalization rate of the more-engaged facilities. The hospitalization rate for non-engaged facilities was very similar to that of the control facilities. Hence, it is likely that if NHs were to be less engaged in the intervention, they appear to perform like NHs which were never exposed to the intervention.

Telemedicine may contribute towards achieving the goal of improving clinical care. Its potential role in addressing issues arising from an ageing population, chronic conditions and rising healthcare costs has been emphasized by the European healthcare community (European Commission, 2009). Studies have demonstrated that the use of telemedicine in accessing care improves quality of patient monitoring, and reduces hospitalizations and

emergency department visits (Smart, 2011; Vander Werf, 2004; Taylor et al. 2014). A study conducted by the U.S. Department of Veteran Affairs (VA) on 281 patients with chronic illnesses demonstrated a significant reduction in emergency department visits and hospitalizations. Furthermore, there were high levels of patient satisfaction and improved perceptions of physical health (McLean et al., 2012).

The two NHs were scheduled for a weekly consultation session and a bi-weekly session of multidisciplinary meeting and mortality audit during the study period. There was no restriction to the number of cases that can be referred to the geriatrician for each of these sessions. The less-engaged NH referred fewer cases to each session and during the last 3 months of the study period, there was no telemedicine consultation session due to cancellation initiated by the NH. However, the more-engaged NH carried out consultations as per normal. Also, shortly after the start of Telegeriatrics, the less-engaged NH experienced a change in management and three TNTC-trained nurses resigned. The new management was not actively engaged in Telegeriatrics. For the more-engaged NH, there was no management and nurse turnover over the course of Telegeriatrics. Many struggling telemedicine programme innovators did not realize that technology implementation is a social process and requires the personnel in following through the programme. The presence of a leader who can manage day-to-day operations and encourage staff acceptance is the key to achieve desired changes in practice and targeted outcomes<sup>25</sup>. A study showed that the leading reason for successful adoption of telemedicine was that the support team had actively identified barriers and found ways to address them (Ellis et al., 2001). The programme champions devoted time and effort in garnering resources for consistent improvement and innovation, and encouraging staff adoption (Chaiyachati et al., 2014).

The results of this study must be interpreted with care because of its small sample size and lack of randomization. However, this study provided preliminary results from a comparison between a more-engaged NH and a less-engaged NH. Hence, it can be tested more rigorously with enrollment of larger, randomized and more diverse sample of NHs. Also, a control NH that did not receive telemedicine consultations or received face-to-face consultations was not included.

This study did not include unmeasured confounding factors that could influence the level of engagement of the NHs with Telegeriatrics. Thus, the differences in hospitalizations observed between

more- and less-engaged facilities may not be of significance, after adjusting for these unmeasured factors.

Also, in this study, reduced hospitalizations were regarded as the primary positive outcome of the Telegeriatrics. Other telemedicine-related outcomes such as the health-related quality of life and functional status, and resident satisfaction with care were not measured.

## 5 CONCLUSIONS

This pilot project showed promise for reducing unnecessary hospital admissions among NH residents. The early identification of clinical issues and access to specialist support provided alternatives to hospital care. By doing so, it could potentially contain costs while optimizing resident outcomes.

It is observed from this study that increased engagement with telemedicine could be fundamental in preventing unnecessary hospitalizations. Savings from hospitalizations were only apparent in the NH that had a greater usage of telemedicine (Grabowski and O'Malley, 2014). The intervention, even when made available to the NH, does not guarantee the NH staff's active involvement. Telemedicine providers will have to put in further efforts to encourage engagement from the NHs. The successful adoption of technological-related interventions was reported to be generally due to continuous support and comprehensive guidance from the management (Moehr et al., 2006; Murray et al., 2011). A team of skilled and knowledgeable NH staff who work effectively together is crucial to sustain the operations of using telemedicine, in order to manage current and future influences.

Further work would be to measure the quality outcome indicators, in order to better comprehend the intrinsic value of distance support. These indicators should measure mortality, cost savings, and user satisfaction with the programme. Further research is needed to qualitatively look into how the NH users perceived Telegeriatrics and the barriers that they face, which could potentially affect the NH's engagement level with Telegeriatrics.

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