RESEARCH

Predictors of nursing home conveyances to emergency department

Keerthana[1*], Yee Har Liew[1], Mui Hua Jean Lee[2,3] and Chong Yau Ong[2]

Abstract

Background With increasing rates of patient conveyances from nursing homes to emergency departments worldwide, we aim to examine factors causing high rates of conveyances from nursing homes to the emergency department (ED) of an acute tertiary hospital.

Methods This was a prospective study involving presentation of ED attendances from nursing home residents during out-of-hours over a 23-month period from April 2020 to February 2022. Data was collected from a standardized manual form used by the Emergency Department to document nursing home conveyances.

Results A total of 338 pre-conveyance forms were reviewed. The most common reasons for conveyances to ED were neurological symptoms (16%), unstable hemodynamics (12%), fever (11%) and falls (10%). The peak conveyances occurred between 1600 and 1900 h on weekends. Respiratory rate, oxygenation requirements and high National Early Warning Score (NEWS) were significantly associated with increased conveyances to the emergency department. When the components of NEWS were analyzed individually, decision for ambulance conveyance to emergency department was significantly associated with respiratory rate ($p < .001$), oxygen saturation ($p < .001$), and the use of oxygen supplementation ($p < .005$).

Conclusions Unstable hemodynamics and falls were among the leading factors for nursing home conveyances to the emergency department, which highlights the need to implement better fall prevention strategies and standardized parameters monitoring in nursing homes. Future research should focus on outcomes of conveyances and the characteristics of nursing home with higher conveyance rates. This would aid to assess the appropriateness of conveyances and to identify strategies to decrease preventable conveyances.

Keywords Conveyances, Emergency department, Nursing homes, Predictors, Transfers

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Introduction

Emergency departments (ED) worldwide are confronted with increasing numbers of patients annually. Singapore is no exception. In 2022, there was a 14.9% increase in attendance rates to EDs from 2021 [1]. The higher rates of attendance have been attributed to various factors like ageing population and increased life expectancy. Chronic diseases, malignancies and frailty are more prevalent in the elderly population [2–5]. Greater influx of patients has led to longer waiting times and poorer health outcomes [6]. Studies have shown that excessive waiting times in EDs are associated with increased risks of death and subsequent hospital admissions [7, 8].

Nursing home residents have been recognized as one of the groups within the growing global patient population [9]. This is because the older population in nursing homes has poorer baseline health status with greater need of psychosocial support and there is inadequate training and staffing in nursing homes. The ED conveyances can lead to adverse consequences such as nosocomial infections, delirium, functional decline, and increased costs [10]. Moreover, several studies have highlighted the potential preventability of nursing home conveyances to EDs [11–13].

There are no studies on the prevalence of conveyances from nursing homes in Singapore. However, ED conveyances led to unplanned hospitalization rate of 1.53 per 1000 resident days in a nursing home in Singapore [14]. With a rapidly aging population and increasing demand for nursing home care in Singapore, it is pivotal to examine the frequency and appropriateness of nursing home conveyances to EDs.

In Singapore, various interventions have been executed. These include teleconsults with geriatricians or EDs, visits by general practitioners, increased access to specialists and advanced care planning discussions [15–17]. Clinical care pathways have been instituted in nursing homes to guide nursing staff on managing common conditions and to minimize inappropriate admissions [18]. Though these interventions had shown reductions in hospital conveyances, ED attendances still remained significant. This accentuates that there are systemic issues within nursing homes that need to be addressed.

The purpose of this research paper is to further explore the issue of nursing home conveyances to EDs in Singapore. This paper aims to examine the predictors and patterns of out-of-hours nursing home referrals to an ED in Singapore. Through this, we hope to identify potential interventions that can be implemented to reduce potentially preventable conveyances. Some potential research questions that can be explored include: (1) What is the demographic profile of nursing home residents who are frequently transferred to EDs in Singapore? (2) What are the common reasons for nursing home conveyances to EDs in Singapore? (3) What are the peak hours of conveyance?

To date, there has been a scarcity of studies on nursing home conveyances to EDs in Singapore. Consequently, conducting research on this subject is crucial to enhance the quality of care for nursing home residents and identify effective interventions to reduce potentially preventable conveyances.

Methods

Study setting and population

Sengkang General Hospital (SKH) is a 1000-bed tertiary hospital in the northeast of Singapore. Operating since August 2018, it serves mainly the population of northeast Singapore which accounts for 16 to 17% of Singapore's population [19]. The study population constitutes nursing home residents who were referred to the ED of Sengkang General Hospital in Singapore out of office hours. Nursing home residents who were not consulted with senior doctors were excluded.

Study design

This was a prospective study that included all ED attendances from nursing home residents during out-of-hours over a 23-month period from April 2020 to February 2022. During office hours (0900–1700 h on weekdays), nursing homes could contact the hospital to discuss regarding the necessity of conveyance, under a program called EAGLEcareACT (Enhancing Advance Care Planning, Geriatrics, and End-of-Life Care Acute Care Team) [20]. Under the EAGLEcareACT, nursing homes could assess services like teleconsult and assistance with advanced care planning. Due to manpower constraints, this service was not extended beyond office hours. In its place, the nursing home could consult an ED senior doctor on duty. The ED senior doctors were emergency physicians of registrar grade (at least three years of training) and above. Data was collected from standardized hardcopy forms used by our ED to document nursing home conveyances. If the decision was made not for conveyance, the nursing home was advised to inform or update the hospital should the condition of the patient change.

Outcome variables

Data collected from the forms included patient demographics, reasons for conveyance, time of conveyance, and name and distance of the nursing home from the ED. The outcome of the referral was to either proceed with conveyance or to continue managing the resident in the nursing home. Furthermore, the rank of the doctor who approved the conveyance was also retrieved to assess if there were any variations in decision-making based on the level of medical expertise.

Table 1 Characteristics of patients

Characteristic	*n* (%)
Age, Median (IQR)	74 (64,84)
Age groups (%)	
< 60	48 (14.2)
61–80	169 (50.0)
81–100	111 (32.8)
> 100	1 (0.3)
Null	9 (2.7)
Gender (%)	
Male	179 (53.0)
Female	150 (44.4)
Null	9 (2.6)
Nursing Homes (%)	
Nursing home A	134 (39.6)
Nursing home B	80 (23.7)
Nursing home C	41 (12.1)
Nursing home D	39 (11.5)
Nursing home E	22 (6.5)
Others	12 (3.6)
Null	10 (3.0)

Patients' vital signs were also extracted to assess the acuity of their condition at the time of conveyance. Additionally, The National Early Warning Score (NEWS) was also reviewed [21]. These tools assisted the doctor in making a clinical judgement regarding the medical exigency of transfer.

Statistical analysis

Data analysis involved descriptive statistics to examine the frequency and demographic profile of nursing home conveyances. Additionally, statistical analysis was conducted to identify factors associated with high rates of nursing home conveyances. Descriptive statistics were analyzed using Microsoft Excel version M365 (Microsoft Inc., Redmond, WA). Pearson Chi square and Mann-Whitney U test were used for categorical and continuous variables respectively. Statistical analysis was performed using Statistical Package for Social Science (SPSS) version 26 (IBM Corp, NY).

Ethics approval

This study has been assessed by SingHealth Centralized Institutions Review Board to not require an ethics board review (CIRB Number 2023–2691).
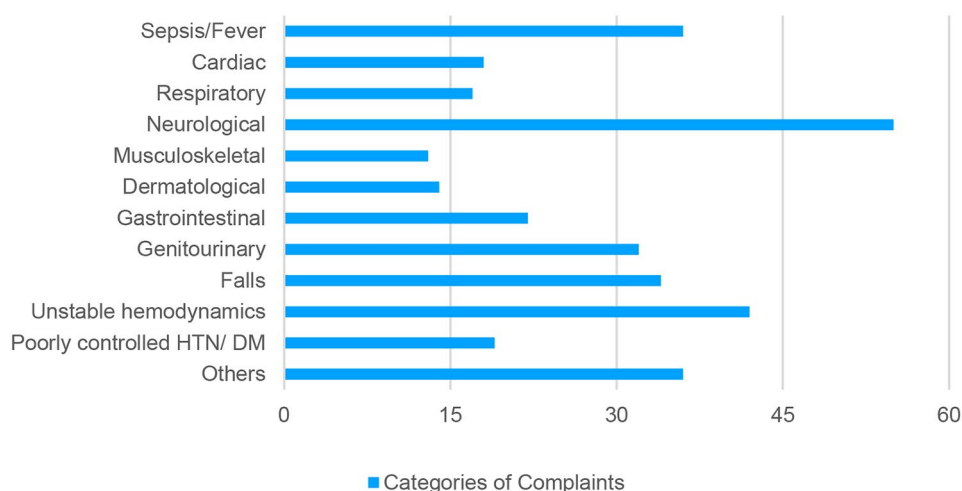
Results

A total of 338 nursing home residents were included in the study. The patients originated from twelve nursing homes. Table 1 shows the demographics of the patients in the pre-conveyance referrals. 53% of the residents were male and the mean age of residents was 75.5 years (SD=37.8).

The most common reasons for conveyance to ED were neurological symptoms like giddiness (16%), unstable hemodynamics (12%), fever (11%) and falls (10%) (Fig. 1). Timing of pre-conveyance referrals were of bimodal pattern with peaks occurring between hours 0900 to 1000 on weekends and public holidays; and hours 1800 to 2100 on all days (Fig. 2).

Almost three-quarters (74%) of the residents referred during out-of-hours have had NEWS of 0 to 4. Higher aggregate NEWS was associated with decision to convey (p=.001) (Table 2). When the components of the NEWS were analyzed independently, respiratory rate (p<.001), oxygen saturation (p<.001), and the need for oxygen use (p=.005) were associated with the decision to convey.

The distance of nursing homes from SKH ED was not associated with increased ED conveyances (p=0.842). Rank of the ED senior doctor (registrar, associate consultant, consultant, and senior consultant) showed

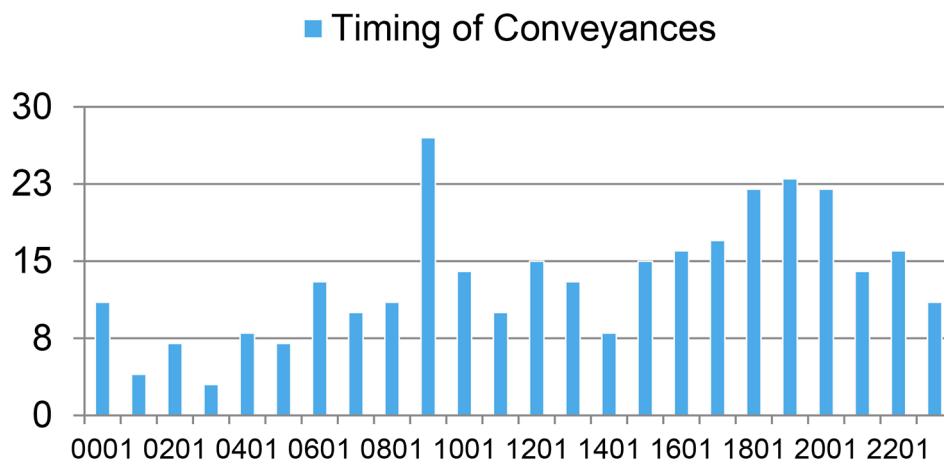**Fig. 1** Categories of presenting complaints

Timing of Conveyances

Fig. 2 Timing of conveyances to the emergency department

Table 2 Factors affecting decision to convey patient to the emergency department

	Decision to convey			*p* value
	Yes	No	Total	
Demographics				
Age	187	141	328	0.905
Presentation				
NEWS Aggregate	133	118	251	0.001
Components in NEWS				
Temperature	135	114	249	0.897
Oxygen use	192	145	337	0.005
Oxygen saturation	160	118	278	0
Systolic blood pressure	170	128	298	1
Respiratory rate	143	110	253	0
Heart rate	105	140	245	0.809
Systemic				
Nursing home distance	186	142	328	0.842
Physician				
Rank of receiving ED senior doctor	160	118	279	0.107

no association with the decision to convey a resident ($p = 0.107$).

Discussion

The findings of this study underscore the frequent conveyances of nursing home residents to an ED in a tertiary hospital. Previous research has shown that there are gaps in communication between nursing homes and EDs which affect care in EDs and potentially lead to increased hospitalizations [22–24]. Potential gaps in the coordination of care should be identified and ameliorated.

There were no differences in decisions for conveyance between senior doctors on duty. The senior doctors have had at least three years of residency training in emergency medicine. In addition to the severity of the complaints, there were objective markers like NEWS which likely influenced the doctors' decision to convey a patient. Including objective markers during communication

between nursing homes and EDs allowed for a more reliable assessment.

In addition to enhancing communications with nursing homes, the next step to reducing conveyances would be to identify the most common reasons for transfer. Unstable hemodynamics and falls were two of the most prevalent reasons for these conveyances. Our findings are in keeping with findings from previous research in other EDs worldwide [25–27]. This highlights the imperative need for implementing better fall prevention strategies within nursing homes, including staff training and environmental modifications.

The other most common reasons for conveyances were fever and giddiness, bringing to the foreground potential areas for intervention. Strengthening the relationship between nursing homes and primary care providers, such as general practitioners, could potentially help to alleviate the strain on EDs. General practitioners could conduct initial assessments of nursing home residents and refer patients to the ED if urgent care or hospitalization is warranted. One study showed that medical examination of nursing home residents by a general practitioner prior to conveyance to ED significantly decreased the rate of inappropriate conveyances [28].

As 74% of the conveyances in our study have had lower acuity NEWS, prior reviews by general practitioners could have reduced conveyances or these conditions could have been potentially escalated to the hospital the following working day.

On evaluation of the demographics of nursing home residents transported to the ED, there was a correlation between respiratory rate, oxygenation requirements and NEWS and conveyances to the ED. This highlights the vulnerability of nursing home residents and the critical need for timely and appropriate care. Moreover, these parameters have proven instrumental in identifying critically ill patients in nursing homes who require prompt

treatment in EDs [29–31]. These parameters should be routinely featured in the communications between nursing homes and EDs.

Future development of incorporating parameters in a computerized clinical decision support system, in replacement of calling the ED senior doctor for pre-conveyance decision, is ongoing.

No association was found between distance of nursing homes and conveyances, highlighting that there are other factors beyond distance that affect the prevalence of transfers from a nursing home. This calls attention to the need to further scrutinize the characteristics of these nursing homes and their residents to mark out the factors behind increased rates of conveyances to EDs.

Limitations

This study has several limitations. Firstly, it was conducted in a single centre. Involvement of other EDs in Singapore would provide a more thorough assessment of the factors that have contributed to the conveyances from nursing homes to EDs.

Secondly, much of the data collected was based on chart review and may be subjected to inaccuracies such as incomplete entries, missing data and illegible handwritings. We mitigated this by verifying data for accuracy before analysis. Variables that had missing values were omitted.

Finally, the study did not include other variables that could have influenced the outcomes. The characteristics of the nursing homes such as staff to patient ratios, access to their in-house general practitioner after office-hours, availability of fall assessment protocol were not studied. The outcomes of whether the patient was hospitalized or discharged, and the mortality rates could serve as barometers to assess the severity of their conditions.

Conclusion

This study provides insights into the predictors and patterns of nursing home residents conveyed to an ED, highlighting falls and unstable hemodynamics as prevalent reasons. The high frequency of falls underscores the necessity for enhanced fall prevention strategies in nursing homes. Monitoring standardized parameters is crucial for addressing unstable hemodynamics. The study underscores the importance of improving coordination between nursing homes and ED and, involving primary care. Further research is recommended to evaluate conveyance outcomes and characteristics of nursing homes with high conveyance rates, forming a foundation for future strategies to reduce unnecessary conveyances and enhance resident care in the nursing homes.

Declarations

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Ethics approval
This study has been assessed by SingHealth Centralized Institutions Review Board, Singapore to not require an ethics board review (CIRB Number 2023–2691). We certify that the study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Consent to participate
Not applicable.

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