Determinants of emergency department utilisation by older adults in Singapore: A systematic review

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ABSTRACT

Introduction: Adults aged ≥60 years contribute to disproportionately higher visits to the emergency departments (ED). We performed a systematic review to examine the reasons why older persons visit the ED in Singapore.

Methods: We searched Medline, Embase and Scopus from January 2000 to December 2021 for studies reporting on ED utilisation by older adults in Singapore, and included studies that investigated determinants of ED utilisation. Statistically significant determinants and their effect sizes were extracted. Determinants of ED utilisation were organised using Andersen and Newman’s model. Quality of studies was evaluated using Newcastle Ottawa Scale and Critical Appraisal Skills Programme.

Results: The search yielded 138 articles, of which 7 were used for analysis. Among the significant individual determinants were predisposing (staying in public rental housing, religiosity, loneliness, poorer coping), enabling (caregiver distress from behavioural and psychological symptoms of dementia) and health factors (multimorbidity in patients with dementia, frailty, primary care visit in last 6 months, better treatment adherence). The 7 included studies are of moderate quality and none of them employed conceptual frameworks to organise determinants of ED utilisation.

Conclusion: The major determinants of ED utilisation by older adults in Singapore were largely individual factors. Evaluation of societal determinants of ED utilisation was lacking in the included studies. There is a need for a more holistic examination of determinants of ED utilisation locally based on conceptual models of health seeking behaviours.

INTRODUCTION

Older adults in Singapore contribute to a disproportionately higher number of visits to the emergency department (ED), mirroring trends around the world.1,2 For instance, hospital admissions among those aged ≥65 years have been on the rise from 2018 to 2020, contributing a growing burden to ED services over the last decade.3 In 2014, the rise in acute hospital admissions led to a hospital bed crunch, where bed occupancy rates increased to 87%.4 Singapore has an ageing population, and it is projected that by 2035, the proportion of Singaporeans ≥65 years will be 32%.5

Compared to younger patients, older patients tend to have more complex healthcare needs requiring extensive investigations. They are also more likely to be hospitalised and have multiple comorbidities that require management beyond the scope of primary care physicians (PCPs).6 Visiting the ED is not without risk for older patients, as they are more susceptible to hospitalisation and adverse events when compared to younger patients.7

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CLINICAL IMPACT

What is New

• Major determinants of ED utilisation by older adults in Singapore were individual factors such as the type of residence, religiosity, sense of loneliness, coping mechanisms, and health factors. Evaluation of societal determinants of ED utilisation was lacking in the included studies.

Clinical Implications

• There is a need for a more holistic examination of determinants of ED utilisation locally based on conceptual models of health seeking behaviours.

Upon discharge from the ED, older patients harbour increased risks of poorer outcomes, resulting in a reduction in community mobility that may not improve subsequently.8

With population ageing, increased life expectancy, and the projected increase in healthcare utilisation by older adults in Singapore,9 it is imperative to understand the various determinants driving ED utilisation by older adults. Hence through this systematic review, we aimed to identify the determinants of ED utilisation by older adults in Singapore, adopting Andersen and Newman’s model for a more holistic view of these determinants.

In a systematic review by McCusker et al. in 2003,10 Andersen’s behavioural model was modified to study the determinants of ED utilisation. However, Andersen and Newman proposed a newer model in 2005,11 as shown in Fig. 1. Factors influencing ED utilisation are broadly categorised into societal and individual determinants in Andersen and Newman’s model. Both determinants influence the infrastructure of health services provided within the country. Societal determinants include technology and social norms, whereas individual determinants include predisposing, enabling and health factors.11 Predisposing factors are patient sociodemographic characteristics that can incline or deter a patient from utilising healthcare. Enabling factors encompass the influence of family and community, with examples including marital status, living conditions and geographical accessibility to PCPs or EDs. Health factors can be divided into perceived (subjective) need or evaluated (objective) need.

METHODS

This systematic review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.12 It is registered in the International Prospective Register of Systematic Reviews (PROSPERO) (CRD42021253770). Ethical approval was not required as all data used were derived from aggregated public sources and contained no individually identifying information.

Search strategy

The search strategy was developed in consultation with a medical information specialist (senior librarian at National University of Singapore). Three bibliographic databases were searched from 1 January 2000 to 31 December 2021: Medline, Embase and Scopus. Medical Subject Headings (MeSH) terms used included “aged”, “health services for the aged”, “health services accessibility”, “emergency service, hospital” and “emergency medical services”. Emtree subject headings used were “aged”, “hospital”, “emergency health service”, “emergency medicine” and “emergency ward”. “Singapore” was included in all searches. The full search strategy is available under Supplementary Materials in the online version of this article. References of relevant sources were hand-searched to identify additional relevant articles. Articles were exported to Endnote X9 (Clarivate Analytics, Philadelphia, US) for screening.

Selection criteria

Studies evaluating one or more determinants of ED utilisation by older adults in Singapore are included. The study will be included as long as one of the study participants is older than 60 years. The United Nations defines older adults as those at and above 60 years,13 while Singapore defines it at 65 years and above.14 As we have limited studies on our research question, we have utilised the age threshold specified by the United Nations...
to capture a larger study population. We posit that there is unlikely to be major differences to the determinants of utilisation between the age of 60 and 65 years. The studies should indicate that older adults have sought care at the ED.

Studies that evaluated determinants of healthcare utilisation in other contexts such as urgent care centres or primary care clinics that are open beyond office hours were excluded. Papers that only studied presenting complaints, revisits or frequent visits were also excluded. Revisits, frequent and inappropriate visits were excluded as these are only a proportion of the patients that visit the ED, while our study focuses on determinants of any visit. Non-English papers were not included.

**Data extraction**

The following study characteristics were identified and extracted from the included studies: (1) author and year, (2) study design, (3) study population, (4) sample size and sampling methods, (5) outcome variable(s), (6) data source for outcome(s), (7) individual determinants, (8) societal determinants, and (9) data source for determinants. The determinants examined were classified according to societal determinants and individual determinants. The statistically significant determinants of ED utilisation were identified in the studies, together with their effect size.

**Quality assessment**

The Newcastle-Ottawa Scale (NOS) was validated and used for evaluating the quality of the included studies. A modified version of the scale was adopted and modified for cross-sectional studies as the original NOS only includes assessment of the quality of cohort and case-control studies. This modified scale was used by a prior study with similar criteria of assessment—selection, comparability and outcomes of study. Modifications were also made to the assessment criteria to suit the context of our study.

For the randomised controlled trial included in our study (Ong 2018), the Critical Appraisal Skills Programme (CASP) tool was used. The CASP aims to review the reliability and applicability of findings published in studies, and provides checklists for different study designs. The CASP randomised controlled trial checklist was last updated in 2010 taking into consideration the CONSORT 2010 guidelines. The CASP assessment of the randomised controlled trial is included in the Supplementary Materials of the online article. Two reviewers (XRT and PPP) independently appraised the included studies, with disagreements resolved in consultation with a third reviewer (FJS).

and modified NOS are included in the Supplementary Material.

**RESULTS**

**Literature retrieval**

The search and selection process is displayed in a PRISMA flow chart in Fig. 2. The database search yielded a total of 134 articles, and an additional 4 articles were identified from hand searching and additional sources. After removal of duplicates, 113 articles were screened for their eligibility through titles and abstracts, and 14 articles shortlisted for full-text screening. Upon full-text screening, 7 papers were excluded as they only measured determinants of frequent admission (n=2), only measured determinants for inappropriate attendances (n=1) and only measured determinants for readmission (n=4). Finally, 7 papers were identified and included in our review.

**Characteristics of included studies**

The characteristics of included studies are presented in Table 1.

**Demographics of older adults**

In the included studies, the majority of older adults studied were aged 60 and above. Data from the Singapore Longitudinal Ageing Study were used in 1 study while data from the Well-being of the Singapore Elderly study were used in 2 studies. The Singapore Longitudinal Ageing Study provides a large database of community-dwelling older adults for gerontology research purposes from 2003 to 2020 while the Well-being of the Singapore Elderly investigates depression and dementia among older adults nationwide over 3 years. However, the Singapore Longitudinal Ageing Study only included Chinese patients in Ng et al.’s study. Older adults residing within the regional healthcare systems—Singapore Health Services and National Healthcare Group—were being studied. Other subpopulations that were studied included persons with dementia (PWD), older adults living alone and those residing in public rental housing.

**Measurements of ED utilisation**

Most of the included studies (4 out of 7) measured ED utilisation dichotomously, while 2 studies reported the frequency of ED visits. In the study by Ng et al., hospitalisations in the past year were used as an indicator of ED utilisation, assuming that majority of older adults who were hospitalised came in through the ED. ED utilisation was measured over a period ranging from 3 to 12 months in the included studies. Two studies used the
| Author (year) | Design of study | Study population | Sample size and sampling methods | Outcome variable(s) | Data source for outcome | Individual determinants | Societal determinants | Data source for determinants |
|--------------|-----------------|------------------|----------------------------------|---------------------|------------------------|------------------------|------------------------|----------------------------|
| Ge et al.21 (2020) | Cross-sectional study | Community-dwelling older adults aged ≥60 years | Random selection within eligible household using Kish grid | Healthcare utilisation, including emergency department visits | Administrative database | Frailty | | Questionnaire |
| Lau et al.23 (2021) | Cross-sectional study | Singaporean residents aged ≥60 years | Disproportionate stratified sampling | Emergency service utilisation and hospital admission | Questionnaire from Well-being of the Singapore Elderly (WiSE) study | Caregiver distress from BPSD | Caregiver psychiatric comorbidity | Administrative database |
| Ng et al.19 (2009) | Cross-sectional study | Community-living Chinese elderly aged ≥65 years | | Hospitalisations (≥1) in past year | Questionnaire from Singapore Longitudinal Ageing study | Successful ageing | | Questionnaire |
| Ong et al.17 (2018) | Randomised controlled trial | Older adults aged ≥65, living alone, experienced fall in last 6 months | | Number of emergency department visits | Telephone interview | | Telephone follow-up | MAPS | Questionnaire |
| Seng et al.22 (2019) | Retrospective cohort study | Patients under care of SingHealth Regional Health System | 10400 elderly staying in public rental housing | Number of emergency department visits | Administrative database | Socio-demographics (age, gender, ethnicity, type of housing) | | Administrative database |
| Vaingankar et al.14 (2017) | Cross-sectional study as part of WISE | Singapore residents aged ≥60 years | Random selection with disproportionate stratified sampling | Service utilisation in past 3 months, including emergency room visits | Interviewer administered survey | Frailty | Socio-demographics | Interviewer administered survey |
Table 1. Characteristics of included studies (Cont’d)

| Author | Year | Design of study | Study population | Sample size and sampling methods | Outcome variables(s) | Source for data for outcome | Source for data for determinants | Societal determinants | Individual determinants |
|--------|------|-----------------|------------------|---------------------------------|----------------------|-----------------------------|---------------------------------|---------------------|------------------------|
| Wee et al. | 2019 | Cross-sectional | Residents aged ≥60 years living in public rental housing | 928 | Emergency room visit in past 6 months | Interviewer administered standardised questionnaire | Interviewer administered standardised questionnaire | Socio-demographics | Family make-up, Health status and physical disabilities/limitations, Health behaviours, Social network and isolation, Psychological health and stressors, Income sources and perception of financial adequacy, Medication adherence, Quality of life |

Client Service Receipt Inventory\textsuperscript{27} to collect information regarding healthcare utilisation.\textsuperscript{23,24} Five out of 7 studies reported their utilisation through questionnaires, surveys or interviews.\textsuperscript{17,19,21,23,24} The other 2 studies sourced ED utilisation through administrative databases.\textsuperscript{20,22}

**Measurement of determinants**

Validated scales and checklists were used to evaluate various determinants. Across 2 studies,\textsuperscript{23,24} psychiatric morbidity was evaluated using the Self-Reported Questionnaire.\textsuperscript{28} Caregiver distress was evaluated using the Neuropsychiatric Inventory Questionnaire.\textsuperscript{25,29} Loneliness was evaluated with UCLA 3-item loneliness scale, while Partners in Health scale was used to evaluate self-management, coping and adherence to treatment in Wee 2019’s study.\textsuperscript{20,26,31} The Partners in Health scale aims to determine how well community-dwelling older adults manage their chronic conditions.\textsuperscript{30} Frailty was evaluated using Fried’s frailty phenotype\textsuperscript{32} and FRAIL scale\textsuperscript{33} in 2 different studies.\textsuperscript{21,24}

In the study by Ng et al.,\textsuperscript{19} successful ageing was associated with lower frequency of hospitalisation. Successful ageing was measured using the following factors: age, sex, type of residence, education level, engagement in physical activities and exercise, presence of religious and spiritual beliefs, and nutritional risk.

None of the studies included conceptual frameworks for organising the determinants of ED utilisation. All the studies conducted multivariate analysis to determine the statistical significance of the examined determinants and ED utilisation. Table 2 provided a summary of determinants that were found to be statistically significant.

**Predisposing factors**

Predisposing factors are socio-demographic factors that can increase a person’s risk utilising healthcare.

Residing in a public rental housing was a significant determinant of ED utilisation in Singapore (odds ratio [OR] 2.4, confidence interval [CI] 2.12–2.74). In Wee et al., loneliness (adjusted OR [aOR] 1.96, 95% CI 1.13–3.43) and poorer coping (aOR 1.72, 95% CI 1.01–3.03) were associated with higher rates of ED visits among older adults living in public rental housing, evaluated with UCLA 3-item loneliness scale and Partners in Health scale, respectively. Among the same sub-population, religiosity is associated with lower ED utilisation (aOR 0.43, 95% CI 0.24–0.76).\textsuperscript{20}

**Enabling factors**

Enabling factors are family and community resources that encourage or impede a person’s access to healthcare.
DISCUSSION

To our knowledge, this is the first systematic review that is being conducted in Singapore to investigate the determinants of ED utilisation among older adults.

Our study found that residing in a public rental housing, religiosity, loneliness and poorer coping and caregiver distress were predisposing factors towards ED utilisation. Health factors that were significantly associated with the rate of ED utilisation included frailty, multimorbidity among PWD, visitation of PCP in the last 6 months and adherence to treatment.

Older adults living in public rental housing were found to have a higher utilisation of the ED. In Singapore, the ownership of housing is typically representative of the socio-economic status (SES) of a person. Public rental housing is usually resided by people who are unable to afford ownership of the property, thus reflecting their lower SES. Housing status by itself has been found to be associated with a higher rate of ED utilisation. Health factors that were significantly associated with the rate of ED utilisation included frailty, multimorbidity among PWD, visitation of PCP in the last 6 months and adherence to treatment.

Caregiver distress from those looking after elderly with behavioural and psychological symptoms of dementia, increased the likelihood of ED visits (OR 1.1, 95% CI 1.0–1.1, \( P=0.003 \)).

Health factors

Health factors can be divided into perceived need (subjective) and evaluated need (objective). Frailty was a significant determinant of ED utilisation (incidence rate ratio 3.1, 95% CI 1.1–8.1). This was assessed using the 5-item FRAIL scale consisting of fatigue, resistance, ambulation, illnesses and loss of weight. In addition, better adherence to treatment (aOR 2.23, 95% CI 1.29–3.83), and presence of multimorbidity among PWD (OR 4.3, 95% CI 1.6–11.3, \( P=0.004 \)) were associated with ED utilisation. Having visited a PCP in the last 6 months for a routine review was a protective factor against ED use (aOR 0.46, 95% CI 0.27–0.80).

Quality assessment of studies

The studies assessed by NOS are shown in Table 3. A maximum of 5 stars can be given for selection and a maximum of 2 stars for comparability. A maximum of 1 star can be given for the quality of the outcome assessment in the original NOS, but 2 stars in the modified NOS.

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comply with their follow-up visits as seen by the lower frequency of specialist outpatient clinic visits among this group. Consequently, older adults with lower SES are also associated with poorer outcomes following an ED visit, which may lead to more costs being incurred in the form of hospital bills and lost work days. Additionally, Chan et al. proposed that their health beliefs, health literacy and perceived need influence their ED utilisation. Religiosity, loneliness and poorer coping were associated with higher ED visits in the study by Wee et al. (2019).

Table 2. Determinants of ED utilisation

| Author (year)       | Predisposing factors (effect size)                                                                 | Enabling factors (effect size)                                                                 | Health factors (effect size)                                                                                                                                 |
|---------------------|----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| Ge et al. (2020)    | Frailty (IRR 3.1, 95% CI 1.1–8.1)                                                                 | Caregiver distress from BPSD (OR 1.1, 95% CI 1.0–1.1, P=0.003)                                  | PWD with multimorbidity (OR 4.3, 95% CI 1.6–11.3, P=0.004)                                       |
| Lau et al. (2021)   | Staying in public rental housing (OR 2.4, CI 2.12–2.74)                                           |                                                                                                 |                                                                                                  |
| Seng et al. (2019)  | Religiosity (aOR 0.43, 95% CI 0.24–0.76)                                                           | Loneliness (aOR 1.96, 95% CI 1.13–3.43)                                                        | Better adherence (aOR 2.23, 95% CI 1.29–3.83)                                                    |
| Wee et al. (2019)   | Visited a PCP in last 6 months for routine review (aOR 0.46, 95% CI 0.27–0.80)                     | Poorer coping (aOR 1.72, 95% CI 1.01–3.03)                                                    |                                                                                                  |

Table 3. Quality assessment of included studies with modified Newcastle-Ottawa Scale

| Author (year)       | Selection | Comparability | Outcome |
|---------------------|-----------|---------------|---------|
| Ge et al. (2020)    | *****     | **            | **      |
| Lau et al. (2021)   | ***       | -             | *       |
| Ng et al. (2009)    | *****     | **            | *       |
| Seng et al. (2019)  | *****     | **            | *       |
| Vaingankar et al. (2017) | *****     | *             | *       |
| Wee et al. (2019)   | *****     | *             | *       |

aOR: adjusted odds ratio; BPSD: behavioural and psychological symptoms of dementia; CI: confidence interval; IRR: incidence rate ratio; OR: odds ratio; PCP: primary care physician; PWD: persons with dementia.

Superscript numbers: Refer to REFERENCES

Religious and spiritual beliefs are part of the “social structure” under predisposing factors, which is hypothesised to influence health care utilisation. Religion can shape an individual’s health beliefs as the sanctity of life is respected across all religions. This potentially influences ED utilisation through enhancement of their perseverance and coping skills. However, the findings may not truly reflect how religious someone is in predisposing them to healthcare utilisation; an amalgamation of influences such as the presence of religious communities and social support are also enabling factors in ED utilisation.

Presence of caregiver distress increased the likelihood of visitation to the ED by PWD, which is congruent with the literature in other countries. Caregivers for PWD face a greater amount of stress among other chronic conditions. Caring for their loved ones more than 40 hours a week, physical strain and aiding in healthcare tasks are found to increase the likelihood of an ED visitation by PWD. In 2010, 74% of regular caregivers were also employed, indicating their need to take on multiple responsibilities within the family. The caregiver burden is expected to worsen as the social structure of families evolve, with smaller families and rise in dual-income families. Sending their loved ones to the ED could provide a respite from their long hours of care for their elderly relatives when they are no longer able to manage by themselves. There is an opportunity for clinicians in the ED to provide these caregivers with adequate emotional support and ensure continuity of care within the community, which will hopefully reduce ED utilisation among this population.

Surprisingly, better adherence to treatment was associated with higher rates of ED utilisation among older adults residing in public rental housing. Wee et al. hypothesised that among this lower income population, they are perhaps disengaged with their PCPs and turn to the ED for care instead. This was consistent with a Taiwanese study investigating ED utilisation among...
people with intellectual disability, where patients who were compliant with their medication regime had a higher number of ED visits.\textsuperscript{52} Another hypothesis to explain this phenomenon is the prompt identification of acute complications of their chronic diseases, where they would immediately seek treatment at the ED. Recent visits in the last 6 months to their PCP was protective against ED utilisation. This shows that by ensuring that the older patients are compliant with their routine follow-up visits, the number of ED visits can be potentially reduced.

Outside Singapore, geographical distance and availability of transport is an important predictor of ED utilisation as living in a rural area versus an urbanised area will determine their accessibility to healthcare institutions.\textsuperscript{53,54} In Singapore, the average amount of time taken for an ambulance to reach a patient ranged from 7 to 15 minutes, with another 20 to 40 minutes to arrive at the ED.\textsuperscript{50} This is in contrast to the US, where ambulances can take more than 14 minutes to arrive in rural areas.\textsuperscript{56} Given the relatively small geographical area of 728.3km\textsuperscript{2} \textsuperscript{57} and organisation of the 3 regional health systems in Singapore (Singapore Health Services, National University Health System and National Healthcare Group), with each serving different regions of the city state,\textsuperscript{56} the impact of geographical distance on healthcare utilisation is minimal. Additionally, due to the proximity and ease of access to primary care in Singapore,\textsuperscript{52} enabling factors would play a less prominent role in predicting ED utilisation as compared to other countries.\textsuperscript{59}

In the included studies, no conceptual frameworks were used to organise determinants for ED utilisation. According to Boudreaux et al.,\textsuperscript{60} health behaviour research in the context of emergency care should be grounded in conceptual models. Adopting these conceptual frameworks help provide a holistic overview of the various influencers of health sub-care utilisation. Hence, future studies in Singapore should incorporate conceptual frameworks to better understand ED utilisation. This would also enable a core set of common variables or indicators to be assessed across studies, allowing for comparison over time and population subgroups. The Andersen and Newman’s model can also be modified according to our Singapore healthcare system in future studies.

Our study has various limitations. We excluded non-English articles in our study but there were minimal non-English articles in our search, and hence the impact of this exclusion is small. The societal determinants (technology and norms) and enabling factors in Andersen and Newman’s model were not thoroughly investigated in the included studies. Additionally, this model was developed in the US against the context of their healthcare system, which differs from our healthcare system in Singapore. This could provide a less comprehensive picture of the various factors influencing ED utilisation here. Future studies can look at the development of a similar model in the context of our healthcare system. The majority of the studies included were cross-sectional studies. The main limitation of cross-sectional studies is the inability to study causality or determine the temporal sequence of events. The Singapore Longitudinal Ageing Study in Ng et al.’s study\textsuperscript{19,25} included only Chinese patients. Hence, there is presence of selection bias as well.

**CONCLUSION**

The major determinants of ED utilisation by older adults in Singapore based on the Andersen and Newman’s model included (1) predisposing and enabling factors such as the type of residence, religiosity, sense of loneliness and coping mechanisms, and (2) health factors such as frailty,\textsuperscript{34} comorbidities, recent visitation of PCPs and adherence to treatment. Evaluation of societal determinants of ED utilisation was lacking in the included studies of this review. Given the greying population in Singapore and disproportionate use of healthcare resources among this population, there is a need for a more holistic examination of determinants of ED utilisation locally based on conceptual models of health seeking behaviours.

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Determinants of ED use by older adults

Xuan Rong Tang et al.

179

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