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Emergency department service utilisation of older patients with urgent conditions: a cross-sectional observational study

Geraldine P.Y. Koo^{1*}, Pei Zhen Seah¹, Mon Hnin Tun², Sinma Tham³ and Steven H.C. Lim¹

Abstract

Background As with many countries worldwide, Singapore is experiencing a rapidly ageing population. Presentation of older persons for urgent but non-emergent conditions to the Emergency Department (ED) represents a growing group of patients utilising public healthcare emergency services and puts a strain on current ED resources. The medical conditions vary, and resources used has been poorly characterized.

Methods This is a single-center cross-sectional observational study of patients aged 55 to 75 years old who visited the ED with urgent conditions, Patient Acuity Category Scale (PACS) P2 or P3, who were subsequently discharged. The patients visited a public hospital in Singapore on four randomly selected weekdays in April 2023. The utilisation of hospital resources and manpower was studied. A formulated criteria was used to determine the appropriate site of care, such as an Urgent Care Centre (UCC), Primary Care Providers (PCP) clinic or the ED.

Results There were 235 eligible patients during the study period, with a mean age of 65.1 years of which a majority, 183 (77.9%) were allocated to patient acuity category scale P2. Most of the patients were walk-in patients with no referrals (169 (71.9%)). Based on the criteria, the majority of 187 (79.6%) of these patient may be safely managed at an outpatient setting; 71 (30.2%) patients by PCP, 116 (49.4%) patients may be managed by an UCC, with the remaining 48 (20.4%) requiring ED care.

Conclusion Our findings indicate that a significant portion of discharged older ED adults with urgent but non-emergent conditions may be adequately managed at outpatient medical services that are appropriately resourced. More research is needed on healthcare initiatives aimed at developing the capabilities of outpatient medical services to manage mild to moderate acute conditions to optimise ED resource allocation.

Keywords Emergency department, Primary health care, Older patients, Urgent conditions, Non-emergent conditions, Burden of care, Healthcare utilization

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Introduction

Singapore is experiencing a rapidly ageing population with a significant rise in the “65 years old and over” age group, with a year-on-year increase of 5.9% in 2023 [1]. They represent an important and growing group among patients attending the Emergency Department (ED) and requiring ED resources [2, 3]. Similarly, overcrowding is an ever-growing issue faced by EDs worldwide. An aging society has added to this inequality of demand and supply due to the higher utilization of the ED in this population group, contributing to the numbers of preventable ED visits. This leads to sub-optimal use of ED resources and adversely impacts patient care [4–6]. Older adults have complex care needs which make the management of these patients in a traditional, fast-paced ED environment challenging [4, 7, 8]. Some studies have shown that 13.7–29.1% of ED visits can be seen at alternative sites including Urgent Care Centers (UCC), with potential annual savings of \$4.4 billion [9, 10].

In Singapore, the government aims to further strengthen primary care and empower Primary Care Providers (PCP) to address the growing burden of chronic diseases in an ageing population. PCP in Singapore includes General Practitioners (GPs) and Polyclinics. Polyclinics are “one stop” healthcare centres throughout the country which provides subsidised primary care consults, treatment, and preventive healthcare. There has been a stronger push for more community-based healthcare and greater emphasis on preventive medicine with programmes such as Healthier SG [11]. Other programmes such as the GPFIRST programme helps to reduce inappropriate visits to the ED and alleviate overcrowding [12]. It works by providing priority consultation and cost incentives in the ED to patients who had first sought their GPs for mild to moderate conditions, and were subsequently referred to the ED. This helps to triage patients who can be appropriately managed by PCP. Another initiative that was introduced was that of UCC. There currently exists three UCC in Singapore. They provide medical care for non-emergent conditions, which can help reduce the burden of care of EDs to manage more emergent and critical cases [9, 13].

The primary objective of the study is to understand the utilisation of hospital resources and services among discharged older patients who present to the ED for urgent, but non-emergent conditions. The secondary objective is to assess whether some of these patients may be safely managed at an outpatient medical service such as UCC or PCP. To our knowledge, this is the first study on discharged older adults from the ED with non-emergent medical needs that could potentially be right-sited to lower acuity outpatient medical services, in Singapore.

Methods

Study population

The study was conducted at an ED of a public acute hospital with an annual ED attendance of around 130,000 to 140,000 during pre-Covid-19 times. 40–50% of these attendances are by patients aged 55 years and above, and this has been increasing year-on-year over the past five years.

Study subjects were obtained from the ED visit register on four random weekdays in the month of April in 2023. The four days were Monday 3 April 2023, Thursday 6 April 2023, Monday 10 April 2023 and Thursday 13 April 2023. Weekends were avoided due to generally lower attendances and lower acuity presentations in view of closure of PCP on weekends, to reflect as accurately as possible older presentations to the ED.

Patients whom we included in the study were those aged 55 to 75 years old who presented with urgent but non-emergent conditions. They were triaged to Patient Acuity Category Scale (PACS) Priority 2 (P2) or Priority 3 (P3) and were subsequently discharged from the ED at the end of their visits. These patients were checked for characteristics which met our exclusion criteria (see Fig. 1).

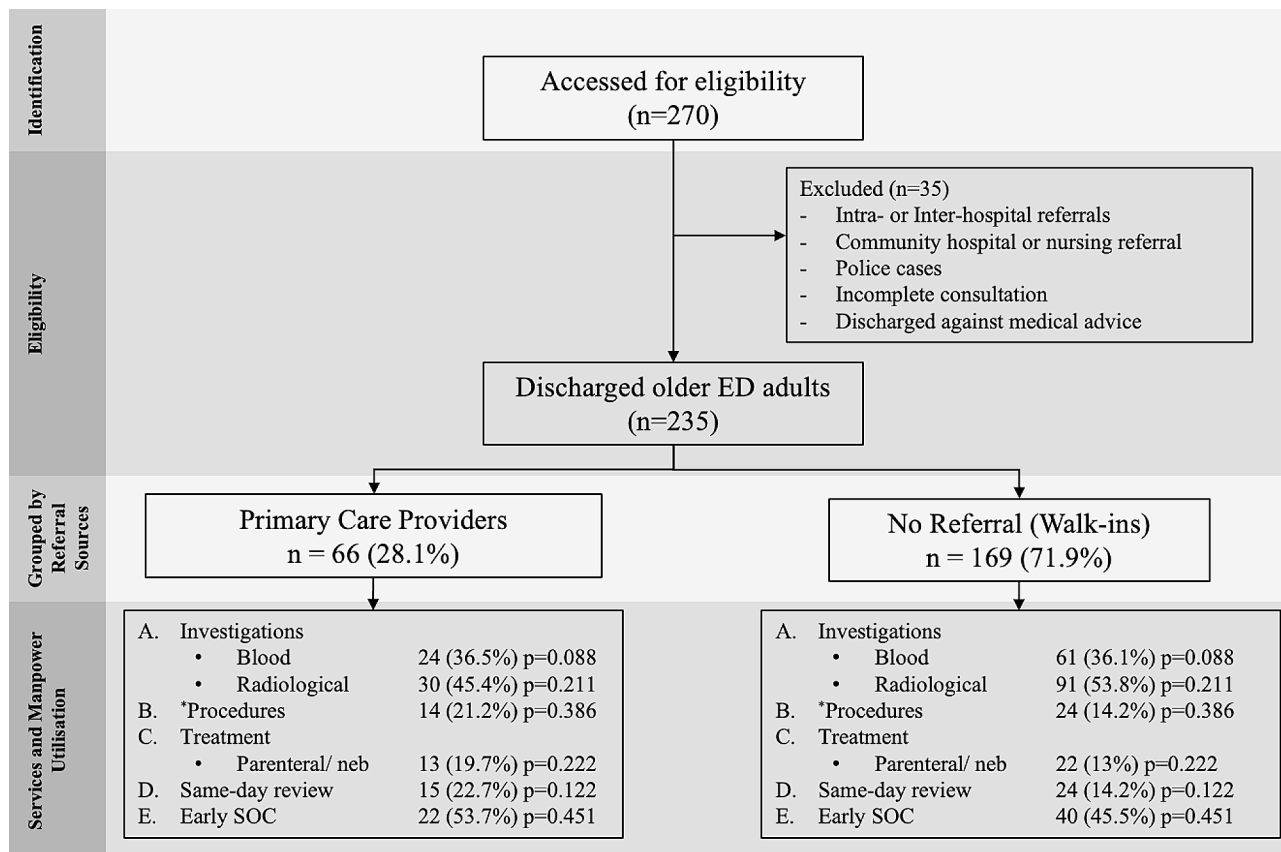
Patients who were triaged as PACS P1 (Priority 1) were those who were critically ill, facing life or limb threatening conditions and were not included as they should be sent immediately to the ED for emergency care. On the contrary, PACS P4 (Priority 4) patients are of the lowest acuity and were excluded as they should not have attended the ED in the first place.

Other patients who were excluded from the study included those who were: (1) Referred from other clinical services of the hospital (intra-hospital referrals) or other acute hospitals (inter-hospital referrals), (2) Referred from affiliated community hospitals, nursing homes or community nurses following recent discharge, (3) Police cases, (4) Incomplete consultations such as those who left without being seen (LWBS) or abscondment, and (5) Discharged against medical advice.

Finally, the hospital’s Data Management and Informatics team assisted to extract patients’ visit details from the hospital electronic medical records (EMR). Chart reviews of the EMR were conducted by two resident doctors training in emergency medicine.

Laboratory and radiological investigation data

Laboratory investigations were grouped into “blood” and “specimen” tests. Blood tests were commonly done tests and their results reviewed at the ED; while “specimen” tests included blood, urine and nasopharyngeal/nasal swabs that were not routinely or commonly ordered in the ED. Bloods tests included: full blood count, renal panel, C-reactive protein, coagulation studies,



* Procedures include: Manipulation and reduction (M&R) of fracture/ dislocation, toilet and suture (T&S) of wound, plaster cast/ splint application, nail resection/ avulsion and nail bed repair, incision and drainage (I&D) of abscess, insertion of urinary catheter. + Centre-based services and intermediate and long-term care services

Fig. 1 Flow diagram describing utilisation of ED resources by discharged older adults grouped by referral sources

liver function test, beta-human chorionic gonadotropin, amylase, lipase, Dengue screen, troponin-T, blood gas, toxicology (paracetamol or salicylate levels); while specimen tests included Covid-19 antigen rapid test and polymerase-chain reaction test, urine formed elements and microscopic examination), urine cultures and blood cultures.

The utilisation of radiological investigations at the ED was studied. They included (1) Advanced radiological investigations such as magnetic resonance imaging, computer tomography and sonographer-conducted ultrasound scans (e.g. doppler sonography of the leg for suspected deep vein thrombosis or US scrotum for testicular torsion) and (2) Point-of-care ultrasound conducted by ED clinician operators.

Treatment and same-day review data

Data on pharmacological treatment were grouped into those which needed a parenteral route of medications, nebulizations, and others which did not.

Data concerning clinical procedures were collected and they included: Manipulation and reduction of fracture or dislocation, toilet and suture of wound, plaster cast or

splint application, nail avulsion and nail bed repair, incision drainage of simple abscess, insertion of indwelling urinary catheter, wound dressings and others.

Same-day reviews were defined as clinical encounters at the ED or other parts of the acute hospital (e.g. at the Specialist Outpatient Clinic) following the initial ED doctor consultation. The reviews may involve (1) A specialty service (specialist-supported service) or (2) A Nurse- or Allied Health Professional-led service such as geriatric nurses, transitional care nurses, medical social workers or physiotherapists.

Criteria to identify patients potentially suitable for Outpatient Medical services

Our criteria to identify patients potentially suitable for outpatient medical services was formulated based on current available resources at the PCP clinics, the ED, and the projected resource availability at UCC [14, 15] (Appendix, Table 4). The scope of service document of an established local UCC was also reviewed when formulating our criteria. Our Cohen Kappa score is 0.754 (0.663–0.846). All patients that required (1) Advanced radiological investigations (i.e. Magnetic resonance

imaging (MRI), computer tomography (CT) and ultrasound (US) scans) or had (2) Same-day reviews were deemed requiring care at the ED.

Next, cases which required at least one of the following services, (1) Same-day tests (e.g. cardiac enzyme); or (2) Point-of-care ultrasound, (POCUS); or (3) Procedures not available at the PCP; or (4) Treatment requiring parenteral medications or nebulisations, were grouped as those who require at least UCC-level outpatient medical services.

The following were defined as procedures not available at the PCP: Manipulation and reduction of fractures or dislocations, wound wash out and suturing, plaster cast or splint application, nail avulsion and nail bed repair, incision and drainage of simple abscess, insertion of a urinary catheter.

Lastly, the rest of the patients that did not require the above ED medical resources or services were assigned by the criteria as potentially appropriate for management at the PCP.

Statistical analysis

Descriptive statistics were used to characterize the participants' attributes in relation to the primary objective of the study. Categorical variables were summarized using

proportions or percentages, while continuous variables were described using means and standard deviations or median and interquartile range (IQR). Chi-square tests were conducted for categorical variables and either t-tests or Wilcoxon signed-rank tests for continuous variables. To assess differences between patients in P2 and P3 groups, t-tests were used for continuous variables, and chi-square tests for categorical variables. The statistical analysis was conducted using Stata version 16, and statistical significance was determined at $p < 0.05$ for all analyses.

Results

Two hundred and seventy ED patient visits from the 4 days during the study were assessed for inclusion into the study, 35 of them were subsequently excluded by the exclusion criteria (Fig. 1).

The demographics of the 235 patients in our study are seen in Table 1. Within this group of patients, 183 (77.9%) were allocated to P2 and 52 (22.1%) to P3. Among them 66 (28.1%) were referred by PCP and 169 (71.9%) were walk-in patients without referrals. The top three diagnoses using the International Classification of Diseases, 10th revision, clinical modification (ICD-10-CM) codes were dizziness and giddiness (12 cases, 5.11%), acute upper respiratory infection (7 cases, 2.98%) and gastroenteritis and colitis (7 cases, 2.98%).

Table 2 shows the utilisation of ED services by study patients. Most patients did not require any blood tests (150 (63.8%)) or specimen tests (207 (88.1%)). Likewise, most patients did not require any parenteral medication or wet nebulisation (200 (85.1%)), procedures (197 (83.8%)) or same-day review at the ED (196 (83.4%)). Nonetheless, most patients still required some form of investigation or intervention (193 (82.1%)).

Both P2 and P3 patients had a similar demographic profile in terms of referral sources - P2: PCP: 55 (30.1%) and walk-in/no referral: 128 (69.9%); P3: PCP: 11 (21.1%) and walk-in/no referral: 41 (78.9%); p -value: 0.488), with a majority being walk-in patients without referrals.

Patients allocated to P2 were generally older (mean: P2: 65.7 years (SD 5.7); P3: 63.1 years (SD 5.9); p -value 0.005). Compared to P2 patients, the majority of P3 patients required no blood investigations done (P2: 106 (57.9%); P3: 44 (84.6%); p -value: 0.001). Only a small number of patients required same-day review (P2: 30 (16.4%); P3: 9 (17.3%); p -value: 0.836), although more P2 patients require parenteral medications and nebulisations (P2: 33 (18.0%); P3: 2 (3.9%), p -value 0.008).

Table 3 shows the investigations and interventions required by patients referred from PCP. It demonstrates that most patients referred from such sources required either an investigation, an intervention, or both. (61 (92.4%)).

Table 1 Demographics of study patients

Demographics of Study Patients (N = 235)		
Subgroup	N	%
Sex		
Female	112	47.7
Male	123	52.3
Race		
Chinese	152	64.7
Malay	50	21.3
Indian	24	10.2
Others	9	3.8
Age		
Mean, SD (years)	65.1 (5.8)	-
Median, IQR (years)	65 (60–70)	-
ED Triage PACS		
P2	183	77.9
P3	52	22.1
Referral Source		
a. With Referral		
PCP (GP/Polyclinic)	66	28.1
b. Without Referral		
No Referral (Walk-ins)	169	71.9
ED Arrival Mode		
Non-Ambulance	206	87.7
Ambulance	29	12.3

*SD: standard deviation; IQR: interquartile range; PACS: Patient acuity category scale; PCP: Primary care provider; GP: general practitioner; ED: emergency department;

Table 2 Utilisation of ED services by the study patients

Utilisation of Services and Resources in ED (N=235)		
Subgroup	N	%
A. Investigations		
Blood tests		
No	150	63.8
Yes	85	36.2
Specimen tests		
No	207	88.1
Yes	28	11.9
Radiological investigations		
No	114	48.5
Yes	121	51.5
Advanced radiological investigations (total number)		
US (scrotal/DVT)	1	0.4
CT scan	9	3.8
MRI scan	0	0
B. Interventions		
a. Parenteral medications and nebulisation		
No	200	85.1
Yes	35	14.9
b.i. Procedure not available at PCP (total patients)		
No	197	83.8
Yes	38	16.2
b.ii. Procedure not available at PCP (types, N=44)		
Toilet and suture	6	2.6
Incision and drainage	2	0.9
Splint	14	5.9
Dressings	9	3.8
Others	13	5.5
c. Same-day review		
No	196	83.4
Yes	39	16.6
Received at least one (A) Investigation; and/or (B) Intervention service		
No	42	17.9
Yes	193	82.1

*ED: emergency department; IV: intravenous

Table 3 ED investigations and interventions for patients referred by PCP (GP or Polyclinic)

Patients needing investigations and interventions Total=66		
	N	%
Investigations		
Blood tests	24	41.4
Radiological investigation	30	51.7
Interventions		
Procedure not available at PCP	14	24.1
Same-day review	15	25.4
Parenteral medication/ nebulization	13	22.4
Any of the above investigation and/or intervention		
No	5	7.6
Yes	61	92.4

*IV: intravenous; PCP: Primary care providers (GPs/ Polyclinics)

Application of Criteria to identify patients potentially suitable for Outpatient Medical services

A criteria based on ED resource utilisation was used to identify patients who were potentially suitable for management at outpatient medical services, see Fig. 2.

Overall, most patients could be managed by PCP or UCC (GP/Polyclinic: 71 (30.2%); UCC: 116 (49.4%)).

When triage PACS status was considered, most P2 patients required at least UCC (P2: 107 (58.4%); P3: 9 (17.3%); p-value: 0.0001) and ED level care (P2: 38 (20.8%); P3: 10 (19.2%); p-value: 0.0001) while a majority of P3 patients were able to be managed by a PCP (P2: 38 (20.8%); P3: 33 (63.5%); p-value: 0.0001), based on our right-siting criteria which identify patients potentially suitable for outpatient medical services.

Discussion

Our findings showed that a majority of discharged older ED patients who presented with urgent but non-emergent conditions may not require an ED visit and can be reviewed at an outpatient medical care facility (187 (79.6%)) such as GP clinics, polyclinics or UCC. Only a small percentage of these patients required same-day specialist interventions and advanced radiological investigations, which would require ED level management [16]. Nonetheless, a large proportion of these patients still require some form of same-day tests or interventions.

Among the patients who were triaged as P2, a significant portion of them (58.4%) required at least UCC level care compared to those triaged to lower acuity P3 (17.3%). This was largely driven by a higher proportion needing parenteral medications and nebulisations (33 patients, 18%). This group of patients also required more blood investigations (77 patients, 42.1%). This finding suggests opportunities to improve the access of such services in the community, which may ease the demand on ED resources. With the advancement of technology, point-of-care diagnostic devices are now capable of performing accurate biochemical testing of blood specimens for measurements such as cardiac enzymes. These are services that are not currently available at most PCP clinics.

Interestingly, our numbers of older urgent presentations that can potentially be seen in lower acuity centers is larger compared to that previously quoted in US studies (13.7–29.1%) [9, 10]. This might be due to how uniquely Singapore's primary care is structured together with factors affecting differences in health knowledge, status and societal roles, which influences local health-seeking behaviours [3, 17]. However, when compared to another local study, which quoted 9.6% of ED attendances as inappropriate, our study also sees higher numbers of such patients. One possible explanation could be that Oh et al. (2020) used a pre-determined administrative

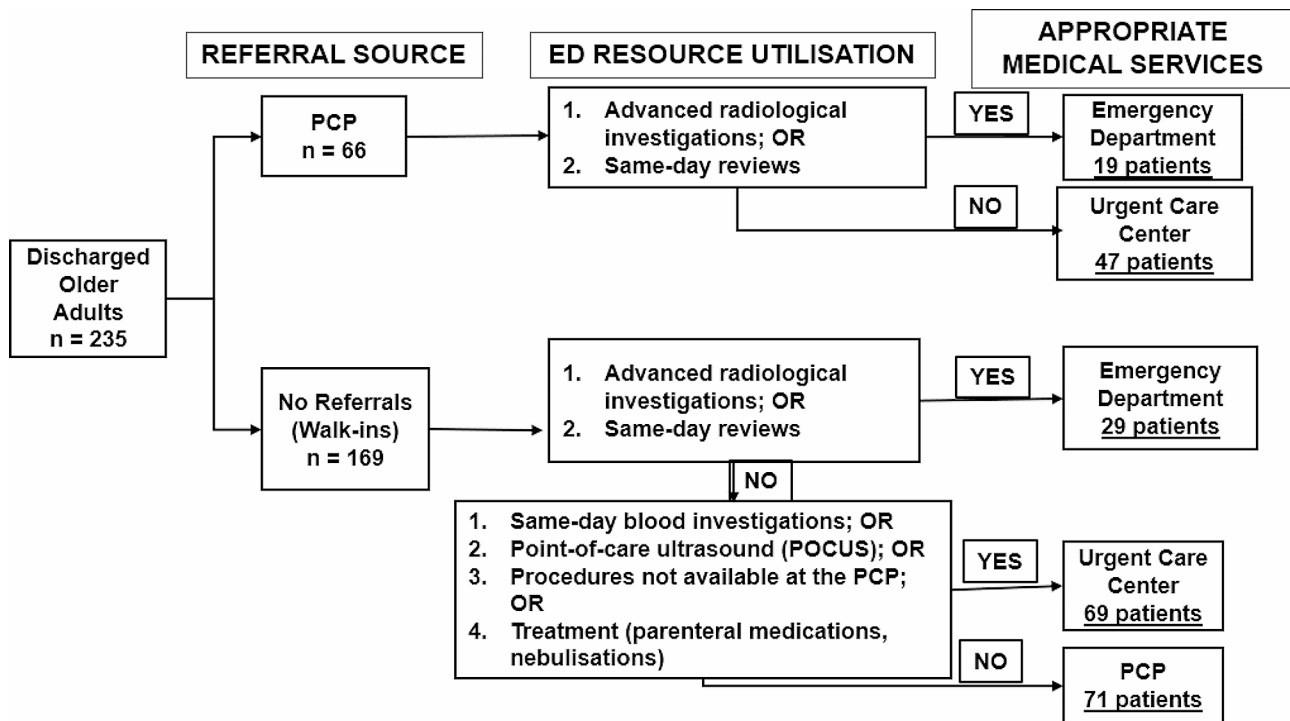


Fig. 2 Appropriate medical services allocation for study patients, based on ED resource utilisation

criteria to define inappropriate attendances while our study had two resident emergency doctors conduct chart reviews [18]. We also included only discharged elderly P2 and P3 patients. This could have led to higher pickup rates of such attendances. Differences in study population, size, formulations and interpretation of criteria could have also accounted for the difference in numbers. In some places, high ED utilisation rates for non-emergent care also reflects other deficiencies such as poorer primary care access or lack of education of alternatives [19]. A Singaporean study have shown that enhancing primary care in Singapore can potentially reduce crowding in Singapore EDs [20]. In Singapore, a large bulk of primary care, about 80%, is still being managed by private GPs, with the remaining by public polyclinics [21]. Tangible aspects of urgent care delivery include availability and timeliness of diagnostic equipment and services at reasonable cost, which might not be possible in most single GP clinics [11, 20, 21]. On the other hand, there are other intangible factors that affect higher ED usage. Societal perceptions of primary care, especially the perceived role of PCP in overall healthcare delivery and preference of going to the ED due to the convenience of 24 h, every day of the week access, prominently affects these health-seeking behaviours [11, 20, 21]. This would require community education in promoting awareness in greater primary care utilisation for non-emergent conditions [11, 12], as well as, equally importantly, interventions informing the community about the location of alternatives for

lower acuity care [22]. Recently, a study showed the effectiveness of such primary care initiatives, including the GPFirst programme. This programme has reduced ED self-referral attendance since its implementation at the target hospital [12]. In our study, we formulated our UCC criteria based on the perceived service gap of the lack of prompt investigations and monitored interventions at PCP clinics. We found that 49.4% of our non-emergent older patients were deemed as potentially being able to be diverted to a lower acuity medical facility with UCC-level care. Our findings identify a possible service need of developing a better equipped outpatient medical services that can adequately manage and observe mild to moderate urgent conditions that did not require ED level care.

Current literature estimates non-urgent ED visits as encompassing 4.8–90% of ED visits, with definitions varying. Management of urgent and non-emergent care is a fine balance between right-siting of non-emergent conditions and inadvertent mis-direction of patients who truly require emergency management [23]. Appropriate right-siting of non-emergent conditions, including unnecessary referrals to the ED, is a complex issue [24]. Our study sheds light on perceived acuity levels of patients already seen by a healthcare provider. Among our patients who were referred to by PCP, all were considered to require a higher care level, by allocation to requiring at least UCC level of care, although when comparing investigations and interventions required between those who were self-referred, they were similar.

Nevertheless, when looking solely at our PCP referral group, 92.4% required some form of investigation and intervention. They may form a group of patients with a potentially unnecessary ED visit, but complex enough to warrant at least a UCC-level review [25]. More research will be needed to investigate the appropriateness of directing more resources for healthcare initiatives aimed at developing the capabilities of outpatient medical services to manage mild to moderate acute conditions.

In our study, our chosen group of patients were those between 55 and 75 years old. Traditionally, older adults were defined as 65 years and above, largely due to health, functional status and life expectancy [26]. However, with an ageing population, it is important to capture the “near elderly” population of 55 years old and above and to study the characteristics of their health-seeking behaviour. They represent an important target group for preventive measures to reduce older non-emergent ED usage [27]. We excluded patients aged 75 years and above in our study as they are likely to have more co-morbidities with poorer functional status. Studies have also shown that this group of patients were more likely to require admission and when triaged to lower acuity levels, were more likely to have higher admission and re-presentation rates [28]. Hence, including such patients in our study would likely skew our findings towards higher ED usage.

Limitations

There are several limitations to our study. Firstly, our sample size is small and the data collection period is short due to resource limitations. However, all charts were reviewed individually and we believe that the sample is a reasonable snapshot of cases which visited the ED. Since the study subjects were discharged ED patients, they did not accurately represent non-emergent elderly patients and conditions being seen in EDs in Singapore. We have hypothetically formulated a criteria based on ED resource utilisation to identify cases appropriate for outpatient medical service usage. The criteria we formulated for UCC attendance is based on existing UCCs in Singapore, PACS status and clinical judgement. This criteria could be different depending on the context and what services a proposed UCC would offer. Other tangible and intangible factors including health literacy, socio-economic factors and location of outpatient medical facilities not been accounted for and are beyond the scope of this study. Of note, we used a conservative criteria for procedures that can be done by the PCP, following those that can be performed at the Polyclinics. There is a wide variation of the procedures that can be done by private PCP, often contributed by the capabilities and clinical experience of both anchoring physicians, locum physicians and clinical staff at GP clinics. As such, we might have underestimated the number of patients

that can be suitably seen by PCP. Nonetheless, they only form a small group of patients in this study and unlikely to affect the results drastically.

Conclusion

Our study found that a significant proportion of urgent but non-emergent older adult presentations that were discharged from the ED may be right-sited and adequately managed at outpatient medical services if they were appropriately resourced. This supports the initiatives of enhancing primary and urgent care facilities, particularly in the service areas of providing parenteral medications, nebulisations under observation as well as same-day tests. More research is needed on developing outpatient medical services capabilities for managing mild to moderate non-emergent conditions and its cost-effectiveness, including the consideration of newer service modalities such as telemedicine, geriatric home and community care services.

Appendix

Table 4 Criteria for appropriate medical services allocation based of resource utilisation

Criteria for ED level care:

- A. Advanced radiological investigations
 - a. CT scans
 - b. Ultrasound scans (i.e. US DVT, US scrotum)
- B. Same-day specialist review
 - a. Specialist review
 - b. Allied health review (i.e. geriatric nurse, medical social worker, physiotherapist)

Criteria for UCC level care:

- A. Point of care ultrasound
- B. Same day investigations (i.e. cardiac enzymes, Dengue screen)
- C. Procedures not available at PCP
 - a. Insertion of indwelling catheters
 - b. Manipulation and reduction of simple fractures/ dislocations that do not require admission
 - c. Toilet and suture of lacerations
 - d. Plaster cast or splint application
 - e. Nail avulsions including nailbed repair
 - f. Incision and drainage of simple and uncomplicated abscesses (in non-critical body areas)
- D. Treatment (parenteral medications, nebulization)

Abbreviations

CT	computer tomography
ED	Emergency Department
EMR	electronic medical records
ICD	International Classification of Diseases
IQR	interquartile range
GPs	General Practitioners
LWBS	left without being seen
MRI	magnetic resonance imaging
PACS	Patient Acuity Category Scale
PCP	Primary Care Provider
POCUS	point-of-care ultrasound
UCC	Urgent Care Centre
US	ultrasound

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Author contributions

G.K.P.Y, S.P.Z and S.L.H.C. conceived the study; G.K.P.Y, S.P.Z and M.T.H. data evaluation and data analysis. All authors reviewed and edited the manuscript. All authors have read and agreed to the published version of the manuscript.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

This project was submitted to our IRB, and it was deemed to be exempt from review and no written consent was required as it did not meet the definition for human subject research (CIRB 2022/2643).

Consent for publication

The authors of this paper give consent for publication and distribution of the data and materials as written.

Competing interests

The authors declare no competing interests.

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