BMJ Open  Root causes and preventability of emergency department presentations of older patients: a prospective observational study

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ABSTRACT

Objective  More older patients are presenting to the emergency department (ED). It is important to know why these patients present and if the ED is the best place for them to receive the care they need. The primary aim of this study was to identify organisational-related, technical-related, healthcare worker-related and patient-related factors leading to ED presentations of older patients. The secondary aim was to determine patients’ and caregivers’ perspectives on what kinds of ED presentations are potentially preventable.

Design  This is a prospective observational study. A root cause analysis was performed by the Prevention and Recovery Information System for Monitoring and Analysis method. It used basic administrative data collected from patient records and interviews of patients, general practitioners (GPs) and physicians at the ED.

Setting  The ED of an academic hospital in the Netherlands.

Participants  100 older patients (aged ≥70 years) who attended the ED between November 2017 and March 2018.

Results  In 100 patients presenting to the ED, 159 factors that contributed to presentation were identified; most of these factors were related to underlying diseases (59%) and patient-related factors (18%). These presentations were considered potentially preventable by 23% of the physicians at the ED and 21% of the GPs, but only 10% of the patients. In only four cases was there overall agreement between the patients and the healthcare workers.

Conclusion  The most frequent underlying factors contributing to an ED presentation in older patients are disease-related and patient-related. The low percentage of ED presentations considered potentially preventable shows that a ‘preventable ED presentation’ is difficult to define and therefore interventions to reduce them are unlikely to be simple. Novel solutions within the acute care pathway are required in order to deliver care of optimal quality and safety to older patients.

INTRODUCTION

As the world population is ageing rapidly, older patients are an important patient group visiting emergency departments (EDs). Currently, they account for up to 38% of all ED presentations, and the percentage of people aged 65 years and over in European countries is forecast to increase from 14% in 2010 to 25% in 2050. Older patients often present with atypical symptoms and complex health problems with multiple comorbidities. Patients with non-specific complaints are often undertriaged in the ED despite the high prevalence of serious underlying conditions. In addition, older patients may have impaired cognition, communication problems, reduced social support and malnutrition and suffer from abuse or neglect, all of which may contribute to ED presentations and influence outcomes. These factors may negatively affect the care received at the ED, leading to more investigations, more specialist consultations and longer lengths of ED stay.

Greater understanding is needed of those factors that influence ED utilisation by older patients. Once an older patient has presented to an ED, even if the presentation...
was potentially preventable, they may be more likely to continue to use ED services and experience high rates of hospitalisation and functional decline, with higher risk of subsequent mortality.\textsuperscript{6,7} Therefore, although the current literature does not provide a standard definition,\textsuperscript{3-11} preventable ED presentations should be avoided and replaced by more valuable and appropriate care alternatives, such as home care, general practitioner (GP) or other community-based services. Furthermore, we believe understanding older patients' and healthcare workers' perspectives is critical to optimisation of emergency care.

The main aim of this study was to identify organisational-related, technical-related, healthcare worker-related and patient-related factors that contribute to ED presentations of older patients. The secondary aim was to gather more insight into patients’ and caregivers’ opinions on the potential preventability of these ED presentations.

MATERIALS AND METHODS

Study design

This is a prospective observational study of 100 older patients (\textgeq\ 70 years) who presented to the ED of the Amsterdam UMC location VU University Medical Centre (VUMC) in Amsterdam from 20 November 2017 to 8 March 2018.

Study setting and population

The VUMC is an urban academic level 1 trauma centre with 733 beds, approximately 50000 hospital admissions and 30000 ED presentations per year. Internal hospital data for the year 2017 indicate that there were approximately 4650 patients aged 70 years and older visiting the ED, resulting in 5500 ED presentations.

We included patients aged 70 years and older who were able to give informed consent. Patients who were unable to give informed consent or were critically ill were excluded. We also excluded patients living in an assisted living facility or a nursing home because they were considered a different patient population and already receiving continuous institutional care. The population studied was a convenient sample of 100 patients who presented from Monday to Friday during daytime when trained researchers to interview them were available. There is no valid method to perform a sample size calculation or a power analysis for a PRISMA (Prevention and Recovery Information System for Monitoring and Analysis) profile.\textsuperscript{12,13} However, Smits \textit{et al.}\textsuperscript{14} state that when the number of analysed events is at least 50, the variety of possible unintended events will be captured and a valid causal factor profile can be drawn.

Patient and public involvement

Patients were not involved in setting the research question, the outcome measures, or the design or implementation of the study. Moreover patients were not asked to advise on the interpretation or documentation of results.

Data collection and measurements

Patients who met the inclusion criteria were approached by a member of the research team to obtain written consent. Semistructured patient interviews were performed by a trained researcher while the patient was in the ED (online supplemental appendix 1). One of the aims of the interview was to gather insight into the causes of the ED presentation, the patient’s health status and living situation, and the patient’s opinion on factors that contributed to their ED presentation. Additionally, the ‘acute presenting older patient (APOP)’ scores\textsuperscript{15} were calculated based on patient age, gender, arrival by ambulance, need for regular assistance, need for assistance with bathing/taking a shower, hospitalisation in the prior 6 months and impaired cognition. The APOP score is expressed as a percentage and identifies the individual risk of 90-day functional decline or mortality in ED patients aged \textgeq\ 70 years. The threshold for a ‘high risk’ is \textgeq\ 45%.

The opinion on the potential preventability of the ED presentation was asked using the following question: ‘Do you feel this current ED presentation was preventable in any way, by anyone?’ Possible options were ‘yes’, ‘no’ and ‘don’t know’, followed by an explanation of their answer. The patient’s GP and their attending physician at the ED were interviewed within 3 days by either telephone or mail, and asked factors they considered contributed to the ED presentation and if it was potentially preventable. Additional data were gathered through the electronic patient records, which included patient characteristics and ED presentation details, which were then tabulated in a standardised data collection form. Six weeks after inclusion in the study, a follow-up telephone interview with the patient was performed (online supplemental appendix 1). When contact with the patient was not possible, the researchers contacted their GP based on the consent already provided by the patient during inclusion.

Data analysis: PRISMA

The PRISMA method identifies the root causes contributing to an incident or event through the creation of a causal tree (online supplemental appendix 2). However, determining the root cause of an event does not necessarily imply that the event is potentially preventable. The PRISMA method has been accepted for incident analysis by the World Alliance for Patient Safety by the WHO\textsuperscript{12,13} and consists of three main steps: (1) incident description, (2) cause classification and (3) translation to structural measures. Two medically and PRISMA-trained researchers (RB, HM) each constructed a causal tree from the information obtained from the interviews and the patient’s electronic medical record. The top of each tree consisted of the event, in this case the presentation at the ED, followed by its direct causes, which were identified by asking why the ED presentation had occurred. Subsequently indirect causes were systematically exposed by constantly asking ‘why’ the event had taken place. An example of a root causal tree is displayed in figure 1.
Root causes were then classified as technical-related, organisational-related, human-related and patient-related factors using the Eindhoven Classification Model (ECM). The root causal trees of both researchers were compared and discussed with a third PRISMA-trained investigator (BD) until consensus was reached. Following the recommendations of Fluitman et al., disease-related root causes were added to the ECM root causes. In the final step, the PRISMA profile was made and prevention recommendations can be directed at the most frequently occurring root causes.

**Data analysis: statistical analysis**

In SPSS V22.0 descriptive characteristics and frequencies were calculated to describe patient characteristics, root causes and preventability. Categorical outcome measures are presented as frequencies and percentages. To gather insight into patients’ health status and whether the ED is the most appropriate location within the acute care pathway at the time of presentation to the ED, we divided the patients into two groups: a group of patients admitted to the hospital and a group of patients discharged home after the ED presentation. For the subgroup analysis we used the Pearson’s \( \chi^2 \) for dichotomous and categorical data. The independent samples t-test was used for continuous variables. Differences were considered statistically significant at a p value less than 0.05.

**RESULTS**

**Patient characteristics**

During the study period 382 patients aged 70 years and older presented while a researcher was present at the ED, but 282 patients were excluded because (1) they were living in an assisted living facility or nursing home (n=149, 52.9%), (2) they were not asked to participate (n=28, 9.9%), (3) they refused to give informed consent (n=59, 20.9%) or (4) they were unable to give informed consent (n=46, 16.3%).

The median age of the final study population of 100 patients was 76 years (IQR 12) and 55% were male.

| Table 1 | Patient characteristics |
|---------|-------------------------|
| n (%)   | 100 (100%)              |
| Age, median (IQR) | 76 (12) |
| Male | 55 (55) |
| Independent living situation prior to ED presentation | 100 (100) |
| Home care | 16 (16) |
| Living alone | 47 (47) |
| ED presentation 30 days prior to current ED presentation | 7 (7) |
| ED presentation 1 year prior to current ED presentation | 22 (22) |
| ED presentation related to ED presentation in the last year prior to ED presentation | 14 (14) |
| Hospital admission 30 days prior to ED presentation | 9 (9) |
| Hospital admission 1 year prior to ED presentation | 33 (33) |
| ED presentation related to hospital admission in the last year prior to ED presentation | 23 (70) |
| Medical specialty* |            |
| Surgery | 3 (3) |
| Orthopaedic | 1 (1) |
| Emergency medicine | 35 (35) |
| Internal medicine | 18 (18) |
| Pulmonary medicine | 11 (11) |
| Gastroenterology | 4 (4) |
| Nephrology | 2 (2) |
| Rheumatology | 2 (2) |
| Oncology | 2 (2) |
| Neurology | 19 (19) |
| Urology | 2 (2) |
| Jaw surgery | 1 (1) |
| Fall-related ED presentation | 22 (22) |
| Admitted to a care supporting facility after 6 weeks of follow-up |            |
| Yes | 10 (10) |
| No | 75 (75) |
| Lost to follow-up | 15 (15) |

*Medical specialty responsible for treatment plan.
ED, emergency department.

(table 1). Majority of the patients (74%) assessed their care situation at home as good. Thirty-four patients (34%) presenting to the ED were self-referrals, 42 patients (42%) were referred by a GP, and 24 patients (24%) were sent in by a medical specialist. Half of the patients (50%) were sent home after their ED presentation, 49 patients (49%) were admitted to the hospital, and 1 patient (1%) was discharged to an emergency respite placement in a nursing home. At 6-week follow-up, 10 patients (10%)...
were admitted to a care supporting facility and 7 patients (7%) were deceased.

**Patients discharged home versus admitted patients**

Significant differences were found in home care, APOP score and triage code; patients admitted to the hospital or a nursing home received more home care (n=13 (26%) vs n=3 (6%), p=0.006) and were more frequently triaged to be seen within 10min (n=30 (60%) vs n=16 (32%), p=0.028). Furthermore, patients admitted to the hospital or a nursing home had a higher risk of functional decline and mortality in the next 3 months according to the APOP score (table 2).

**PRISMA analysis and root causes**

The PRISMA method identified 159 root causes that contributed to ED presentation of the 100 patients studied. In more than half of the patients (54%) a single root cause was identified, 36 patients (36%) had two root causes, 8 patients (8%) had three root causes, and 2 patients (2%) had four or more root causes. The categories, descriptions, examples based on our study population and the frequencies of all root causes are displayed in table 3.

Majority (n=121, 76%) of the root causes were related to the individual specifics of the patient and could be divided into disease-related factors (n=93, 58.5%) and patient-related factors (n=28, 17.6%). Disease-related factors, such as progression of a malignant tumour or exacerbation of chronic obstructive pulmonary disease, were mostly beyond the control of the patient and the physician. Patient-related causes, such as refusal to take

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**Table 2** Patient characteristics discharged home versus admission

|                        | Discharged home | Admitted       | P value |
|------------------------|-----------------|----------------|---------|
| Age, mean (range)      | 77 (70–92), SD 6.3 | 79 (70–96), SD 7.7 | 0.271   |
| Sex, n (%)             |                 |                | 0.841   |
| Male                   | 27 (54%         | 28 (56%)       |         |
| Female                 | 23 (46%)        | 22 (44%)       | 0.006   |
| Home care, n (%)       |                 |                |         |
| Yes                    | 3 (6%)          | 13 (26%)       |         |
| No                     | 47 (94%)        | 37 (74%)       |         |
| Polypharmacy*, n (%)   |                 |                | 0.221   |
| Yes                    | 23 (46%)        | 32 (64%)       |         |
| No                     | 27 (54%)        | 18 (36%)       |         |
| APOP decline, mean (range) | 23.18 (0–70), SD 14.17 | 33.48 (8–80), SD 20.98 | 0.005   |
| APOP mortality, mean (range) | 4.96 (0–21), SD 4.281 | 9.72 (0–37), SD 8.86 | 0.001   |
| Type of referral, n (%)|                 |                | 0.717   |
| Self-referral          | 18 (36%)        | 16 (32%)       |         |
| GP                     | 19 (38%)        | 23 (46%)       |         |
| Specialist             | 13 (26%)        | 11 (22%)       |         |
| Arrival by ambulance, n (%) | 17 (34%)       | 26 (52%)       | 0.069   |
| Yes                    | 33 (66%)        | 24 (48%)       |         |
| Triage code, to be seen, n (%) | 0 (0)          | 5 (10%)        | 0.028   |
| U1: direct             |                 |                |         |
| U2: <10 min            | 16 (32%)        | 25 (50%)       |         |
| U3: >10 min            | 20 (40%)        | 13 (26%)       |         |
| U4: >1 hour            | 5 (10%)         | 2 (4)          |         |
| U5: >1 hour            | 9 (18%)         | 5 (10%)        |         |
| Deceased at 6-week follow-up, n (%) | 4 (8%) | 3 (6%) | 0.881 |
| Yes                    | 42 (84%)        | 42 (84%)       |         |
| Lost to follow-up      | 4 (8%)          | 5 (10%)        |         |

*Polypharmacy: medication use ≥5.
APOP, acute presenting older patient; GP, general practitioner.
| Main category | Subcategory | Code | Description | Examples (if available) | Discharged home frequencies n (%)* | Admitted frequencies n (%)* |
|--------------|-------------|------|-------------|-------------------------|------------------------------------|-------------------------------|
| Technical    | External    | T-ex | Technical failures beyond the control of the organisation. | Not available. | 0 (0) | 0 (0) |
|              | Design      | TD   | Failures due to poor design of equipment, etc. | Not available. | 0 (0) | 0 (0) |
|              | Construction| TC   | Correct design inappropriately constructed or placed. | Not available. | 0 (0) | 0 (0) |
|              | Materials   | TM   | Material defects not classified under TD or TC. | Not available. | 0 (0) | 0 (0) |
| Organisational| External    | O-ex | Failures at an organisational level beyond the control and responsibility of the investigating team. | Patient presented to the ED due to delay in time to operate due to delay in receiving patient information from an external hospital. | 0 (0) | 1 (1.4) |
|              | Transfer of knowledge | OK | Failure resulting from inadequate measures to train or supervise new or inexperienced staff. | Not available. | 0 (0) | 0 (0) |
|              | Protocols   | OP   | Failures relating to the quality or availability of appropriate protocols. | Oncological patient who is instructed by the specialist to present to the ED when he has fever. | 1 (1.2%) | 2 (2.7) |
|              | Management priorities | OM | Internal management decisions which reduce focus on patient safety when faced with conflicting priorities. | Patient presented to the ED because there is no short-term outpatient department appointment available. Presentation due to long waiting time until operation. | 7 (8.2) | 5 (6.7) |
|              | Culture     | OC   | Failure due to attitude and approach of the treating organisation. | Patient is sent from the outpatient department to the ED by a specialist instead of to the GP. | 1 (1.2) | 1 (1.4) |
| Human        | External    | H-ex | Human failures beyond the control of the organisation/department. | Patient arrived at the ED with an ambulance, which was called by bystanders after a fall on the street. | 1 (1.2) | 0 (0) |
| Knowledge-based behaviour | HKK | Failure of an individual to apply their knowledge to a new clinical situation. | GP thought the fever was due to influenza instead of rheumatism. Therefore inadequate treatment and presentation to ED. | 1 (1.2) | 2 (2.7) |
| Qualifications | HRQ | An inappropriately trained individual performing the clinical task. | Not available. | 0 (0) | 0 (0) |
| Coordination | HRC | A lack of task coordination within the healthcare team. | Not available. | 0 (0) | 0 (0) |
| Verification | HRV | Failure to correctly check and assess the situation before performing interventions | GP refers the patient to the ED directly without examining the patient adequately due to lack of time. | 3 (1.9) | 0 (0) |
| Intervention | HRI | Failure resulting from faulty task planning or performance. | Inadequate medication schedule, therefore progression of complaints. Inadequate explanation to the patient when to present to the ED. | 4 (4.7) | 3 (4.0) |
| Monitoring   | HRM | Failure to monitor the patient's progress or condition. | Patient was admitted to the hospital, no adequate analysis of complaints and discharged home. Presents to the ED with same complaints. Insufficient monitoring done by GP. | 1 (1.2) | 1 (1.4) |
| Skills-based | HSS | Failure in performance of highly developed skills. | Not available. | 0 (0) | 0 (0) |

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Preventability

Sixty-eight ED presentations were considered potentially preventable by either the patient, the physician at the ED or the patient’s GP. Ten (10%) presentations were judged potentially preventable by the patient, 23 (23%) by the physician at the ED and 24 (24%) by the patient’s GP (table A). In only four cases did the patient, the attending physician and the patient’s GP all agree that the ED presentation could, potentially, have been prevented. One patient could have visited the GP earlier, but tried to ignore his complaints due to anxiety. A patient with a back injury after a fall found it too difficult to arrange a GP appointment. Another patient with a fractured arm was unable to contact the GP by phone or arrange an early outpatient department appointment. A patient with known allergies developed a reaction to antibiotics that should not have been prescribed. In these four agreed cases, preventability was based on patient-related, organisational or human verification causes.

DISCUSSION

The main finding of this study is that the most common root causes contributing to ED presentations in older patients are disease-related (59%), followed by patient-related causes (18%). In addition, there was little consensus between patients, their GP and the attending physician on preventability. The reasons for this are not purely patient-related or organisational. Although in this study both patients and physicians felt most of these presentations were not potentially preventable, this may not always be the case. For example, a patient with a problem based on a disease-related factor could, in some cases, also have been treated by their GP without referral to the ED. Moreover, if patients are discharged home, this does not necessarily mean that the presentation was inappropriate and therefore preventable. For example, an ED presentation might identify an underlying health problem that requires medical intervention. If the patient is discharged home, the ED presentation may not be seen as preventable. The extent of agreement on preventability of an ED presentation as it depends on the perspectives of the patients, their GP and the attending physician. These findings are consistent with other studies that have found a lack of consensus between patients and healthcare professionals. There is no consensus definition of a preventable ED presentation as it depends on the different perspectives of the different stakeholders involved.

Table 3 continued

| Main category | Subcategory | Code | Description | Examples (if available) | Discharged home frequencies n (%) | Admitted frequencies n (%) |
|---------------|-------------|------|-------------|------------------------|-----------------------------------|---------------------------|
| Patient       | Patient-related | PRF | Failures related to patient characteristics or conditions, which are beyond the control of staff and influence clinical progress. | Patient falls due to refusal to walk with walking aid. Patient postponed GP appointment due to anxiety and presents to ED with heavy complaints. | 18 (21.2) | 10 (13.5) |
|               | Disease-related | DRF | Failures related to the natural progress of disease which are beyond the control of the patient, its carers and staff. | Patient with COPD presents with acute progression of dyspnoea. Shoulder luxation after fall. | 46 (54.1) | 47 (63.5) |
|               | Unclassifiable | X   | Trauma capitis due to fall of suitcase during flight. Patient is still living independently despite frailty. Uncertainty of GP resulting in referral to ED. Patient presents to ED with postoperative infection. | 2 (2.3) | 2 (2.7) |

Total | 85 (100) | 74 (100)

Distribution of 159 root causes based on 100 patient cases.

*Number of root causes.

COPD, chronic obstructive pulmonary disease; ED, emergency department; GP, general practitioner; PRISMA, Prevention and Recovery Information System for Monitoring and Analysis.
attending physician at the ED. In this study 42 patients were referred to the hospital by their GP, and in this group the GP judged the ED presentation potentially preventable in just 8 cases (19%). From any physician’s perspective, any presentation that could be managed in an alternative setting could be considered potentially preventable. Likewise, if a patient is a self-referral to the ED, it is likely that he/she will judge the ED presentation as not preventable. Although 34 patients were self-referrals, only 4 of them (12%) judged the ED presentation as potentially preventable. It is possible, of course, that more patients would concede that their presentation was preventable had they been better informed on alternative treatment options, and these were convenient and easily available. Overall, physicians at the ED judged that 23% of the presentations were potentially preventable. This suggests they believe that these patients could have been managed effectively by other health service providers, such as patients triaged as low urgency (triage code U4 and U5, they can be seen after 1 hour). Our results show that patients admitted to the hospital had a significantly high urgency triage code. Patients with a low urgency code could have been seen at their GP instead of the ED, which would allow the ED to focus more on emergency and urgent presentations.

New solutions should be explored to ensure that the acute care pathway remains accessible and available and care is of sufficient quality for the increasing number of older patients. 

Table 4 Different perspectives on preventability

| Preventability                  | Yes, n (%) | No, n (%) | Don’t know, n (%) | Missing, n (%) | P value |
|--------------------------------|------------|-----------|-------------------|----------------|---------|
| Patient                        |            |           |                   |                |         |
| Discharged home                | 7 (14)     | 43 (86)   | 0 (0)             | 0 (0)          | 0.182   |
| Admitted                       | 3 (6)      | 47 (94)   | 0 (0)             | 0 (0)          | 0.616   |
| Physician at the emergency department |          |           |                   |                |         |
| Discharged home                | 14 (28)    | 27 (54)   | 1 (2)             | 8 (16)         | 0.010   |
| Admitted                       | 9 (18)     | 24 (48)   | 2 (4)             | 15 (30)        |         |
| General practitioner           |            |           |                   |                |         |
| Discharged home                | 16 (34)    | 30 (60)   | 0 (0)             | 4 (6)          |         |
| Admitted                       | 5 (10)     | 34 (68)   | 0 (0)             | 11 (22)        |         |

importance of fostering an age-friendly environment so that acute care for older patients is optimal. This can be achieved through the introduction of care pathways that include consultations with geriatric nurses or an ED observation unit for older patients. The geographical design of the ED and training healthcare professionals in the management of common geriatric syndromes should be improved.

For future research, changes in the acute care pathways of older patients are needed to improve their care by providing alternatives to ED presentations, such as high urgency outpatient department or the introduction of advanced care planning. Furthermore, it would be interesting to see whether some causes are tied to perceived preventability more than others and to include other healthcare workers in the analysis of root causes.

Strengths

A major strength of our study is the inclusion of patients’ perspectives. Understanding patients’ perspectives is needed to design strategies that create a more comprehensive, patient-centred approach to older patients who present to the ED. We determined the causal factors by using the PRISMA method, which, compared with other methods, efficiently examines the active (ie, human failures) and latent (ie, technical and organisational failures) factors to identify reoccurring patterns of root causes.

Limitations

This study has some limitations. First, although the PRISMA method is highly structured and accepted by the World Alliance for Patient Safety by the WHO, it is relatively new and has not been used in this setting before. The causal trees of some patients may be incomplete due to missing responses. We only included patients in a selected period during peak hours. Furthermore, our study population excluded patients who were likely to be frail, such as those living in an assisted living facility or nursing home and patients with inability to sign informed consent due to delirium or other cognitive impairments. Finally, the study was performed in one Dutch hospital, so our findings may not be applicable to other hospitals or countries.
CONCLUSION

It is important to improve the quality of care and safety for older patients within the acute care pathway. In this study the root causes of most ED presentations in older patients were related to their disease, and there is little agreement between patients and healthcare workers on ED presentations that were potentially preventable. To prevent ED presentations of older patients, new solutions that focus on providing alternative settings within the acute care pathway are required.

REFERENCES

1. Samaras N, Chevalley T, Samaras D, et al. Older patients in the emergency department: a review. Ann Emerg Med 2010;56:261–9.
2. Dufour I, Chiu Y, Courteau J, et al. Frequent emergency department use by older adults with ambulatory care sensitive conditions: a population-based cohort study. Geriatr Gerontol Int 2020;20:317–23.
3. World Health Organization. Data, 2012. Available: https://www.who.int/data [Accessed 18 Mar 2018].
4. McCusker J, Karp I, Cardin S, et al. Determinants of emergency department visits by older adults: a systematic review. Acad Emerg Med 2003;10:1363–70.
5. Gray LC, Peel NM, Costa AP, et al. Profiles of older patients in the emergency department: findings from the interRAI multinational emergency department study. Ann Emerg Med 2013;62:467–74.
6. Aminzadeh F, Dzialziel WB. Older adults in the emergency department: a systematic review of patterns of use, adverse outcomes, and effectiveness of interventions. Ann Emerg Med 2002;39:238–47.
7. Salvi F, Morichi V, Grilli A, et al. The elderly in the emergency department: a critical review of problems and solutions. Intern Emerg Med 2007;2:292–301.
8. Wachelder J, Stassen PM, Fourmanov RS, et al. Higher in-hospital mortality in patients with nonspecific complaints presenting to the emergency department. Acute Med 2019;18:232–8.
9. Yam CHK, Wong ELY, Chan FWK, et al. Avoidable readmission in Hong Kong—system, clinician, patient or social factor? BMC Health Serv Res 2010;10:311.
10. Faulkner D, Law J. The ‘unnecessary’ use of emergency departments by older people: findings from hospital data, hospital staff and older people. Aest Health Rev 2015;39:544–51.
11. Resar RK, Griffin FA. Rethinking emergency department visits. J Ambul Care Manage 2010;33:290–5.
12. Van Vuuren WSC, Schaat TW. The development of an incident analysis tool for the medical field. Available: http://alexandria.tue.nl/repository/books/493452.pdf [Accessed 18 Mar 2018].
13. Van der Schaat TW, HM. PRISMA- medical. A brief description. Eindhoven: Eindhoven University of Technology, Faculty of Technology Management, Patient Safety Systems, 2005.
14. Smits M, Janssen J, de Vet R, et al. Analysis of unintended events in hospitals: inter-rater reliability of constructing causal trees and classifying root causes. Int J Qual Health Care 2009;21:292–300.
15. Wachelder J, Lucke JA, Blazek LC, et al. Optimization of the APOP screener to predict functional decline or mortality in older emergency department patients: cross-validation in four prospective cohorts. Exp Gerontol 2018;110:253–9.
16. Fluitman KS, van Galen LS, Merten H, et al. Exploring the preventable causes of unplanned readmissions using root cause analysis: coordination of care is the weakest link. Eur J Intern Med 2016;30:18–24.
17. Verhaegh MTH, Snijders F, Janssen L, et al. Perspectives on the preventability of emergency department visits by older patients. Neth J Med 2019;77:330–7.
18. Sufettoletto B, Hu J, Guyette M, et al. Factors contributing to emergency department care within 30 days of hospital discharge and potential ways to prevent it: differences in perspectives of patients, caregivers, and emergency physicians. J Hosp Med 2014;9:315–9.
19. Siebens H. The domain management model—a tool for teaching and management of older adults in emergency departments. Acad Emerg Med 2005;12:162–8.
20. Terrell KM, Hustey FM, Hwang U, et al. Quality indicators for geriatric emergency care. Acad Emerg Med 2009;16:441–9.
21. McCusker J, Verdon J. Do geriatric interventions reduce emergency department visits? A systematic review. J Gerontol A Biol Sci Med Sci 2006;61:53–62.
22. Malik M, Moore Z, Patton D, et al. The impact of geriatric focused nurse assessment and intervention in the emergency department: a systematic review. Int Emerg Nurs 2018;37:55–60.
23. Moseley MG, Hawley MP, Caterino JM. Emergency department observation units and the older patient. Clin Geriatr Med 2013;29:71–89.
24. Johannessen A-K, Steinhaug S. Municipal acute units as part of the clinical pathway for older patients. Int J Integr Care 2019;19:2.
25. Lum HD, Sudore RL, Bekelman DB. Advance care planning in the elderly. Med Clin North Am 2015;99:391–403.