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REVIEW

Research priorities for prehospital care of older patients with injuries: scoping review

NAIF HARTHI^{1,2}, STEVE GOODACRE¹, FIONA SAMPSON¹, RAYAN ALHARBI^{2,3}

¹School of Health and Related-Research, University of Sheffield, Sheffield City, UK

²Faculty of Applied Medical Sciences, Jazan University, Jazan City, Saudi Arabia

³School of Nursing and Midwifery, La Trobe University, Melbourne City, Australia

Address correspondence to: Naif Harthi, School of Health and Related-Research, University of Sheffield, Sheffield City, UK. Tel: 07939 562204. Email: nharthi1@sheffield.ac.uk

Abstract

Background and objective: There is increasing recognition of the importance of prehospital trauma care for older patients, but little systematic research to guide practice. We aimed to review the published evidence on prehospital trauma care for older patients, determine the scope of existing research and identify research gaps in the literature.

Methods: We undertook a systematic scoping review guided by the Arksey and O'Malley framework and reported in line with the PRISMA-ScR checklist. A systematic search was conducted of Scopus, CINAHL, MEDLINE, PubMed and Cochrane library databases to identify articles published between 2001 and 2021. Study selection criteria were applied independently by two reviewers. Data were extracted, charted and summarised from eligible articles. A data-charting form was then developed to facilitate thematic analysis. Narrative synthesis then involved identifying major themes and subthemes from the data.

Results: We identified and reviewed 65 studies, and included 25. We identified five categories: 'field triage', 'ageing impacts', 'decision-making', 'paramedic awareness' and 'paramedic's behaviour'. Undertriage and overtriage (sensitivity and specificity) were commonly cited as poorly investigated field-triage subthemes. Ageing-related physiologic changes, comorbidities and polypharmacy were the most widely researched. Inaccurate decision-making and poor early identification of major injuries were identified as potentially influencing patient outcomes.

Conclusion: This is the first study reviewing the published evidence on prehospital trauma care for older patients and identifying research priorities for future research. Field-triage tools, paramedics' knowledge about injuries in the older population, and understanding of paramedics' negative behaviours towards older patients were identified as key research priorities.

Keywords: older patients, trauma, prehospital care, older people

Key Points

- This is the first review identifying research priorities in prehospital trauma care for older patients.
- We identified five research areas: 'field-triage', 'ageing changes', 'decision-making', 'paramedic's awareness' and 'paramedics' behaviours'.
- Ageing-related physiologic changes, comorbidities, and polypharmacy were the most widely researched.
- Undertriage and overtriage were commonly cited as poorly investigated field-triage subthemes.
- Inaccurate decision-making and poor early identification of major injuries were identified as potentially influencing patient outcomes.

Introduction

Globally, the ageing population, improved care for chronic illnesses, and lifestyle changes have contributed to increased injuries amongst older people [1–3]. Bala *et al.* (2013) [4] estimate that the older population will reach two billion in 2050 based on the World Health Organisation statistics. Studies of population demographics worldwide suggest that 20% of the US population will be aged over 65 by 2030, 23% of the UK population aged 65 or more by 2035, 30% aged over 65 in Europe by 2050 and 21% in Australia by 2054 [2, 5–7]. Older people use ambulance services at higher rates than younger counterparts [8], so paramedics face a challenge of increased calls from older patients [9]. Healthcare costs and demand for healthcare services will increase due to higher complication rates and prolonged hospitalisations in older people [10–12].

The primary reason for the increased incidence of older people presenting with injuries appears to be the increasing older population [13, 14]. According to Bonne and Schuerer (2013), injured older patients admitted to hospitals represent 25% of all trauma cases in the USA. Paramedics strive to provide effective trauma assessment and management for older people with injuries [15], but paramedics face challenges making definitive decisions [2, 16, 17]. Ageing-related changes can increase the risk of adverse outcomes, such as disabilities or deaths [18], but there is a lack of evidence to guide prehospital trauma care for older patients. A scoping review is therefore required to identify what evidence is available and where the gaps in the evidence lie.

Methods

This scoping review was conducted according to the five-stage Arksey and O'Malley framework. This approach was applied in line with the PRISMA extension for scoping reviews (PRISMA-ScR) checklist [19] (see [supplementary file 1](#)). It did not fulfil the registration criteria of PROSPERO.

The first stage: the development of research question

The review question was formalised using the Levac, Colquhoun and O'Brien (2010) [20] approach for scoping studies by combining a broad question with a clear inquiry scope. This approach consists of three components: the concept is 'prehospital care', the target population is 'older patients with injuries', and the health outcomes of interest is 'improvement of prehospital trauma care of older patients and their outcomes'. This led us to formalise the review question: 'What does the published research tell us about the gaps in the available evidence that could constitute research priorities for prehospital trauma care for older patients?'

The second stage: identification of relevant papers

A literature search strategy was applied, initially using specific online databases (Cochrane library, Campbell Library of

Systematic Reviews and PROSPERO) to ensure the review question had not been addressed in the last 5 years. These databases were searched by employing three broad terms: 'elderly', 'injury' and 'prehospital'. Inclusion and exclusion criteria were developed and then agreed as a consensus between the authors (see [Table 1](#)):

The Arksey and O'Malley approach aims to ensure a broad and comprehensive review by including relevant papers from searches of online databases (for published papers), grey literature (for unpublished papers) and reference lists of relevant papers [19]. We did not undertake a grey literature search because the review question dictated including only published papers.

The keywords: 'elderly', 'injury' and 'prehospital' were used to explore their synonyms by depending on self-suggestion to generate synonyms for each keyword and then using each keyword and suggested synonym in the MeSH search engines of the PubMed and CINAHL databases to allow for high specificity searches, leading to these synonyms: (Old OR Elder OR Geriatric OR Ageing OR Aging) AND (Trauma OR Wound) AND (Out of Hospital OR Emergency medical services OR Ambulance OR Paramedic). Therefore, the keywords and synonyms were used with applying a truncation style (*), acronyms and phrases (using quotes "") during searching in these online databases Scopus, CINAHL, MEDLINE, PubMed and Cochrane library. A combination of keywords, synonyms, and phrases was applied in these online databases by using Boolean operators (AND/OR) to refine the literature search further (see [Appendix 1](#)). A qualified health sciences librarian was consulted for advice on the MeSH search engines and determining which online databases to use. We devised an initial search strategy, which was later refined in the light of early results.

The third stage: study selection

The initial 5,452 search records were electronically limited by first reviewer NH, in accordance with the PRISMA 2009 Flow Diagram [21], to identify papers that were written in English, published in or after 2001, and available as full-text papers. A two-stage study selection process was then applied independently by two reviewers NH and RA: 1st stage to scan titles and abstracts and 2nd stage to review full-text papers to include studies focusing on paramedic care for older people with injuries.

The fourth stage: charting data

A table of the characteristics of included articles was developed to report study authors, date of publishing, origins, publishers, aims/objectives, research designs, sample and key findings from the included papers (see [Appendix 2](#)). The extracted information was then exported onto a Microsoft Excel spreadsheet to develop the data-charting form to help identify themes and subthemes for the 5th stage of this review and facilitate updating this review in an iterative process. The key information of included papers were then extracted and charted by using the SPSS 27 software to show

Table 1. Inclusion and exclusion criteria

<i>Inclusion criteria</i>	<i>Exclusion criteria</i>	<i>Rationale</i>
English language	Non-English language	There might be useful non-English papers, but practical difficulties of translating papers would make a scoping review unmanageable.
Available full-text papers	Unavailable full-text papers	Some databases or journals do not provide access to full-text articles.
Papers focus on prehospital care	Papers focus on other settings	This review focuses on prehospital settings.
All published relevant papers that include method and results sections.	The following papers: editorials, opinion pieces, and narrative reviews.	To ensure a broad literature search for original research papers.
Papers published in or after 2001.	Papers published before 2001.	To ensure including the most relevant evidence through the last twenty years.
Papers focusing on paramedic roles for older persons with injuries.	Papers focus on other disciplines such as epidemiology, injury prevention, etc.	To ensure the most useful papers focusing on paramedic's roles for older patients with injuries.

the characteristics of existing literature such as number of papers published per year, and percentages and times of each theme identified in the included literature.

The major themes and subthemes were identified by several steps. Firstly, the included papers' findings were reviewed using the Excel Sheet software to record information that addressed the review question and link the identified information with each paper. Secondly, the identified information was collected and considered as subthemes. Thirdly, the subthemes were collected and classified to generate major themes. Fourthly, we implemented a process to determine the percentages and times each major theme was identified in the included literature.

The fifth stage: collating, summarising and reporting the existing results

Each paper's findings were read and re-read in order to address the review question and objectives. To determine the scope of existing research, the thematic analysis was applied by highlighting and identifying each point indicated in the included papers addressing the review question. Then, all identified points were considered as subthemes and all subthemes were imported onto an excel spreadsheet to link each identified subtheme with its paper to facilitate returning back to that paper for the following two excel spreadsheet functions: (i) when we need to collate, summarise and report the existing literature, and (ii) when we need to identify research gaps under each major theme.

After that, all subthemes were allocated to five categories that were then considered as major themes that then led to a narrative synthesis by collating, summarising and reporting the existing literature results. We then returned back to the included papers' findings to identify research gaps associated with each subtheme. We directly identified gaps that were specifically reported in the primary studies as issues needing further research. We indirectly identified gaps by inference from uncertainties in the findings or reported lack of reliable knowledge, or evidence of poor care reported in the primary studies, since poor care may reflect lack of evidence.

Results

The search strategy yielded 5,452 citations: Scopus *n* = 1,572; CINAHL via EBSCO *n* = 518; MEDLINE via Ovid *n* = 1,303; PubMed *n* = 1,154; Cochrane library *n* = 905 (see Appendix 1). These 5,452 citations were then refined into 2,940 that were English papers, published in or after 2001 and available as full-text papers. The titles and abstracts of these 2,940 citations were scanned, yielding 127 relevant articles which were then exported to Mendeley Software to remove duplicates, and manage and facilitate reviewing the final included papers. We removed 62 duplicates to include 65 articles. The 2nd stage reviewing of these 65 articles led us finally include 25 papers and exclude ineligible 40 papers. The reference lists of included papers were then scanned and no paper met the inclusion criteria (see Figure 1). The second reviewer checked the eligibility of the 65 articles and did not find any differences with the first reviewer.

Figure 2 describes publication years for the included papers from 2001 into 2021, showing a gradual increase in the relevant published studies in the last 10 years.

Most included papers (20 out of 25) were from the USA, with four from Australia and one from Germany. Research designs included 21 quantitative papers (18 retrospective papers and three prospective papers), two reviews, one mixed methods paper (a consensus panel of experts) and one qualitative paper (interviews and focus groups).

Review of the included papers identified the following major themes: 'field-triage', 'ageing changes', 'decision-making', 'paramedics' awareness' and 'paramedics' behaviours' (see Figure 3):

Table 2 shows which papers identified each major theme. Field-triage represented the most common major theme (38%–22 times), followed by the paramedic's awareness (24%–14 times), decision-making (17%–10 times), ageing changes (14%–8 times), and paramedic's behaviour (7%–4 times).

Field triage-related challenges

Four subthemes were generated under this theme: under-triage and over-triage, and triage sensitivity and specificity. Major trauma older patients can be undertriaged by

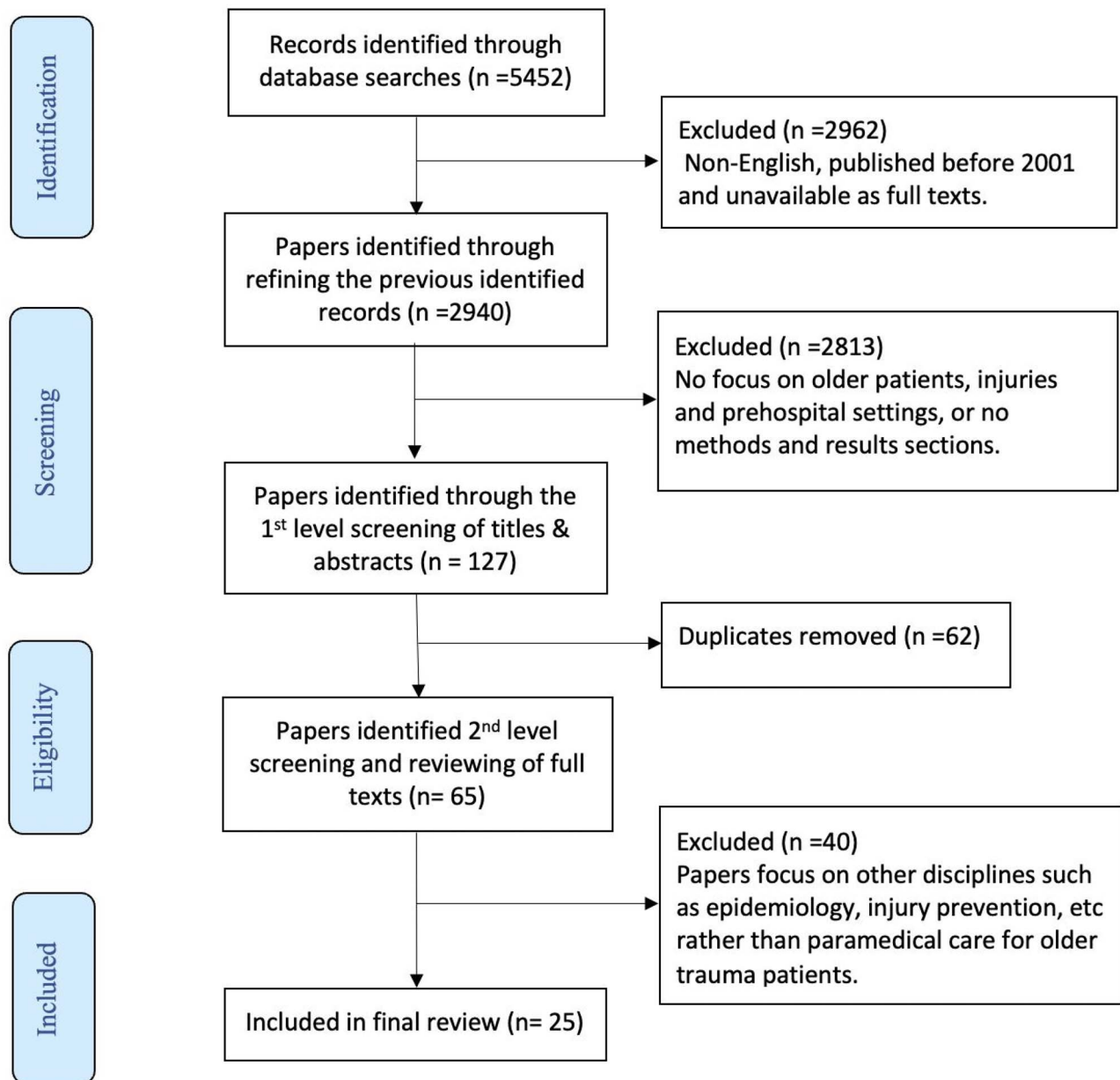


Figure 1. The PRISMA flow diagram for scoping review of literature focusing on prehospital care for older patients with injuries.

transporting them to a suboptimal level of care [12, 22–24], whereas overtriage can occur when older patients with minor injuries are taken to major trauma centres [25]. The existing literature suggested that older patients with injuries are at greater risk of undertriage [12, 13, 23, 26, 27], with most existing literature focusing on undertriage. Newgard *et al.*, (2016) reported that reducing undertriage in injured older patients can increase the risk of overtriage.

Undertriage is multifactorial issue [22], involving inadequate geriatric care training, paramedics perceptions of the value of healthcare for older patients, unfamiliarity or non-adherence in triaging older patients, perceived negative attitudes at trauma centres towards paramedics delivering older patients, poorer prognosis, the proximity to

trauma units, ineffective or inapplicable triage tools, patient preference, lack of trauma centres in residence area, increased comorbidities, failure to identify major injuries due to low energy trauma and resistance to improve care [22, 23, 27, 29–32]. Wasserman *et al.* (2014) and Newgard *et al.* (2016) recommended that overtriage also should be considered when attempting to reduce undertriage, but Wasserman *et al.* (2014) described this as a challenge. In terms of implications, Benjamin *et al.* (2018) and Brown *et al.* (2019) reported that undertriage led to reduced transports to trauma centres and consequent increased in-hospital mortality amongst geriatric patients. Newgard *et al.* (2014) and Wasserman *et al.* (2014) reported that overtriage resulted in increasing ambulance transports, ED attendances, healthcare costs,

Research priorities for prehospital care of older patients with injuries

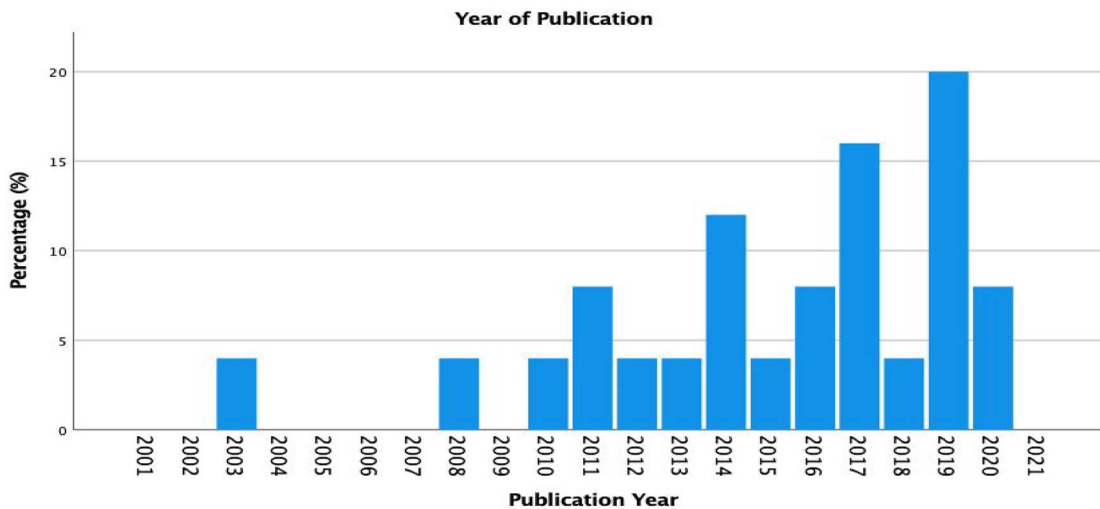


Figure 2. Years of publication for the included papers.

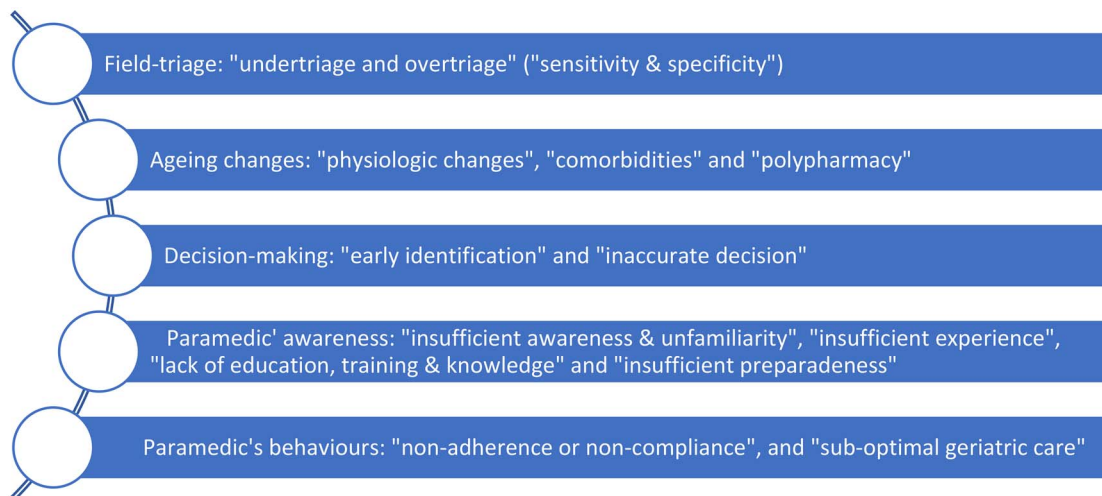


Figure 3. The major themes and subthemes.

decreasing trauma system efficiency and disruption in healthcare continuity.

Sensitivity means the field-triage tool's probability of identifying older patients with major injuries when the condition is present, whereas the specificity means the probability that the field-triage tool will identify patients who do not suffer from major injuries when the condition is absent [32]. Field-triage tools should aim to increase sensitivity to prevent undertriage and increase specificity to reduce overtriage [32]. Adding geriatric criteria to adult field-triage tools can increase the sensitivity and specificity for identifying older patients who need transport to trauma centres [14]. Using adult field-triage with older patients can lead to decreased sensitivity, whereas using geriatric field-triage with younger patients can lead to increased sensitivity and decreased specificity [14, 35]. Four retrospective studies were conducted to determine the field-triage sensitivity and specificity after adding geriatric criteria such as GCS, vital signs, comorbidities and anticoagulants or antiplatelet use [31, 36–38]. Cull

et al. (2019) found that adding prehospital scores of GCS and vital signs helped to improve undertriage 'sensitivity' and overtriage 'specificity'. Although Caterino, Raubenolt and Cudnik (2011) and Newgard *et al.* (2019) reported that changing the GCS cutoff from 13 to 14, or adding vital signs and comorbidities improved the field-triage sensitivity to identify older patients who need transporting to trauma centres at the expense of specificity. Regarding anticoagulant and antiplatelet use, Nishijima, S. D. Gaona, *et al.* (2017) showed that this criterion has improved triage tool sensitivity, whereas Newgard *et al.* (2019) found that adding anticoagulant use criterion did not help to identify high-risk older patients.

There was no consistent age threshold to determine which patients should be managed by geriatric-specific guidelines [3], with studies using 55 years [12, 26, 27, 34, 35, 37, 39, 40], 65 years [24, 28, 29, 31, 32, 38], 70 years [14, 22, 36, 41], 60 years [33, 42] and 50 years-old to define older patients [30].

Table 2. Distribution of the major themes in the included papers

No	Papers	Field-triage	Decision-making	Ageing changes	Paramedic's awareness	Paramedic's behaviour
1	Amoako <i>et al.</i> (2019)	Yes	Yes	No	Yes	No
2	Benjamin <i>et al.</i> (2018)	Yes	Yes	Yes	No	No
3	Brown <i>et al.</i> (2019)	Yes	No	No	No	No
4	Brown <i>et al.</i> (2020)	Yes	Yes	No	Yes	Yes
5	Caterino, Raubenolt and Cudnik (2011)	Yes	No	No	No	No
6	Chang <i>et al.</i> (2008)	Yes	Yes	No	Yes	No
7	Cox <i>et al.</i> (2014)	Yes	Yes	Yes	No	No
8	Cull <i>et al.</i> (2019)	Yes	No	No	Yes	No
9	Garwe <i>et al.</i> (2017)	Yes	No	Yes	Yes	No
10	Hon <i>et al.</i> (2020)	Yes	Yes	No	Yes	No
11	Ichwan <i>et al.</i> (2015)	Yes	No	No	No	No
12	Meyers <i>et al.</i> (2019)	Yes	Yes	No	Yes	Yes
13	Nakamura <i>et al.</i> (2012)	Yes	No	Yes	No	No
14	Newgard <i>et al.</i> (2019)	Yes	Yes	No	No	No
15	Newgard <i>et al.</i> (2016)	Yes	No	No	Yes	No
16	Newgard <i>et al.</i> (2014)	Yes	No	No	Yes	No
17	Oberkircher <i>et al.</i> (2016)	No	No	Yes	Yes	No
18	Simpson <i>et al.</i> (2017)	No	Yes	No	Yes	Yes
19	Staudenmayer <i>et al.</i> (2013)	Yes	No	Yes	No	No
20	Wasserman <i>et al.</i> (2014)	Yes	No	No	No	No
21	Werman <i>et al.</i> (2011)	Yes	No	No	No	No
22	Nishijima, S. D. Gaona, <i>et al.</i> (2017)	Yes	No	No	Yes	No
23	Nishijima, S. Gaona, <i>et al.</i> (2017)	No	No	No	Yes	No
24	Scheetz (2003)	Yes	No	Yes	Yes	Yes
25	Scheetz (2010)	Yes	Yes	Yes	No	No

Ageing changes and impacts in older patients

Three subthemes were identified under ageing changes that can influence patient outcomes as combined factors: physiological changes, comorbidities and polypharmacy, [12, 32]. Physiological changes reflect reduced ability of older patients to tolerate blood loss or rapid fluid shifts, and reduced respiratory and cardiovascular responses to injuries [13, 27, 33, 42]. Three quantitative studies showed that multiple diseases (congestive heart failure and cerebrovascular accident) and polypharmacy use (beta-blockers, anticoagulants and antiplatelets) can blunt the compensatory physiologic responses to injuries [27, 32, 33]. Paramedics may delay providing aggressive care or undertriage those older patients, leading to risks of mortality [12, 33].

Decision-making processes when caring for older trauma patients

Two relevant subthemes were generated: early identification of high-risk older patients and inaccurate decision-making. Three papers indicated that early identification of high-risk older patients is the first decision-making step in managing older patients with injuries [28, 33, 38]. Cox *et al.* (2014) stated that paramedics play important roles in the field-triage decision-making to provide optimal care for older patients but may make inaccurate decisions [23]. The reasons for this inaccuracy include age bias, decreased level of suspicion, inadequate training and unfamiliarity with triage [23, 29, 35, 38]. A qualitative study indicated that some paramedics received inadequate geriatric-specific training and education

regarding the decision-making [43], but there is little existing literature on the causes of inadequate training in prehospital decision-making. Amoako *et al.*, (2019) and Meyers *et al.* (2019) recommended that education and training are required to improve the accuracy of prehospital decision-making, whereas Scheetz (2010) advised providing reliable evidence to inform field-triage decision-making.

Paramedic's awareness regarding the older population

The four relevant subthemes were identified: (i) insufficient awareness or unfamiliarity, (ii) inexperience, (iii) inadequate education, training and knowledge and (iv) inadequate preparedness. In terms of insufficient awareness or unfamiliarity, two papers identified a need to increase paramedics' awareness regarding the impacts of pre-injury polypharmacy (e.g. antiplatelets and anticoagulants) in head-injured older patients [37, 39]. Some paramedics are unfamiliar with field-triage, which can be a reason for undertriage [29, 31], and some paramedics have insufficient experience in assessing and diagnosing older patients with injuries [23, 35]. This may be due to inadequate training and knowledge regarding geriatric care and ageing impacts [29, 31, 32]. Insufficient preparedness can also occur due to inadequate education and training, lack of confidence and constant work pressure that can inhibit providing effective care [43]. The existing literature recommends educating paramedics about the polypharmacy impacts, improving field-triage and transport criteria, educating and training paramedics before implementing

new field-triage criteria, and training paramedics in giving analgesia for injured older patients [22, 27–30, 34, 39, 42].

Paramedic's behaviour when caring for older trauma patients

Two relevant subthemes were generated: non-adherence or non-compliance, and sub-optimal geriatric care. Meyers *et al.* (2019) and Brown *et al.* (2020) identified paramedics' non-adherence or non-compliance in applying field-triage tools for older patients with injuries, potentially leading to undertriage and poor patient outcomes [23, 30]. Scheetz, (2003) recommended integrating compliance into geriatric-specific training to ensure effective triage. Further, Simpson *et al.* (2017) interviewed paramedics who were frustrated by repeated requirement to attend older patients with low-energy injury and reported inadequate geriatric training. Sub-optimal care can occur when paramedics believe that they are trained to provide optimal care for older patients with life-threatening conditions rather than older patients with low-energy injury [43].

Discussion

To our knowledge, this is the first review identifying research priorities in prehospital trauma care for older patients. We included twenty-five studies identifying five topic areas with their subthemes to address the review question. Most studies were carried out in the last ten years and originated in the United States, and most were retrospective. They commonly focused on the 'field-triage', followed by 'paramedic's awareness', 'decision-making', 'ageing changes', and 'paramedic's behaviour' themes.

This review identified several research gaps and priorities. The existing studies focused on undertriage amongst older patients with injuries more than overtriage. Overtriage received little attention in the existing literature, despite evidence that overtriage can increase when addressing undertriage. There is a need to investigate factors associated with undertriage and overtriage, along with improving triage sensitivity and specificity. Increasing paramedics' knowledge regarding ageing-related physiological changes, comorbidities and polypharmacy could reduce the risk of undertriage, delayed definitive care, and avoidable mortality. Research is required to identify the causes of insufficient knowledge regarding the older population and ageing impacts on patient outcomes. We found only one paper investigating how inaccurate decision-making can lead to sub-optimal geriatric care, so further research required to identify factors influencing the decision-making process. We also found evidence suggesting that some paramedics are unfamiliar with triage guidelines, lack experience in geriatric care, or are insufficiently prepared to manage geriatric trauma. Further research is needed to understand how paramedics approach the challenge of geriatric trauma. Finally, we found some evidence of negative attitudes amongst paramedics to geriatric trauma that could result in sub-optimal care, so

further studies are needed to understand these behavioural issues.

This review followed a systematic approach to scoping the existing literature based upon an established framework, ensuring that the methods are transparent and the results reproducible. In terms of limitations, the included papers were not critically appraised because this is not a common practice with scoping studies. The lack of critical appraisal means that this review may have accepted conclusions that are not supported by the data. This scoping review only included papers written in English, which can lead to missing important articles written in other languages. Most of the included studies were observational quantitative studies, so we need to be cautious about drawing any conclusions about causation.

We aimed to identify research gaps that could constitute future research priorities. A scoping review can identify gaps reported in or arising from previous studies but may not identify important gaps that have been overlooked by previous research. For instance, older people with syndromes such as delirium, falls and frailty may present with injuries, thus requiring paramedics to have a good understanding of geriatric syndromes. We found little relevant consideration of geriatric syndromes, suggesting that these syndromes have been overlooked by the existing literature. These gaps could be identified by qualitative interviews, focus groups, or a survey of relevant stakeholders, such as paramedics or experts in geriatric trauma, to identify the key uncertainties they encounter in their practice.

Conclusion

This review has highlighted five main topics: field-triage related challenges, impacts of ageing changes on prehospital care, prehospital decision-making processes, paramedic's awareness regarding older population, and negative paramedic's behaviours when responding to older trauma patients. Future research is required to investigate the causes of undertriage and overtriage, and improve field-triage sensitivity and specificity to identify high-risk older patients. Further studies are also needed to determine factors contributing to insufficient awareness about ageing impacts, explore the decision-making process, and understand negative paramedic's attitudes in dealing with older patients.

Declaration of Conflicts of Interest: None.

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