

REVIEW

Open Access



Understanding patient non-transport decision theories in the pre-hospital setting: a narrative review

Hassan Farhat^{1,2,3}, Kawther El Aifa¹, Guillaume Alinier^{1,4,5,6*}, Abdulqadir Nashwan⁷, Padarath Gangaram^{1,8}, Moncef Khadhraoui⁹, Loua Al-Shaikh¹, Imed Gargouri¹⁰ and James Laughton¹

Abstract

Background In pre-hospital emergency care, decisions regarding patient non-conveyance emerged as significant determinants of healthcare outcomes and resource utilization. These complex decisions became integral to the progress of emergency medical services, thus warranting an evolving exploration within the medical discourse.

Objectives and methods This narrative review aimed to synthesize and critically evaluate various theoretical stances on patient non-conveyance in the pre-hospital emergency. The focus on studies published between January 2012 and August 2022 was intentional to capture contemporary practices and insights. PubMed and Google Scholar served as the primary databases for the investigation, while the AL-Rayyan[®] software facilitated a thorough screening process.

Results and discussion Twenty-nine studies—encompassing articles, books, and theses—were discovered through our search, each presenting unique perspectives on patient non-transport, thus highlighting its criticality as a healthcare concern. Predominant factors influencing non-transport decisions were classified into patient-initiated refusals (PIR), clinician-initiated decisions (CID), and dispatcher-initiated decisions (DID).

Conclusions The issue of patient non-conveyance to hospitals continues to pose a crucial challenge to the seamless operation of emergency healthcare systems, warranting increased attention from various healthcare entities. To comprehend and pinpoint potential areas of improvement, a comprehensive analysis of pre-hospital non-transport events is imperative. A well-informed, strategic approach could prevent resource waste while ensuring patients receive the required and definitive care.

Key messages

Why is this topic important?

Some studies have suggested that non-transport to hospitals following emergency calls is safe. However, it is a concerning issue for health systems. It is also considered a key performance metric for health systems.

What does this review attempt to show?

This review aimed to map the various factors discussed in the literature regarding the decisions not to transport patients following emergency calls in a pre-hospital setting.

*Correspondence:

Guillaume Alinier

G.Alinier@herts.ac.uk

Full list of author information is available at the end of the article



© The Author(s) 2023. **Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>. The Creative Commons Public Domain Dedication waiver (<http://creativecommons.org/publicdomain/zero/1.0/>) applies to the data made available in this article, unless otherwise stated in a credit line to the data.

What are the key findings?

The existing theories regarding non-transport to hospitals after the provision of emergency care in the pre-hospital setting were identified. Non-transport due to non-clinical decisions jeopardizes emergency care outcomes for paediatric and elderly patients in particular. Hence, further research is required to identify and control the factors governing these decisions.

How is patient care impacted?

The decisions regarding patient transport following emergency calls in a pre-hospital setting are crucial for patient outcomes. They could impact the pre-hospital emergency care outcomes as well as patient safety. They can also affect the emergency services resources' ability to respond to other critical emergencies.

Keywords Non-conveyance, Non-transport, Transport refusal, Prehospital care, Ambulance service

Background

The Emergency Medical Services (EMS) system provides an out-hospital emergency medical service response. When a health emergency arises, the patient or their next of kin will likely dial the EMS number. Most EMS services utilize a computerized dispatch system to manage pre-hospital emergency calls [1]. Once the emergency call is received, the emergency medical dispatcher (EMD) processes the call using internationally recognized and standardized software systems [2]. Initially, the caller is asked a series of pre-determined questions using a Program Question Answer (ProQA[®]) system owned by Priority Dispatch Corporation.™ (PDC). These are used to determine the final dispatch coding [3]. Subsequently, the EMD determines the most appropriate emergency response unit (ERU) for immediate dispatch using the Medical Priority Dispatch Systems (MPDS). After ERU's arrival on scene, the medical responder assesses and triages the patient, provides them with initial emergency treatment, and transports them to the appropriate healthcare facility to receive definitive care [4–6].

In most EMS systems, patients with full mental capacity have the absolute right to refuse treatment or transport to a healthcare facility. Recent studies have identified that the percentage of patients not transported to healthcare facilities varies between 3.7 and 93.7% globally [7]. The theory-based classification of non-transport factors could help explain the wide variance in non-transport decisions. Understanding these factors and theories is essential as non-transport concerns health systems worldwide [6–8].

Researchers have worked on determining appropriate guidance, regulations, and rules to mitigate the potential risks of non-transport [9, 10]. Such decisions could jeopardize patient health, delay definitive care, and create a feeling of fear within the EMS staff [4]. To our knowledge, no previous review summarized the existing theories of patient non-transportation following an emergency call in the pre-hospital setting.

This review highlights the different approaches published in the literature regarding patient non-transport, also called non-conveyance, to healthcare facilities in the pre-hospital emergency setting.

Methods

A narrative review of the literature was conducted. First, a research question was formulated, followed by a pilot search to identify and map the theories reported in the literature. Subsequently, a thorough search was conducted between May and August 2022 through Google Scholar and MEDLINE/PubMed. Only articles published during the last decade (between 2012 and 2022) were included in this search. These inclusion criteria were adopted as, over the last decade, EMS systems have seen significant changes, including a surge in the use of new technologies, such as digital communications and electronic medical records, improvements in the health policies, medical guidelines and clinical practice [11, 12]. This could significantly impact decision-making processes regarding patient transport, and then including older articles may not reflect these realities. The PubMed search was conducted using MeSh terms (((non transport[Title] ambulance[Title]) OR (Non conveyance hospital[Title])) OR (non transport hospital[Title])) OR (Non conveyance[Title] hospital[Title]). The Google Scholar search was conducted using (allintitle: "Non conveyance" allintitle: "Non transport"). This helped to hone in on articles directly applicable to this review, as generally if non-transport or non-conveyance were a significant part of a study, it would be mentioned in the title. Articles where these topics were not in the title could be less focused on these aspects and not significantly contribute to our review.

All articles, books, theses, and reports discussing patients' outcomes after non-transport were considered. However, studies that did not discuss patient non-transport outcomes in the pre-hospital setting were excluded. Al-Rayyan[®] software was also utilized in this study. Al-Rayyan[®] is a free web software that facilitates the screening of articles, titles, and abstracts using a semi-automatic process [13]. Articles

pertinent to the subject were identified and imported into the Al-Rayyan[®] software. Subsequently, Al-Rayyan[®] automatically identified the duplicated articles and excluded them after verification. Afterwards, the authors (HF and KEA) reviewed and screened the remaining articles' titles, abstracts, and full texts for relevance, with blinding initially turned off and then on in Al-Rayyan[®]. In case of disagreement, a third reviewer (GA) was consulted. The authors (HF and KEA) performed the analysis as well. Articles with irrelevant backgrounds and outcomes were excluded, along with duplicates not identified by the Al-Rayyan[®] software.

Results

A total of 29 articles fulfilled the inclusion criteria. The retained articles and their identifiers are listed in Table 1 and Fig. 1.

In total, 10 studies were identified from the PubMed database and 72 from Google Scholar. Furthermore, 73.6% ($n=53$) of studies were excluded from this review. First, 16.6% ($n=12$) of duplicated articles were excluded by Al-Rayyan[®] software and 2.7% ($n=2$) by the reviewers. Second, the reviewers excluded 43% ($n=31$) of studies with irrelevant backgrounds. Third, 12.5% ($n=9$) of studies with irrelevant outcomes were removed. Therefore, 36.1% ($n=26$) of the articles, two theses and one book chapter were ultimately retained as they were considered relevant for this review. The factors related to patient non-conveyance identified after the thorough review of these articles were patient-initiated refusals (PIR), clinical-initiated decisions (CID), and dispatcher-initiated decisions (DID).

PIR refer to situations where the patient, after having initially called for emergency services, refused to be transported to the hospital. These decisions can be due to various reasons, such as perceived improvement in their condition, fear of medical costs, or unwillingness to leave home. Conversely, CID denotes circumstances where the healthcare professionals responding to the emergency call decide not to transport the patient to the hospital. This could occur when the responding clinician assesses the patient's condition as not requiring further hospital care or deems it more appropriate for the patient to seek alternative care pathways such as primary or community care services. Lastly, DID are instances where the decision for patient non-conveyance is made at the dispatch level. Based on the information provided during the call, this might happen when the dispatcher determines that the situation does not necessitate ambulance transport to the hospital. In such cases, callers might be advised to seek alternative care pathways. Each of these aspects reflects a different point in the emergency services pathway where a decision for non-transport may be made. They underline the multifaceted nature of non-transport decisions in

emergency medical services and contribute to our understanding of the complexity of these scenarios.

According to the data presented in Tables 2 and 3, 46.4% ($n=51$) of the studies included in this review were from North America, 43.6% ($n=48$) were from Europe, and 7.3% ($n=8$) were from Australia. The remaining 9% ($n=3$) were from Asia and Africa.

Discussion

Ensuring the provision of effective and safe healthcare within the out-of-hospital environment is an enduring challenge for healthcare professionals. This issue has received considerable attention within North American and European contexts, perhaps attributable to these regions' established and comprehensive prehospital EMS systems. Moreover, the literature reviewed herein dissected three primary theoretical frameworks that underpin decisions of patient non-transportation: DID, CID, and PIR.

These decision-making mechanisms collectively shape the landscape of patient non-transport decisions in pre-hospital care. The juxtaposition of these diverse theories underscores the multifaceted and complex nature of non-transport decisions. It hints at the necessity for a nuanced understanding incorporating the varied elements of pre-hospital care environments.

Dispatcher-initiated decisions (DID)

Utilizing a standardized computerized system in the triage and management of pre-hospital emergency calls can notably diminish error rates, bolstering quality management and assurance. EMDs often employ a computer-aided dispatch (CAD) system to enhance their decision-making processes, ensuring the expedited dispatch of the most appropriate ERUs. This system undergoes consistent regulation and enhancement, with its performance benchmarks often tethered to the best-performing global EMS systems. A select number of ambulance services employ a computerized medical dispatch system to adeptly manage pre-hospital emergency calls [14, 15], known as the MPDS [16]. MPDS is a computer-based pre-hospital categorization system that can be utilized to optimize the management of pre-hospital cases. It facilitates allocating and dispatching the most appropriate pre-hospital ERU according to the patient's chief complaints. MPDS enables EMDs to dispatch an ERU staffed with a responder with the required level of skills. This helps avoid delays in providing emergency treatment [17]. A recent study from Finland demonstrated that 40% of emergency calls resulted in patient non-transport decisions; 37.7% of these were aborted by the EMD before the ERU reached the patient [18]. This could be due to causes related to the caller or the EMD.

Table 1 List of the articles included in this study

Title	Reference type	Database provider	Year	Volume	Authors	ISBN/ISSN	DOI	URL
1 Can Paramedics Safely Refuse Transport of Non-Urgent Patients?	Journal Article	Cambridge University Press	2016	31	Fraess-Phillips, Alex J	1049-023X, 1945-1938	10.1017/S1049023X16000935	https://www.cambridge.org/core/journals/prehospital-and-disaster-medicine/article/abs/can-paramedics-safely-refuse-transport-of-nonurgent-patients/B0E2CA566A9B268DEA7A168C0C6FF158#
2 Variation in Interpretation of Guidance as an Explanation of Between-Service Variation in Ambulance Quality Indicators on Non-Conveyance	Journal Article	emj.bmj.com	2016	33	Stone, Tony; O' Cathain, Alicia; Knowles, Emma	1472-0205, 1472-0213	10.1136/emmermed-2016-206139.36	https://emj.bmj.com/content/33/9/e11.2;
3 A patient-safety and professional perspective on non-conveyance in ambulance care: a systematic review	Journal Article	BioMed Central	2017	25	Ebben, Remco H.A.; Voet, Lilian C.M.; Speijers, Renate F.; Tonjes, N	1757-7241	10.1186/s13049-017-0409-6	https://doi.org/10.1186/s13049-017-0409-6;
4 Conveyance and non-conveyance to the emergency department after self-harm: Prevalence and ambulance service staff perspectives	Thesis	etheses.whiterose.ac.uk	2017	Unassigned	Jenkins, Emily Jayne	Unassigned	Unassigned	https://etheses.whiterose.ac.uk/18257/;
5 Encountering and counselling patients and family members in out-of-hospital emergency care in non-conveyance situations	Journal Article	pagepressjournals.org	2018	14	Paavilainen, Eija; Mikola, Ritita; Salminen-Tuomaala, Mari; Leikkol	2282-2054	10.4081/ecj.2018.7468	https://pagepressjournals.org/index.php/ecj/article/view/7468;
6 Exploring variation in how ambulance services address non-conveyance: a qualitative interview study	Journal Article	bmjopen.bmj.com	2018	8	Knowles, Emma; Bishop-Edwards, Lindsey; O' Cathain, Alicia	2044-6055, 2044-6055	10.1136/bmjopen-2018-024228	https://bmjopen.bmj.com/content/8/11/e024228;

Table 1 (continued)

Item	Reference type	Database provider	Year	Volume	Authors	ISBN/ISSN	DOI	URL
7	Journal Article	BioMed Central	2018	13	Porter, Alison; Dale, Jeremy; Foster, Theresa; Logan, Pip; Wells, Bridg	1748–5908	10.1186/s13012-018-0786-x	https://doi.org/10.1186/s13012-018-0786-x
8	Journal Article	Wiley Online Library	2018	62	Pekanoja, S.; Hoikka, M.; Kyngäs, H.; Elo, S	1399–6576	10.1111/aas.13071	https://onlinelibrary.wiley.com/doi/abs/10.1111/aas.13071 ;
9	Book	www.ncbi.nlm.nih.gov	2018	Unassigned	O’Cathain, Alicia; Knowles, Emma; Bishop-Edwards, Lindsey; Coster,	Unassigned	Unassigned	https://www.ncbi.nlm.nih.gov/books/NBK506836/ ;
10	Journal Article	PLoS Journals	2018	13	O’Cathain, Alicia; Jacques, Richard; Stone, Tony; Turner, Janette	1932–6203	10.1371/journal.pone.0204508	https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0204508 ;
11	Journal Article	PubMed Central	2019	10	Ebben, Remco H.A.; Castelijn, Mariola; Frenken, Joost; Vloet, Lillian	1920–8642	10.5847/wjem.j.1920-8642.2019.04.008	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6732166/ ;
12	Journal Article	ScienceDirect	2019	13	Karbakhsh, Mojgan; Beaulieu, Emilie; Smith, Jennifer; Zheng, Alex; T	2211–3355	10.1016/j.pmedr.2018.12.010	https://www.sciencedirect.com/science/article/pii/S2211335518301591 ;

Table 1 (continued)

Title	Reference type	Database provider	Year	Volume	Authors	ISBN/ISSN	DOI	URL
13 Patients' aged ≥ 65 years dispositions during ambulance assignments, including factors associated with non-conveyance to hospital	Journal Article	BMJ	2020	10	Forsgårde, Elin-Sofie; Elmqvist, Carina; Fridlund, Bengt; Svensson, A	2044–6055, 2044–6055	10.1136/bmjopen-2020-038885	https://bmjopen.bmj.com/content/10/11/e038885 ;
14 Association Between an Electronic Non-transport Checklist and the Mortality of Patients Discharged-at-Scene by Paramedics in New Zealand	Thesis	Auckland University of Techn	2021	Unassigned	Watson, Fraser	Unassigned	Unassigned	https://openrepository.aut.ac.nz/handle/10292/14360 ;
15 EMS non-conveyance: A safe practice to decrease ED crowding or a threat to patient safety?	Journal Article	Springer	2021	21	Paulin, Jani; Kurola, Jouni; Koivisto, Mari; Iirola, Timo	1471-227X	10.1186/s12873-021-00508-1	https://doi.org/10.1186/s12873-021-00508-1 ;
16 Non-Conveyance Due to Patient-Initiated Refusal in Emergency Medical Services: A Retrospective Population-Based Registry Analysis	Journal Article	MDPI	2021	18	Moafa, Hassan N.; van Kujik, Sander M. J.; Moukhyer, Moham-med E	1660-4601	10.3390/ijerph18179252	https://www.mdpi.com/1660-4601/18/17/9252 ;
17 Non-conveyance of older adult patients and association with subsequent clinical and adverse events after initial assessment by ambulance	Journal Article	BioMed Central	2021	21	Lederman, Jakob; Lindström, Veronica; Elmqvist, Carina; Löfvenmark	1471-227X	10.1186/s12873-021-00548-7	https://doi.org/10.1186/s12873-021-00548-7 ;
18 Patient experience of non-conveyance following emergency ambulance service response: A scoping review of the literature	Journal Article	ScienceDirect	2021	24	King, Robbie; Opreacu, Florin; Lord, Bill; Flanagan, Belinda	2588-994X	10.1016/j.iauec.2020.08.006	https://www.sciencedirect.com/science/article/pii/S2588994X2030083X ;

Table 1 (continued)

Title	Reference type	Database provider	Year	Volume	Authors	ISBN/ISSN	DOI	URL
19 The Alternative Pre-hospital Pathway team: reducing conveyances to the emergency department through patient centered Community Emergency Medicine	Journal Article	Springer	2021	21	Patton, Andrew; O'Donnell, Cathal; Keane, Owen; Henry, Kieran; Cio	1471-227X	10.1186/s12873-021-00536-x	https://doi.org/10.1186/s12873-021-00536-x
20 The effect of a specialist paramedic primary care rotation on appropriate non-conveyance decisions (SPRAINED) study	Journal Article	The College of Paramedics	2021	7	Pilbery, Richard; Young, Tracey; Hodge, Andrew	Unassigned	10.29045/14784726.2022.06.7.1.9	https://www.ingentaconnect.com/content/ucop/bpj/2022/0000007/0000001/art00003?sessionid=5glib34gic4nmxc-lve-03
21 The experience of non-conveyance following emergency medical service triage from the perspective of patients and their relatives	Journal Article	ScienceDirect	2021	54	van Doorn, Silvie C. M.; Verhalle, Ruud C.; Ebben, Remco H. A.; Fro	1755-599X	10.1016/j.ienj.2020.100952	https://www.sciencedirect.com/science/article/pii/S1755599X20.301.245
22 The Safety of Non-Transport Decisions Made by Ambulance Personnel: A Retrospective Study of Subsequent Hospital Admission and 30-Day Mortality	Report	Research Square	2021	1	Amundsen, Kjersti; Elden, Marie Svanes; Myrmei, Lais; Assmus, Jörg;	Unassigned	10.21203/rs.3.rs-276252/v1	https://www.researchsquare.com/article/rs-276252/v1
23 Ambulance crew-initiated non-conveyance in the Helsinki EMS system—A retrospective cohort study	Journal Article	Wiley Online Library	2022	66	Heinonen, Kari; Puolakka, Tuukka; Salmi, Heli; Boyd, James; Laihio,	1399-6576	10.1111/aas.14049	https://onlinelibrary.wiley.com/doi/abs/10.1111/aas.14049
24 Emergency Medical Services Clinicians' Perspectives on Pediatric Non-Transport	Journal Article	Taylor and Francis+NEJM	2022	0	Ward, Caleb E.; Singletary, Judith; Hatcliffe, Rachel E.; Colson, Cindy	1090-3127	10.1080/10903127.2022.2108180	https://doi.org/10.1080/10903127.2022.2108180

Table 1 (continued)

Title	Reference type	Database provider	Year	Volume	Authors	ISBN/ISSN	DOI	URL
25 EMS Non-Transport of Low-Risk COVID-19 Patients	Journal Article	Taylor and Francis+NEJM	2022	0	Couturier, Katherine; Nelson, Alexander R; Burns, Kevin; Cone, Davi	1090-3127	10.1080/10903127.2022.2083278	https://doi.org/10.1080/10903127.2022.2083278 ;
26 Trends in fall-related encounters and predictors of non-transport at a US Emergency Medical Services Agency	Journal Article	Wiley Online Library	2022	30	Jeruzal, Jessica N; Boland, Lori L; Jin, Diana; Traczyk, Christie L.; S	1365-2524	10.1111/hsc.13613	https://onlinelibrary.wiley.com/doi/abs/10.1111/hsc.13613 ;
27 Using machine learning to predict subsequent events after EMS non-conveyance decisions	Journal Article	BioMed Central	2022	22	Paulin, Jani; Reunamo, Akseli; Kurola, Jouni; Moen, Hans; Salanterä,	1472-6947	10.1186/s12911-022-01901-x	https://doi.org/10.1186/s12911-022-01901-x ;
28 Decision-making in ambulance service non-conveyance – the DMASC survey	Journal Article	Emergency Medicine Journal	2019	36	Sarah Black, Ian Frampton	Unassigned	10.1136/emered-2019-999.25	https://www.proquest.com/openview/e4fc2aa74cc9181adf7bf5c0b6c0fd44/1?pq-origsite=gscolar&cbl=2,041,072 ;
29 Convey or not convey? Does crew skill level predict hospital conveyance rate in a UK regional NHS ambulance service trust?	Journal Article	Emergency Medicine Journal	2019	36	Sarah Black, Ian Frampton	Unassigned	10.1136/emered-2019-999.26	https://www.proquest.com/openview/e4fc2aa74cc9181adf7bf5c0b6c0fd44/1?pq-origsite=gscolar&cbl=2,041,072 ;

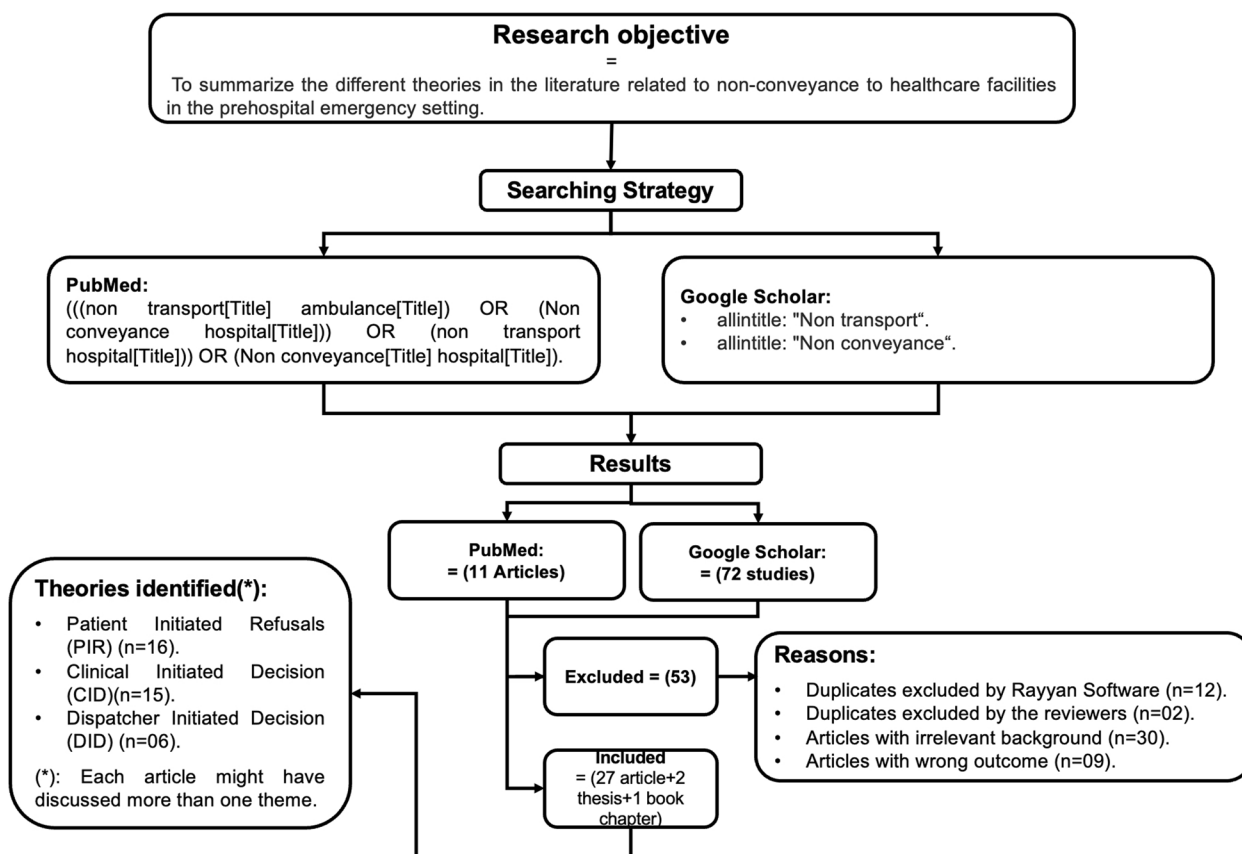


Fig. 1 Search strategy

Additionally, there are instances where the caller decides that EMS assistance is no longer necessary. For example, in some instances, the patient improved or managed their own transportation to the hospital while the EMD still gathered information and processed the case through ProQA. In certain instances, following a comprehensive assessment using ProQA, the EMDs may advise the caller that it is appropriate for the patient to proceed to the nearest healthcare facility using their own means of transportation, if necessary. This is observed in cases where the patient is “not fulfilling” the requirements of an emergency medical condition that mandates immediate pre-hospital medical assistance. Examples of such cases include “asymptomatic hypertension”, “waters were broken for a pregnant woman with no contractions”, or “fever” [19].

MPDS facilitates the EMD going through a detailed medical questionnaire process. This enables them to determine the appropriate protocol and dispatch code according to the information provided by the caller about the patient’s condition. An expert panel continually updates the MPDS using emergency calls from the databases of the best-performing ambulance services

worldwide [20]. The determined dispatch code dictates which type of medical or non-medical ERU should be dispatched [20]. A quality improvement study conducted in the USA included cases triaged by the EMDs as not requiring a medical ERU. In such cases, the EMD could dispatch a “non-transport unit”.

Furthermore, based on information provided by the emergency caller and the dispatch code determined by MDPS, the EMD may decide that the dispatch of a highly equipped ERU staffed with advanced healthcare professionals is not required in some instances [21]. Subsequently, they may dispatch a “non-transport unit” as a follow-up unit for patients with minor medical complaints. In a recent study in New York, the researchers demonstrated that the reasons leading to the cancellation of the ERU could be determined based on the information gathered by the EMD during the emergency call process [22]. Occasionally, the caller ends the emergency call without calling back or answering the EMD’s calls [22]. Multiple studies have reported this non-transport by DID [23–28]. Recent systematic reviews have investigated the efficacy of EMS systems utilizing the MPDS and other EMS systems utilizing criteria-based dispatch

Table 2 Count of non-transport articles included (including the articles cited in the review articles) according to the geographic area

Geographic areas covered	Number of articles
North America	36
Europe	17
USA	13
UK	11
Australia	6
Asia	5
Finland	5
Sweden	4
Netherlands	4
Canada	2
New Zealand	2
Turkey	2
Ireland	2
Africa	1
Australia	1
KSA	1
Norway	1
Total	113

(CBD). However, published evidence regarding the efficacy of these medical dispatch systems is lacking [1]. Healthcare professionals in some EMS systems under-triaged patients requiring critical care but appropriately identified cases of cardiac arrest [29]. This suggests that not transporting a patient following an emergency call might sometimes be risky.

Several other studies have demonstrated that these systems also under-triage some stroke cases. This is because some of these patients are older adults presenting with non-specific conditions (NSC) which might then be encoded as “sick person” [1]. Other studies have demonstrated that the dispatch code determined by these systems for trauma cases is inconsistent with the patient assessment findings observed by the medical responders [1, 30]. Researchers have also suggested that the anatomical presentation in the dispatch system’s questionnaire would be more effective if appropriately matched with the paramedics’ assessment [30]. In addition, these systems over-triage chest pain, cardiac problems, and complaints of headache [1]. A UK-based study reported that only 5% of priority one dispatch calls with these mentioned complaints were identified as critical [31]. This indicates that EMS resources could be wasted in 95% of non-critical cases that probably did not require conveyance to the emergency department.

Clinical-initiated decisions (CID)

Clinical determinations enacted by the evaluating medical practitioner may occasionally culminate in a non-transport decision for the patient, a scenario commonly referred to as CID. ‘Non-conveyance’ according to clinician discretion is an outcome that has been cited in many studies ($n = 15$) [18, 23–26, 28, 32–40]. In some instances, non-conveyance represents a clinical verdict enacted by EMS personnel subsequent to their response to an emergency call and the subsequent provision of emergency care to the patient. Consequently, upon the clinical assessment, the responder possesses the discretion to ascertain whether the patient is enduring a non-significant medical condition, obviating the necessity for immediate emergency treatment within a hospital setting. As a result, the patient may not be transported to the hospital.

Notwithstanding, these individuals may be advised to pursue additional medical assistance from an alternate, non-emergency healthcare service or provider. This non-conveyance system has seen widespread adoption among various ambulance services globally [16]. This approach aids in averting unwarranted ambulance conveyances to the hospital for medical conditions that can be effectively addressed in alternate settings, encompassing primary healthcare centers, thereby reducing the undue burden on emergency departments [41]. This system helps avoid emergency department crowding [7, 23, 42, 43].

Nonetheless, the EMS systems adopting this procedure monitor these non-conveyance patients closely by contacting some of them later for follow-up. Non-conveyance rates are also used as a quality indicator within these systems [23, 42, 43]. Furthermore, studies have demonstrated that serious cases might sometimes be miss-triaged as non-conveyance, specifically in older adult patients [44]. A recent study from Sweden demonstrated that NSC is mainly related to older patients. These patients were generally present with stable vital signs. Also, they reported complaints of “affected general health condition,” “general malaise,” “sense of illness,” or “just being unable to cope with daily activities” without providing a more specific chief complaint [44].

Consequently, these patients might be triaged as not requiring critical care. However, they might experience serious health outcomes without immediate treatment and care. Previous studies in the EMS setting have reported that at least one in three NSC patients presented with a serious health issue requiring close hospital monitoring [45, 46].

Patient-initiated refusal (PIR)

The non-transport decision can also stem from PIR [18, 27, 36, 47–57]. Contemporary studies have illuminated

Table 3 Geographic areas covered by the included articles' title

	Title	Geographic areas covered
1.	Can Paramedics Safely Refuse Transport of Non-Urgent Patients?	Turkey = 2, USA = 6, Ireland = 1, UK = 1, Canada = 1
2.	Variation in Interpretation of Guidance as an Explanation of Between-Service Variation in Ambulance Quality Indicators on Non-Conveyance	UK
3.	A patient-safety and professional perspective on non-conveyance in ambulance care: a systematic review	North America (n = 36), Europe (n = 17), Australia (n = 6), Asia (n = 5), and Africa (n = 1)
4.	Conveyance and non-conveyance to the emergency department after self-harm: Prevalence and ambulance service staff perspectives	Yorkshire UK
5.	Encountering and counselling patients and family members in out-of-hospital emergency care in non-conveyance situations: Follow-up s	Finland
6.	Exploring variation in how ambulance services address non-conveyance: a qualitative interview study	UK
7.	Implementation and use of computerized clinical decision support (CCDS) in emergency pre-hospital care	UK
8.	Non-transport emergency medical service missions – a retrospective study based on medical charts	Finland
9.	Variation in non-conveyance of patients with breathing problems (work package 4.2)	UK
10.	Why do ambulance services have different non-transport rates? A national cross-sectional study	UK
11.	Characteristics of non-conveyance ambulance runs: A retrospective study in the Netherlands	Netherlands
12.	Public attitudes towards the preventability of transport and non-transport related injuries: Can a social marketing campaign make a differ	Canada
13.	Patients' aged ≥ 65 years dispositions during ambulance assignments, including factors associated with non-conveyance to hospital	Sweden
14.	Association Between an Electronic Non-transport Checklist and the Mortality of Patients Discharged-at-Scene by Paramedics in New Ze	New Zealand
15.	EMS non-conveyance: A safe practice to decrease ED crowding or a threat to patient safety?	Finland
16.	Non-Conveyance Due to Patient-Initiated Refusal in Emergency Medical Services: A Retrospective Population-Based Registry Analysis	KSA
17.	Non-conveyance of older adult patients and association with subsequent clinical and adverse events after initial assessment by ambulance	Sweden
18.	Patient experience of non-conveyance following emergency ambulance service response: A scoping review of the literature	USA = 4, Sweden = 2, Australia = 1, New Zealand = 1, Netherlands = 1, Finland = 1, and the United Kingdom = 1
19.	The Alternative Pre-hospital Pathway team: reducing conveyances to the emergency department through patient-centred Community Emergency Medicine	Ireland
20.	The effect of a specialist paramedic primary care rotation on appropriate non-conveyance decisions (SPRAINED) study: a controlled int	UK
21.	The experience of non-conveyance following emergency medical service triage from the perspective of patients and their relatives: A qua	Netherlands
22.	The Safety of Non-Transport Decisions Made by Ambulance Personnel: A Retrospective Study of Subsequent Hospital Admission and 3	Norway
23.	Ambulance crew-initiated non-conveyance in the Helsinki EMS system—A retrospective cohort study	Helsinki Finland
24.	Emergency Medical Services Clinicians' Perspectives on Pediatric Non-Transport	USA
25.	EMS Non-Transport of Low-Risk COVID-19 Patients	USA
26.	Trends in fall-related encounters and predictors of non-transport at a US Emergency Medical Services Agency	USA
27.	Using machine learning to predict subsequent events after EMS non-conveyance decisions	Finland
28.	Decision-making in ambulance service non-conveyance – the DMASC survey	UK
29.	Convey or not convey? Does crew skill level predict hospital conveyance rate in a UK regional NHS ambulance service trust?	UK

instances where, within numerous EMS systems, patients elect not to be conveyed to the hospital, against clinical advice [56]. In specific EMS systems, for example, in the USA, pre-hospital healthcare workers can acknowledge the PIR only after an online consultation with the medical management team [33, 58]. These PIRs are frequently correlated with a patient's incapacity to shoulder prospective transport fees, especially in specific jurisdictions where the individual bears such costs. Additional deterrents encompass protracted wait times encountered within the emergency department. In some instances, PIRs are precipitated by patient contentment with the caliber of pre-hospital medical assistance they receive, juxtaposed against their dissatisfaction with the drawn-out procedural rigmarole anticipated at the emergency department [7, 56, 59, 60]. In a recent Middle-East study conducted by the National Ambulance Service of Riyadh, 35.5% of the pre-hospital emergency calls ended with PIR, compared with only 8.8% of patient non-conveyance due to CID [56].

Psychological considerations also significantly come into play, particularly with elderly patients who might harbor apprehension towards polypharmacy. As a result, physicians encounter challenges when prescribing a higher quantity of medications, sometimes as much as 25 pills, for older adults and persuading them to return home when everything seems to be in order [61]. Furthermore, a Swedish study demonstrated that with the increase in the age of patients visiting emergency departments for emergency care, hospitalization, and mortality rates also increase. This is because, in some instances, older patients only visit the emergency department when their medical condition becomes critical [62]. Therefore, many health systems worldwide have recognized the impact of patient non-transport, both for the health outcomes of older adult patients and as a quality indicator in EMS systems. They also reflect a significant challenge that could compromise patients' health conditions in major and minor trauma cases [63]. Some concerns about the non-conveyance of older patients have been expressed since they can be easily under-triaged. Many older patients not transported to the hospitals, called the emergency services again, and were eventually transported and admitted to the hospital [45, 46, 64]. Some recent studies have focused on the non-conveyance of elderly trauma victims. With their vulnerable physiopathological conditions, older patients can present with significant trauma even after incidents with low-impact mechanisms. Older patients might also be often misdiagnosed [46].

Meta-analyses have demonstrated that patient non-conveyance mainly affects younger than older patients [64, 65]. Furthermore, these studies have indicated that

more than a quarter of the non-transported patients accessed alternative healthcare service providers other than those working in emergency departments (e.g., private clinics) [64].

Synthesis of recommendations from analyzed studies

Inferences drawn from a comprehensive examination of prior studies reveal that specific EMS systems have integrated the concept of patient non-conveyance into their guidelines. They deem it a practice with an acceptable level of risk, contingent on initiating a telephonic medical consultation or deploying follow-up units for non-conveyance cases [32, 38, 49, 66]. Notably, the term 'acceptable' risk elicits diverse interpretations across the literature [37, 38, 50, 67]. There is a latent risk of under-triage, potentially leading to overlooked life-threatening complaints. This is especially pertinent for elderly patients, who might necessitate urgent medical attention within a brief interval [39, 50].

As such, the predominant perception within EMS systems classifies patient non-conveyance to a hospital as an adverse event that could compromise their health outcomes [25, 37–39, 48, 51, 53, 65, 68].

In light of these observations, we concur with the call for precautionary patient transportation to hospitals or implementing a reliable medical follow-up mechanism. It is crucial to clarify that this conclusion hinges on our interpretation of the reviewed literature and advocates for further empirical exploration.

Limitations

Our study recognizes and acknowledges its intrinsic limitations. Primarily, our investigative approach is a narrative review instead of a systematic exploration of the extant literature. This method, though enabling an encompassing overview of the subject matter, is potentially susceptible to selection bias during the process of literature analysis, which may engender considerable distortions in our resultant findings. Second, the non-conveyance decisions reported in the literature could be affected by factors such as the worldwide diversity of the EMS operational systems. This could also affect the proportion of non-conveyance decisions. Further, generalizing the non-conveyance theories could be difficult as it is also affected by many social, ethnic, and cultural factors and the diversification of worldwide EMS systems. The widespread diversity in policy and practice inherently constrains the universal applicability of our observations and recommendations. As such, we advocate for future research to engage in a more systematic review methodology. Such an approach could help address these potential biases and facilitate a more thorough comprehension.

Conclusions

Over the past decade, patient non-conveyance to hospitals has surfaced as a significant healthcare concern within pre-hospital environments. While certain studies advocate non-conveyance as a safe practice, others underscore its potential implications on patient safety, potentially compromising healthcare outcomes. In addition to patient safety, non-conveyance can impact the efficiency of the health system by expending resources on potentially unnecessary dispatches of pre-hospital response units. We underscore the need for further research to understand this issue and define its variables comprehensively. Utilizing advanced research methodologies, such as machine learning, can prove instrumental in this exploration. Doing so could enhance clinical decision-making processes and optimize resource utilization, thereby striving to improve both patient outcomes and system efficiency.

Abbreviations

EMS	Emergency Medical Services
EMD	Emergency Medical Dispatcher
ProQA	Program Question Answer
ERU	Emergency Response Unit
MPDS	Medical Priority Dispatch Systems
PIR	Patient-initiated refusals
CID	Clinical-Initiated Decisions
DID	Dispatcher-Initiated Decisions

Acknowledgements

The open-access funding was provided by the University of Hertfordshire. The authors thank the peer reviewers for providing constructive feedback that improved the article.

Authors' contributions

JL, GA, IG and MK supervised this study. JL, GA, PG, LAS and AN reviewed the study. HF and KEA collected and analyzed the data. HF prepared the manuscript for this study.

Funding

The open-access funding was provided by the University of Hertfordshire.

Availability of data and materials

The datasets generated during and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

¹Hamad Medical Corporation Ambulance Service, Doha, Qatar. ²Faculty of Sciences, University of Sfax, 3000 Sfax, Tunisia. ³Faculty of Medicine of Sousse "Ibn El Jazzar", University of Sousse, 4000 Sousse, Tunisia. ⁴School of Health and Social Work, University of Hertfordshire, Hatfield, UK. ⁵Weill Cornell Medicine-Qatar, Doha, Qatar. ⁶Northumbria University, Newcastle Upon Tyne, UK. ⁷Department of Nursing, Hamad Medical Corporation, Doha, Qatar.

⁸Faculty of Health Sciences, Durban University of Technology, PO Box 1334, Durban 4000, South Africa. ⁹Higher Institute of Biotechnology, University of Sfax, Sfax, Tunisia. ¹⁰Faculty of Medicine, University of Sfax, Sfax, Tunisia.

Received: 2 June 2023 Accepted: 20 August 2023

Published online: 11 October 2023

References

- Bohm K, Kurland L. The accuracy of medical dispatch - a systematic review. *Scand J Trauma Resusc Emerg Med.* 2018;26(1):94.
- Alinier G, Wilson P, Reimann T, Morris B. Influential factors on urban and rural response times for emergency ambulances in Qatar. *Mediterr J Emerg Med.* 2018;26:8–13.
- Clwason JJ, Dernocoeur KB, Murray C. Principles of Emergency Medical Dispatch, 5th edition. 5th ed. USA: The International Academy of EMD; 2014.
- Alinier G, Meyer J, Farhat H, Bayoumy A, Gonzales E, Ragbheer S, et al. Initial results from a driving safety survey distributed to ambulance paramedics in Qatar. *J Local Glob Health Sci.* 2015 Nov 12;2015(Proceedings of the 24th World International Traffic Medicine Association Congress, Qatar 2015):59.
- Farhat H, Laughton J, Gangaram P, El Aifa K, Khenissi MC, Zaghouani O, et al. Hazardous material and chemical, biological, radiological, and nuclear incident readiness among prehospital care professionals in the State of Qatar. *Glob Secur Health Sci Policy.* 2022;7(1):24–36.
- Farhat H, Alinier G, El Aifa K, Athemneh K, Gangaram P, Romero R, et al. Quality improvement tools to manage emergency callbacks from patients with diabetes in a prehospital setting. *BMJ Open Qual.* 2023;12(1):e002007.
- King R, Oprescu F, Lord B, Flanagan B. Patient experience of non-conveyance following emergency ambulance service response: A scoping review of the literature. *Australas Emerg Care.* 2020 Sep 14 [cited 2021 Jul 6]; Available from: <https://www.sciencedirect.com/science/article/pii/S2588994X2030083X>
- Weaver J, Brinsfield KH, Dalphond D. P REHOSPITAL R EFUSAL - OF - TRANSPORT P OLICIES : A DEQUATE L EGAL P ROTECTION ? *Prehosp Emerg Care.* 2009 Jul 2 [cited 2022 Jul 10]; Available from: <https://www.tandfonline.com/doi/abs/https://doi.org/10.1080/10903120090941650>
- Greaves I, Porter SK. Oxford Handbook of Pre-hospital Care. Oxford University Press; 2021. 753 p.
- Moss SG. Legislation Study on Emergency Medical Care Systems in the English-speaking Caribbean. Pan American Health Organization; 2010. 19 p.
- Kim H, Kim SW, Park E, Kim JH, Chang H. The role of fifth-generation mobile technology in prehospital emergency care: An opportunity to support paramedics. *Health Policy Technol.* 2020;9(1):109–14.
- Taymour RK, Abir M, Chamberlin M, Dunne RB, Lowell M, Wahl K, et al. Policy, Practice, and Research Agenda for Emergency Medical Services Oversight: A Systematic Review and Environmental Scan. *Prehospital Disaster Med.* 2018;33(1):89–97.
- Ouzzani M, Hammady H, Fedorowicz Z, Elmagarmid A. Rayyan—a web and mobile app for systematic reviews. *Syst Rev.* 2016;5(1):210.
- Allen D. Prioritizing the mobilization of emergency medical services: patient making at the healthcare gateway. *J Health Organ Manag.* 2021;35(2):160–76.
- Nimmolrat A, Sutham K, Thinnukool O. Patient triage system for supporting the operation of dispatch centres and rescue teams. *BMC Med Inform Decis Mak.* 2021 [cited 2022 Jul 10];21(68). Available from: <https://bmcmidinformedicmak.biomedcentral.com/articles/https://doi.org/10.1186/s12911-021-01440-x>
- Sporer KA, Johnson NJ. Detailed analysis of prehospital interventions in medical priority dispatch system determinants. *West J Emerg Med.* 2011;12(1):19–29.
- Sanko S, Lane C, Eckstein M. Effect of New 9-1-1 System on Efficiency of Initial Resource Assignment. *Prehosp Emerg Care.* 2020;24(5):634–43.
- Pekanoja S, Hoikka M, Kyngäs H, Elo S. Non-transport emergency medical service missions – a retrospective study based on medical charts. *Acta Anaesthesiol Scand.* 2018;62(5):701–8.

19. Scott G, McQueen J, McQueen J, Gardett I, Zavadsky M. The distribution of 911 triaged call incident types within the Emergency Communication Nurse System™. 2014 [cited 2022 Jul 11]. Available from: <https://www.aedjournal.org>
20. Baabdullah M, Faden H, Alsubhi R, Almalki A, Masri B, Alharbi A. The efficiency of the medical priority dispatch system in improving patient outcomes. *Saudi J Emerg Med*. 2020;1(2):110–110.
21. Yoon S, Albert LA, White VM. A stochastic programming approach for locating and dispatching two types of ambulances. *Transp Sci*. 2021;55(2):275–96.
22. Koenig KL. *Emergency Ambulance Utilization in Harlem, New York* (July 1985). *Prehosp Emerg Care*. 2022;26(3):W1-17.
23. O’Cathain A, Jacques R, Stone T, Turner J. Why do ambulance services have different non-transport rates? A national cross sectional study. *PLoS ONE*. 2018;13(9):e0204508.
24. Ebben RHA, Castelijns M, Frenken J, Vloet LCM. Characteristics of non-conveyance ambulance runs: A retrospective study in the Netherlands. *World J Emerg Med*. 2019;10(4):239–43.
25. Paulin J, Reunamo A, Kurola J, Moen H, Salanterä S, Riihimäki H, et al. Using machine learning to predict subsequent events after EMS non-conveyance decisions. *BMC Med Inform Decis Mak*. 2022;22(1):166.
26. Lederman J, Lindström V, Elmqvist C, Löfvenmark C, Ljunggren G, Djärv T. Non-conveyance of older adult patients and association with subsequent clinical and adverse events after initial assessment by ambulance clinicians: a cohort analysis. *BMC Emerg Med*. 2021;21(1):154.
27. O’Cathain A, Knowles E, Bishop-Edwards L, Coster J, Crum A, Jacques R, et al. Variation in non-conveyance of patients with breathing problems (work package 4.2). Understanding variation in ambulance service non-conveyance rates: a mixed methods study. *NIHR Journals Library*; 2018 [cited 2022 Sep 7]. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK506836/>
28. Stone T, O’Cathain A, Knowles E. Variation in Interpretation of Guidance as an Explanation of Between-Service Variation in Ambulance Quality Indicators on Non-Conveyance. *Emerg Med J*. 2016;33(9):e11–e11.
29. Satty T, Ramgopal S, Elmer J, Mosesso VN, Martin-Gill C. EMS responses and non-transports during the COVID-19 pandemic. *Am J Emerg Med*. 2021;1(42):1–8.
30. Dami F, Golay C, Pasquier M, Fuchs V, Carron PN, Hugli O. Prehospital triage accuracy in a criteria based dispatch centre. *BMC Emerg Med*. 2015;15(1):32.
31. Wilmer I, Chalk G, Davies GE, Weaver AE, Lockey DJ. Air ambulance tasking: mechanism of injury, telephone interrogation or ambulance crew assessment? *Emerg Med J*. 2015;32(10):813–6.
32. Patton A, O’Donnell C, Keane O, Henry K, Crowley D, Collins A, et al. The Alternative Pre-hospital Pathway team: reducing conveyances to the emergency department through patient centered Community Emergency Medicine. *BMC Emerg Med*. 2021;21(1):138.
33. Sinclair JE, Austin M, Froats M, Leduc S, Maloney J, Dionne R, et al. Characteristics, prehospital management, and outcomes in patients assessed for hypoglycemia: repeat access to prehospital or emergency care. *Prehosp Emerg Care*. 2019;23(3):364–76.
34. Porter A, Dale J, Foster T, Logan P, Wells B, Snooks H. Implementation and use of computerized clinical decision support (CCDS) in emergency pre-hospital care: a qualitative study of paramedic views and experience using Strong Structuration Theory. *Implement Sci*. 2018;13(1):91.
35. Ward CE, Singletary J, Hatcliffe RE, Colson CD, Simpson JN, Brown KM, et al. Emergency medical services clinicians’ perspectives on pediatric non-transport. *Prehosp Emerg Care*. 2022;0(0):1–11.
36. Karbakhsh M, Beaulieu E, Smith J, Zheng A, Turcotte K, Pike I. Public attitudes towards the preventability of transport and non-transport related injuries: can a social marketing campaign make a difference? *Prev Med Rep*. 2019;1(13):179–82.
37. Couturier K, Nelson AR, Burns K, Cone DC, Rollins M, Venkatesh AK, et al. EMS non-transport of low-risk COVID-19 patients. *Prehosp Emerg Care*. 2022;0(0):1–5.
38. Fraess-Phillips AJ. Can paramedics safely refuse transport of non-urgent patients? *Prehospital Disaster Med*. 2016;31(6):667–74.
39. Amundsen K, Elden MS, Myrmet L, Assmus J, Lange A, Brattebø G. The safety of non-transport decisions made by ambulance personnel: a retrospective study of subsequent hospital admission and 30-day mortality. In: *Review*; 2021 Mar [cited 2022 Sep 7]. Available from: <https://www.researchsquare.com/article/rs-276252/v1>
40. Watson F. Association between an electronic non-transport checklist and the mortality of patients discharged-at-scene by paramedics in New Zealand: a retrospective cohort study [Internet] [Thesis]. Auckland University of Technology; 2021 [cited 2022 Sep 7]. Available from: <https://openrepository.aut.ac.nz/handle/10292/14360>
41. Abdunnassir FH Aljaziri, Alinier. Access to emergency healthcare. In: *Healthcare Access*. UK: IntechOpen; 2022. p. 171.
42. Lederman J, Lindström V, Elmqvist C, Löfvenmark C, Djärv T. Non-conveyance in the ambulance service: a population-based cohort study in Stockholm, Sweden. *BMJ Open*. 2020;10(7):e036659.
43. O’Cathain A, Knowles E, Bishop-Edwards L, Coster J, Crum A, Jacques R, et al. Understanding variation in ambulance service non-conveyance rates: a mixed methods study. 2018 Jun 5 [cited 2022 Jul 8]; Available from: <http://uhra.herts.ac.uk/handle/2299/20208>
44. Ivic R, Vicenteal V, Kurland L, Svensson J, Sahde R, Lintemård K, et al. Pre-hospital emergency nurse specialist’s experiences in caring for patients with non-specific chief complaints in the ambulance – a qualitative interview study. *International Emergency Nursing* [Internet]. 2022 [cited 2022 Jul 8];63. Available from: <https://www.sciencedirect.com/science/article/pii/S1755599X22000350>
45. Samaras N, Chevalley T, Samaras D, Gold G. Older patients in the emergency department: a review - ScienceDirect. *Ann Emerg Med*. 2010;56(3):261–9.
46. Aminzadeh F, Dalziel 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(3):238–47.
47. B. LG Ang JY, Kim N, Gabbe BJ, Mitra B, Dietze PM, Braaf S, Beck. Prevalence of alcohol and other drug use in non-transport injury events: a systematic review in drug and alcohol review. 2021;40:595.
48. Knowles E, Bishop-Edwards L, O’Cathain A. Exploring variation in how ambulance services address non-conveyance: a qualitative interview study. *BMJ Open*. 2018;8(11):e024228.
49. King R, Oprescu F, Lord B, Flanagan B. Patient experience of non-conveyance following emergency ambulance service response: a scoping review of the literature. *Australas Emerg Care*. 2021;24(3):210–23.
50. Forsgård E, Elmqvist C, Fridlund B, Svensson A, Andersson R, Rööst M. Patients’ aged ≥65 years dispositions during ambulance assignments, including factors associated with non-conveyance to hospital: a longitudinal and comparative study. *BMJ Open*. 2020;10(11):e038885.
51. Jenkins EJ. Conveyance and non-conveyance to the emergency department after self-harm: prevalence and ambulance service staff perspectives. [dclipsycho]. University of Leeds; 2017 [cited 2022 Sep 7]. Available from: <https://etheses.whiterose.ac.uk/18257/>
52. Bishop-Edwards L, O’Cathain A, Knowles E. Successes and challenges in commissioning for ambulance non-conveyance: the commissioner perspective | *Emergency Medicine Journal*. In *BMJ Journals*; 2016 [cited 2022 Sep 14]. (9; vol. 33). Available from: <https://emj.bmj.com/content/33/9/e4.5.abstract>
53. Ebben RHA, Vloet LCM, Speijers RF, Tönjes NW, Loef J, Pelgrim T, et al. A patient-safety and professional perspective on non-conveyance in ambulance care: a systematic review. *Scand J Trauma Resusc Emerg Med*. 2017;25(1):71.
54. Jeruzal JN, Boland LL, Jin D, Traczyk CL, Shippee ND, Neprash HT, et al. Trends in fall-related encounters and predictors of non-transport at a US Emergency Medical Services Agency. *Health Soc Care Community*. 2022;30(5):e1835–43.
55. van Doorn SCM, Verhalle RC, Ebben RHA, Frost DM, Vloet LCM, de Brouwer CPM. The experience of non-conveyance following emergency medical service triage from the perspective of patients and their relatives: a qualitative study. *Int Emerg Nurs*. 2021;1(54):100952.
56. Moafa HN, van Kuijk SMJ, Moukhyer ME, Alqahtani DM, Haak HR. Non-conveyance due to patient-initiated refusal in emergency medical services: a retrospective population-based registry analysis study in Riyadh Province, Saudi Arabia. *Int J Environ Res Public Health*. 2021;18(17):9252.
57. Paavilainen E, Mikkola R, Salminen-Tuomaala M, Leikkola P. Encountering and counselling patients and family members in out-of-hospital emergency care in non-conveyance situations: follow-up study in Finland. *Emerg Care J*. 2018 Aug 2 [cited 2022 Sep 7];14(2). Available from: <https://pagepressjournals.org/index.php/ecj/article/view/7468>

58. Schierholtz T, Carter D, Kane A, Kemp O, Gallant C, Sheikh B, et al. Impact of lift assist calls on paramedic services: a descriptive study. *Prehosp Emerg Care*. 2019;23(2):233–40.
59. Huabbangyang T, Sangketchon C, Piewthamai K, Saengmanee K, Ruangchai K, Bunkhamsaen N, et al. Perception and satisfaction of patients' relatives regarding emergency medical service response times: a cross-sectional study. *Open Access Emerg Med OAEM*. 2022;13(14):155–63.
60. Phiri M, Heyns T, Coetzee I. Patients' experiences of triage in an emergency department: a phenomenographic study. *Appl Nurs Res*. 2020;1(54):151271.
61. Farrell B, Shamji S, Monahan A, French MV. Reducing polypharmacy in the elderly: cases to help you "rock the boat." *Can Pharm J Rev Pharm Can*. 2013;146(5):243–4.
62. Lee SB, Oh JH, Park JH, Choi SP, Wee JH. Differences in youngest-old, middle-old, and oldest-old patients who visit the emergency department. *Clin Exp Emerg Med*. 2018;5(4):249–55.
63. Kehoe A, Smith JE, Edwards A, Yates D, Lecky F. The changing face of major trauma in the UK. *Emerg Med J*. 2015;32(12):911–5.
64. Yeung T, Shannon B, Perillo S, Nehme Z, Jennings P, Olausson A. Review article: outcomes of patients who are not transported following ambulance attendance: A systematic review and meta-analysis. *Emerg Med Australas*. 2019;31(3):321–31.
65. A retrospective comparison between non-conveyed and conveyed patients in ambulance care | *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine* | Full Text. [cited 2022 Jul 11]. Available from: <https://sjtrem.biomedcentral.com/articles/https://doi.org/10.1186/s13049-018-0557-3>
66. Paulin J, Kurola J, Koivisto M, Iirola T. EMS non-conveyance: a safe practice to decrease ED crowding or a threat to patient safety? *BMC Emerg Med*. 2021;21(1):115.
67. Black S, Frampton I. PP26 Convey or not convey? Does crew skill level predict hospital conveyance rate in a UK regional NHS ambulance service trust? *Emerg Med J*. 2019;36(1):e10–1.
68. Black S, Frampton I. PP25 Decision-making in ambulance service non-conveyance – the DMASC survey. *Emerg Med J*. 2019;36(1):e10–e10.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Ready to submit your research? Choose BMC and benefit from:

- fast, convenient online submission
- thorough peer review by experienced researchers in your field
- rapid publication on acceptance
- support for research data, including large and complex data types
- gold Open Access which fosters wider collaboration and increased citations
- maximum visibility for your research: over 100M website views per year

At BMC, research is always in progress.

Learn more biomedcentral.com/submissions

