Risk Management and Healthcare Policy

Dovepress
open access to scientific and medical research

Open Access Full Text Article

REVIEW

Managing High Frequency of Ambulance Calls in Hospitals: A Systematic Review

Abdullah Alruwaili[1–4], Ahmed Alanazy[1–3], Turki M Alanazi[1–3], Nowaf Alobaidi[1–3], Ahmad Saleh Almamary[1–3], Bandar M Faqihi[1–3], Fahad H Al Enazi[1–3], Rayan Siraj[5], Yasir Almukhlifi[6,7], Ziyad F Al Nufaiei[6,7], Maher Alsulami[6,7]

[1]College of Applied Medical Sciences, King Saud bin Abdulaziz University for Health Sciences, Al-Ahsa, Saudi Arabia; [2]King Abdullah International Medical Research Center, Al-Ahsa, Saudi Arabia; [3]Ministry of National Guard- Health Affairs, Al Ahsa, Saudi Arabia; [4]School of Health: Faculty of Medicine and Health, University of New England, Armidale, New South Wales, Australia; [5]Department of Respiratory Therapy, College of Applied Medical Sciences, King Faisal University, Al-Hasa, Saudi Arabia; [6]College of Applied Medical Sciences, King Saud bin Abdulaziz University for Health Sciences, Jeddah, Saudi Arabia; [7]King Abdullah International Medical Research Center, Jeddah, Saudi Arabia

Correspondence: Maher Alsulami, Department of Emergency Medical Services, College of Applied Medical Sciences-Jeddah, King Saud bin Abdulaziz University for Health Sciences, Mail Code 6610, P.O.Box.9515, Jeddah, 21423, Saudi Arabia, Tel +966501596230 Ext 46087, Email alsulamim@ksau-hs.edu.sa

Background: This study addresses the critical issue of high-volume emergency calls in hospitals, focusing on the strain caused by frequent caller patients on ambulance services. The aim was to synthesize various management methods for handling high-frequency hospital calls.

Methods: The systematic review was conducted following the Preferred Reporting Items for Systematic Review and Meta-analysis (PRISMA) guidelines and guided by the Cochrane Handbook for systematic reviews. Inclusion criteria encompassed studies focusing on the management of emergency departments in hospitals, exploring various medical conditions requiring ambulance attention, and reporting on the impact of a high volume of ambulance calls on hospitals. Databases including PubMed, Web of Science, and Google Scholar were searched from January 1, 2005, to May 1, 2022. The quality of included studies was assessed using the Critical Appraisal Skills Programme (CASP) Checklist.

Results: Out of 2390 identified citations, 18 studies met the inclusion criteria. These studies, from 12 countries, presented diverse methods categorized into country policy-based management, modeling approaches, and general strategies. Key findings included the effectiveness of risk stratification models and community-based interventions in managing high call frequencies and improving patient care. Our review identified effective strategies such as risk stratification models and community-based interventions, which have shown significant impacts in managing high call frequencies, aligning closely with our objective. These approaches have been pivotal in reducing the burden on emergency services and improving patient care.

Conclusion: The study synthesizes effective management methods for high-frequency ambulance calls, including predictive modeling and community interventions. It highlights the need for multi-faceted management strategies in different healthcare settings and underscores the importance of continued research and implementation of these methods to improve emergency service efficiency.

Keywords: systematic review, ambulance calls, emergency services

Introduction

The high volume of calls received by emergency ambulance services in standard or high-ranking hospitals is a matter of growing concern in healthcare systems worldwide. Emergency units and healthcare centers have grappled with the challenges posed by the incessant rise in the demand for emergency medical assistance. Despite implementing various strategies to manage this surge, the effectiveness of these measures has remained a critical issue. The impact of this crisis is exemplified by the alarming statistics reported by the Health and Social Care Information Centre, indicating an unsustainable increase in requests for emergency ambulance services.[1] For instance, in England, the number of emergency calls to ambulance dispatch centers more than doubled, soaring from 4.72 million in 2003 to 9.1 million in 2015.[2] The operational burden on healthcare systems, particularly on emergency services, has reached unprecedented levels.[2]

Received: 20 September 2023
Accepted: 19 January 2024
Published: 1 February 2024

The gravity of the situation has not gone unnoticed, and public concern, along with media attention, has intensified. To address this pressing issue, the United Kingdom (UK) has undergone significant reform of its Emergency Departments, seeking to alleviate the mounting pressure on emergency services. The proposed policy advocates a comprehensive system-wide approach, granting greater clinical autonomy and establishing new care pathways within the ambulance service.[3]

Amidst this healthcare crisis, one key problem that emerged was the recurrent and excessive use of ambulance services by certain patients, commonly referred to as "frequent caller patients".[4] The over-reliance on emergency ambulance services by these individuals placed immense strain on the system, compromising its ability to provide timely and efficient care to those with genuine time-critical medical needs. Consequently, the lack of a well-established transfer process for patients and limited availability of services hindered ambulance personnel from directing patients to appropriate care. This situation resulted in longer waiting times at emergency departments, further exacerbating the challenges faced by healthcare facilities.[3]

In response to this issue, the UK implemented a policy in 2013, classifying citizens who made more than 12 calls within three months as frequent callers.[5] A similar policy was also introduced in London, where a staggering 1.7 million emergency calls were recorded between 2014 and 2015. Among these calls, 1622 individuals met the criteria for frequent caller patients, resulting in 49,534 ambulance attendances and incurring costs of approximately 4.4 million euros for the London Ambulance Service (LAS).[6] In addition to the European context, the issue of managing high-frequency ambulance calls is a global challenge, with diverse approaches observed across different countries. In the United States, for example, community paramedicine programs have been recognized for their positive impact on public health. These programs have evolved from traditional emergency medical services (EMS) to include more advanced care and preventative measures. A significant benefit of these programs is the reduction in 911 calls, emergency room visits, and hospital readmission rates, which relieves financial and physical stress on health providers. Current evidence suggests that redirecting 15% of 911 patients to primary care could result in over $500 million in national Medicare cost savings. In many African countries, the existence, distribution, and characteristics of EMS systems are less known. A survey covering 49 out of 54 African countries found that only 30% of these countries had EMS systems, servicing only 8.7% of the African population. The leading causes of EMS transport included injury and obstetric complaints. Most of these systems were basic life support, government-operated, and fee-for-service, highlighting the varied and often limited EMS resources available in Africa. Ambulance Victoria implemented a secondary telephone triage service called the Referral Service (RS) for low-priority patients. This service, which offers alternatives to ambulance dispatch such as doctor or nurse home visits, managed over 107,000 cases from 2009 to 2012, accounting for 10.3% of total ambulance calls. This approach proved effective in managing emergency ambulance demand, demonstrating a successful model of secondary telephone triage in the ambulance setting.

Moreover, ambulance services play a crucial role in catering to the needs of vulnerable patient groups, such as those suffering from self-harming tendencies, chronic illnesses, old age, abnormal mental health conditions, and loneliness. Notably, patients in underserved rural areas often experience a lower quality of life compared to their urban counterparts.[7,8] Consequently, the burden on emergency departments increases, straining the system's capacity beyond its capabilities.[9] Addressing the needs of frequent caller patients becomes essential for healthcare facilities to ensure efficient service delivery and patient care, thereby managing the high volume of calls received by emergency departments.[10]

In the context of this review, exploring various medical conditions requiring ambulance attention and their impacts on hospitals is crucial. This broad perspective allows for a comprehensive synthesis of management strategies, encompassing not just the direct handling of high-frequency calls but also understanding the underlying medical conditions that contribute to these calls. This approach is vital for developing holistic management methods that are effective across different medical scenarios and hospital contexts.

While some individual hospitals have reported a significant decrease in call rates after implementing case management strategies,[4] such interventions have not been widely reviewed or examined in systematic reviews. There remains a notable gap in the literature regarding comprehensive investigations into the management of high-frequency hospital calls by emergency departments. The potential consequences of delayed ambulance responses and late emergency department attendance are concerning, as patients may not receive timely medical attention, leading to a deterioration of their condition and increased complications. Hence, this systematic review aimed to fill the existing gap in the

literature by critically examining and synthesizing the different management methods employed for handling high-frequency hospital calls.

Methods and Materials

This systematic review was performed according to the Preferred Reporting Items for Systematic Review and Meta-analysis (PRISMA guidelines)[11] as shown in Appendix I in the supplementary materials. The methods were guided by the Cochrane Handbook for systematics Reviews.[12]

Inclusion Criteria

We included studies focusing on the management of emergency departments in hospitals those exploring various medical conditions requiring ambulance attention, studies reporting on the impact of a high volume of ambulance calls on hospitals, as well as those investigating the implications and policies regarding ambulance dispatch. Exploring various medical conditions requiring ambulance attention and the impact of a high volume of ambulance calls on hospitals directly informs and enriches the understanding of different management methods utilized for addressing high-frequency hospital calls. These criteria ensure that the review captures a broad spectrum of scenarios and challenges associated with high ambulance call volumes, which is crucial for synthesizing effective management strategies, thus ensures a comprehensive understanding of the challenges and solutions in managing high-frequency ambulance calls., aligning closely with our objectives. Moreover, studies that provide insights into the functions and roles of emergency units in handling emergency cases are part of the review.

We excluded studies that were not in English language. Furthermore, magazine articles and conference abstracts were also excluded from this review.

Data Sources and Searches

Databases including PubMed, Web of Science, and Google scholar were searched from 1st January 2005 to 1st May 2022. Two independent reviewers (AA, AA) searched the databases using search terms such as "Managing", "ambulanc*" and "hospital*". Using the search term "ambulanc*" with an asterisk allows for a comprehensive inclusion of all variations related to ambulance services, ensuring a thorough review of literature encompassing various aspects of ambulance usage and management.

Reference lists of all relevant articles and "related citation" search tool of PubMed was checked for any additional eligible publications. Appendix II in supplementary materials details the search terms used.

Screening, Data Extraction and Quality Assessment

Two reviewers (AA, AA) independently screened titles, abstracts and full-texts of all identified records for eligibility using Endnote. Data were extracted independently by two reviewers (AA, AA), including citation details, study characteristics, participant characteristics relevant to the selection criteria, key findings, country, and total calls. We independently assessed the quality of included studies using Critical Appraisal Skills Programme (CASP) Checklist.[13] Each question has only three answer options: Yes, No and Cannot Say. A study that answered 'Yes' to all questions was considered relevant, a study that answered "Can't" say was regarded as unclear, while a study that answered "No" was considered irrelevant. Disagreements were resolved by consensus in the presence of a third reviewer. A table of the CASP checklist is provided in Appendix III in the supplementary materials.

Results

Study Selection

A total of 2390 citations were identified from the database searched. Of which, 1560 were duplicates and were removed. A further 796 articles were excluded after screening titles and abstracts. We assessed 34 articles for full-text screening and 18 articles met our inclusion criteria and were included in this review and reasons for exclusion were reported. The PRISMA flow diagram for this study is shown in Figure 1.

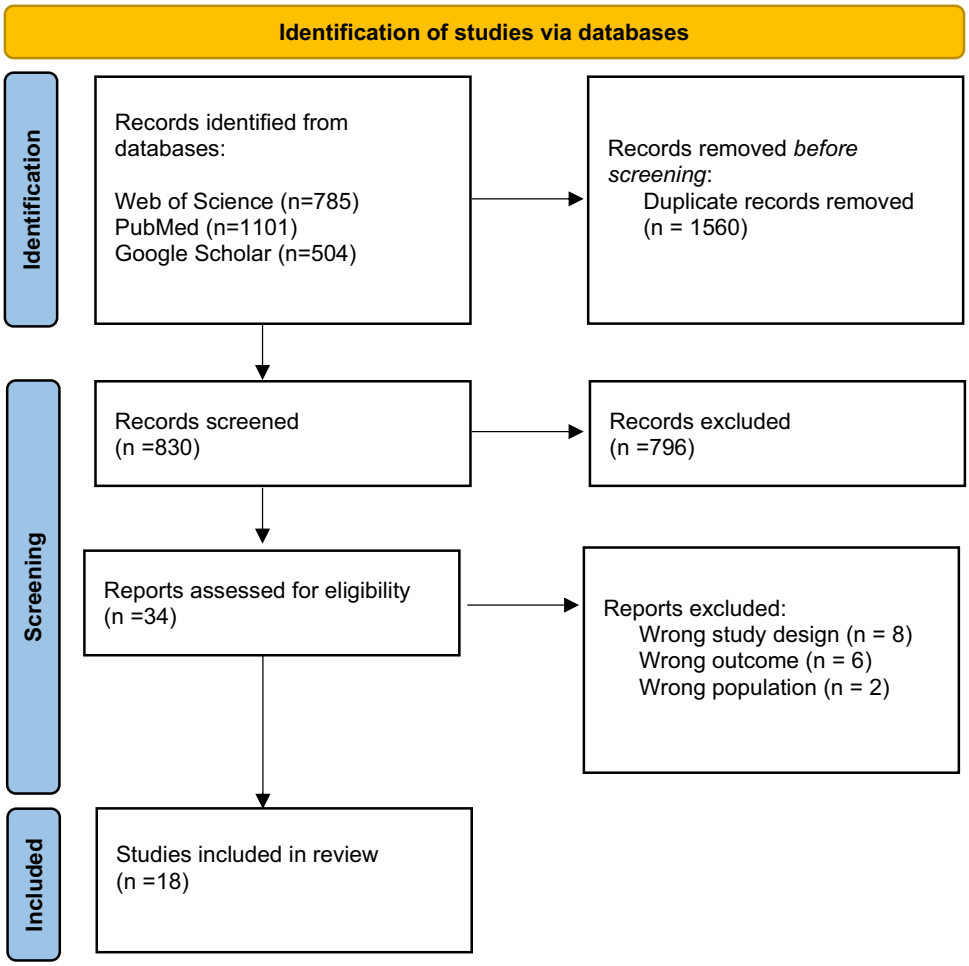

Figure 1 PRISMA Flow Diagram.
Note: Page M J, McKenzie J E, Bossuyt P M, Boutron I, Hoffmann T C, Mulrow C D et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews BMJ 2021; 372:n71 doi:10.1136/bmj.n71[14]

Study Characteristics

Table 1 presents the characteristics of included studies.

Six of the included studies were in the United Kingdom (UK), two were in Japan,[17,20] One study each from Denmark,[15] France,[25] Swedish,[32] Norway,[27] Canada,[24] England,[29] Korea,[19] Barbados,[23] Rhode Island[21] and Turkey.[28]

With regards to the design of the included studies, nine conducted retrospective cohorts, two used observational study designs, two were exploratory and one was a case-study design.

Among all included studies, seven applied a predictive or proposed model for managing frequent calls; seven reported management based on the country's policy on the emergency department. Four studies reported general methods of management. Figure 2 illustrates the structured approach used in our systematic review, aligning it with the objective of examining and synthesizing various management methods for high-frequency hospital calls.

Management Methods for Handling High-Frequency Hospital Calls

We categorized the management methods for handling high-frequency hospital calls into three distinct research areas for a structured and comprehensive analysis. These are: country policy-based management, modeling approaches, and general studies proposing alternative strategies. This categorization facilitated a focused examination of diverse management methods, reflecting a broad spectrum of strategies employed worldwide to address high-frequency hospital.

Table 1 Characteristics of Included Studies

Author & Year of Publication	Study Design	Country	Total Emergency Calls	Methods/Manage	Conditions/ Outcomes	Key Findings
Andersen 2018[15]	Observational	Denmark	7052	Audio recordings of ECs and ambulance records were reviewed to identify calls concerning patients ≤ 15 years. EMDC dispatch records were examined to establish how the medical issues leading to these calls were classified and which pre-hospital units were dispatched to the pediatric emergencies.	The symptoms and conditions pertaining to the symptom categories "seizures" and "sick child."	The most common reported medical issues in pediatric emergency calls were "seizures" (22.1%), "sick child" (18.9%), and "unclear problem" (12.9%).
Helen 2019[16]	Observational	UK	600–900 people calls > 12 per day in a months	Questionnaires was used to gathered data about the management of people who call the EASD frequently. The Nationality policy was that, any patients that calls 12 times in a day should be regarded as "frequent calls" and should be attended to.	Mental health, Drug and Alcohol services	What the EASD did to meet up with frequent calls people
Kashima 2015[17]	Observational	Japan	8646	Data were obtained on all ambulance calls and dispatch from 2010 to 2012 generalized Log-linear model was used by estimating the IRR of ambulance calls for each 10 minutes increase in driving time to hospital.	The incidence rate and the incidence rate ratio (IRR) of ambulance calls for each 10-minute increase in the driving time.	The median incidence rate of ambulance calls in targeted communities was 436 per 10,000 people. An increase in driving time to the closest primary/secondary medical facility by 10 minutes was significantly associated with a higher incidence rate ratio (IRR) of ambulance calls, especially during colder seasons.
Watson 2021[18]	Retrospective Cohort	UK	11,396	Data set from NIAS, highest group were diabetes patients	Diabetes Mellitus	Variation in ambulance calls and conveyance rates of patients
Hyeon et al 2019[19]	Experimental	Korea	NR	Mini batch monotone approximate dynamic programming	All patients with severe and moderate cases	Increase in under-triage rates has a greater negative effect on patient RLI than over-triage rates
Kitamura 2014[20]	Retrospective Cohort	Osaka City, Japan	17,879	Data from Ambulances Survive department records	Acute myocardial infarction	Investigated the association between ambulance calls and hospitals' acceptance of cardiovascular patients
Chenelle 2016[21]	Retrospective Cohort	Rhode Island	9616	Analysis of diagnostic groups	Diagnostic conditions	Identification of patients who frequently call Urban Emergency Medical Service
Bevan 2009[22]	Case Study	UK	Various	English System of star rating	NR	Examination of various systems of performance measurement in the UK ambulance services
Phillips 2012[23]	Retrospective Cohort	Barbados	8875	Emergency Medical Dispatch (Medical Priority Dispatch System)	Pregnancy, Medical and Psychiatric conditions	Management of Barbados Emergency Ambulance Service with high frequency of non-transported calls
Young 2016[24]	Exploratory	Canada	NR	Mixed methods, personal emergency response calls	NR	Development of a model for personal emergency response spoken dialogue system
Viglino 2017[25]	Retrospective Cohort	France	507	Generalized additive model	Gastroenteritis, Influenza	Built a model on daily cases of emergency calls in a hospital
Dunca 2019[26]	Retrospective Cohort	UK	608	Linked study of ambulance and death records	Mental Health	Investigation of the effects of high demands of ambulance services on patients

(*Continued*)

Table 1 (Continued).

Author & Year of Publication	Study Design	Country	Total Emergency Calls	Methods/Manage	Conditions/ Outcomes	Key Findings
Sterud 2006[27]	Retrospective Cohort	Norway	49	Literature Review	Accident	Identification of health problems in ambulance services
Sariyer 2016[28]	Retrospective Cohort	Turkey	NR	Izmir EMS 112 system data	Emergency Medical	Analysis of Emergency Medical Service Demand
Logan et al[29]	Case Study	England	204	Provision of community fall prevention service	Fallen People	Provision of community fall prevention service to older people who call ambulance when they fall but not taken to hospital
Aslam et al 2022[30]	Retrospective Cohort	UK	1200	Focus groups, STRETCHED logic model	All patients	Evaluation of case management approaches for frequent ambulance callers
Edwards et al 2014[31]	Retrospective Cohort	UK	110	Patient-Centered Action Team intervention	Medical need, acute and chronic mental health conditions	Impact of case management intervention approach to frequent callers
Hedman 2016[32]	Case Study	Swedish	NR	Ethnographic framework, emergency call audio recordings	NR	Management of emergency calls between emergency call operators and callers to pre-hospital emergency

Abbreviations: EMDC, Emergency Medical Dispatch Centers (EMDC); EC, Emergency call; EASD, emergency ambulance services Department; NIAS, Northern Ireland Ambulance Service; EAC, Emergency ambulance calls.

Country Policy-Based Management

In examining the impact of country-specific policies on the management of high-frequency ambulance calls, our review identified key practices within national emergency services. For instance, the Pediatrics Medical Emergency Department managed by the Emergency Medical Dispatch Center (EMDC) recorded 7052 calls in a month, implementing an auto-voice recorder system to categorize calls based on severity.[15] Moreover, the UK's emergency ambulance services policy defines "Frequent calls" with a range of 600–900 calls per month, demonstrating how localized policy variations can influence the management of call frequencies.[23,28]

Modeling Approaches

To manage frequent calls, a dynamic decision-making model using a semi-Markov decision process and mini-batch monotone approximate dynamic programming (ADP) algorithm reduced the risk level index (RLI) for all patients by 11.2% compared to the greedy policy.[20] Kitamura et al found a positive correlation between call rates and ambulance arrival time The study found that the number of calls increased with the duration of ambulance arrival time (with arrests: 23.2 min to 39.7 min, without arrests: 24.4 min to 36.7 min).[20] Another study also classified personal emergency response calls using a mixed methods model. Patients with severe cases had the highest call rates, followed by older individuals.[24]

General Studies Proposing Alternative Strategies

The review also uncovered a variety of alternative strategies proposed by general studies. Young et al demonstrated that proximity to primary or secondary healthcare in rural areas, increased ambulance availability, and improved service care can reduce frequent calls.[17] Additionally, four emotional management strategies were proposed to control and reduce call frequency, including offering promising ambulance assistance and presenting problem-solving measures for callers' concerns to instill hope.[32] Watson et al analyzed ambulance calls in relation to patient conveyance rates, with a majority being male and aged 60–79 years.[18] We also included Dunca et al's examination of Scottish ambulance emergency department operations and death records for adults aged 16 years and above, as well as Sterud et al's study on health problems in ambulance services in Norway.[26,27]

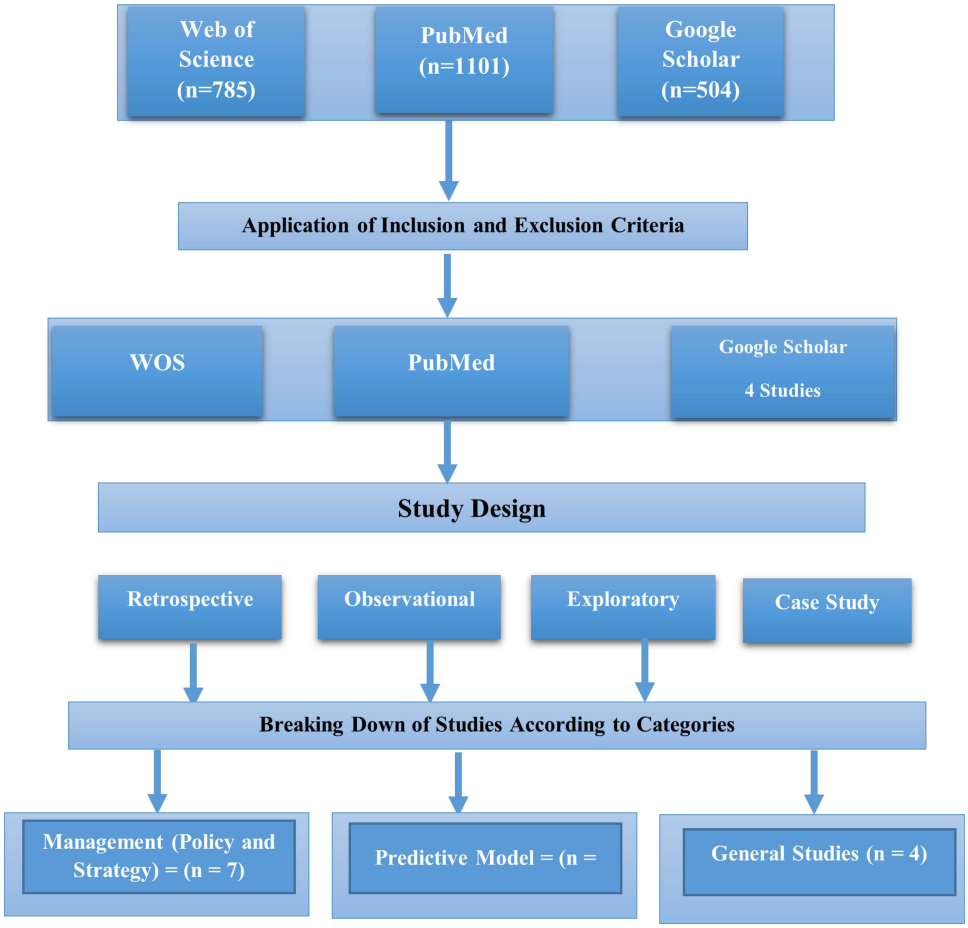

Figure 2 Systematic Review Analysis Structure.

Quality Assessment and Risk of Bias

The quality assessment and risk of bias for the synthesis articles in Table 2 indicate that all the included studies, such as Andersen et al (2018), Young et al (2016), Kashima et al (2015), and others, are categorized as "Relevant Studies" with a low risk of bias. This suggests a high level of reliability and validity in the data and findings presented in these studies, supporting the robustness of the systematic review's conclusions (as shown in Table 2).

Table 2 Risk of Bias for "Relevant" Studies

Author First Name	Response	Bias	Author First Name	Response	Bias
Andersen et al (2018)[15]	Relevant Study	Low	Young et al (2016)[24]	Relevant Study	Low
Helen et al (2019)[16]	Relevant Study	Low	Viglino et al (2017)[25]	Relevant Study	Low
Kashima et al (2015)[17]	Relevant Study	Low	Dunca et al (2019)[26]	Relevant Study	Low
Watson et al (2021)[18]	Relevant Study	Low	Sterud et al (2006)[27]	Relevant Study	Low
Hyeon et al (2019)[19]	Relevant Study	Low	Sariyer et al (2016)[28]	Relevant Study	Low
Kitamura et al (2014)[20]	Relevant Study	Low	Logan et al (2019)[29]	Relevant Study	Low
Chenelle et al (2016)[21]	Relevant Study	Low	Aslam et al (2022)[30]	Relevant Study	Low
Bevan et al (2009)[22]	Relevant Study	Low	Edwards et al (2014)[31]	Relevant Study	Low
Phillips et al (2012)[23]	Relevant Study	Low	Hedman (2016)[32]	Relevant Study	Low

Discussion

This systematic review is the first to examine the management of high-frequency ambulance calls in hospitals, to the best of our knowledge. Responding promptly to emergency calls is a global priority, guided by various government and local policies. However, our findings demonstrate that the management of high call volumes varies across countries and hospitals. The definition of "frequent calls" depends on factors such as patient condition and proximity to hospitals. Our review also highlights that emergency services personnel face a higher risk of health problems compared to other working populations, with increased call volume observed during weekends, public holidays, and disease outbreaks like influenza and gastroenteritis.

We propose four risk management and four emotional management strategies to improve emergency ambulance services. Effective emergency care requires calmness, interactive empathetic skills, reassurance, and critical reflection to make informed decisions during crises.

Our results indicate that 81% of emergency calls were prioritized, aligning with previous studies (Linell et al,[33] Svensson et al[34]). Andersen et al found that 73.3% of emergency calls received priority in Denmark, focusing on life-threatening or potentially life-threatening situations and younger children below 15 years. In contrast, Phillips et al[23] utilized the medical priority dispatch system, categorizing calls and dispatching ambulances based on the condition's prevalence. One of our strategic suggestions is placing ambulance stations in densely populated areas to improve response times, as supported by a UK study showing a high proportion of calls responded to within 10–15 minutes due to proper ambulance station placement. Notably, the definition of a high volume of calls or frequent calls varies across countries. For instance, the UK uses a national definition where patients making 12 calls in a day are considered to have "frequent calls" (Helen et al[16]). Multidisciplinary case management is proposed to address the clinical and emotional needs of such patients (Mercer et al[35]). However, our study lacked information on call reasons or the demographics of callers. Better ambulance maintenance and access to training could also enhance practice methodologies.

While this systematic review provides valuable insights, it has some limitations to consider when interpreting the results. Firstly, the limited number of included studies was a challenge in identifying accurate and reliable sources, with many studies deemed irrelevant or containing insufficient information. Secondly, our focus on management without details on caller categories or reasons for calls may limit the scope of our findings. Lastly, we lack information on differences between responding and non-responding services in managing frequent callers. The absence of meta-analysis further highlights the need for more comprehensive studies.

Conclusion

This systematic review has identified effective management strategies for high-frequency ambulance calls, including country policy-based management, modeling approaches, and innovative alternative strategies. Our findings, derived from studies with a low risk of bias, highlight the importance of diverse, adaptable solutions in emergency healthcare. Continued research and implementation of these methods across varied healthcare contexts remain crucial for.

Disclosure

The authors report no conflicts of interest in this work.

References

1. The Health and Social Care Information Centre (HSCIC). Ambulance services, England; 2014. Available from: http://content.digital.nhs.uk/catalogue/PUB17722/ambu-serv-eng-2014-2015-rep.pdf. Accessed June 21, 2019.
2. Keogh B; Urgent and Emergency Care Review Team. *Transforming Urgent and Emergency Care Services in England Urgent and Emergency Care Review End of Phase 1 Report*. NHS England: Leeds; 2013.
3. The NHS Long Term Plan 2019; 2019. Available from: https://www.longtermplan.nhs.uk/wpcontent/uploads/2019/01/nhs-long-term-plan-june-2019.pdf. Accessed July 16, 2019.
4. Edwards MJ, Bassett G, Sinden L, Fothergill RT. Frequent callers to the ambulance service: patient profiling and impact of case management on patient utilization of the ambulance service. *Emerg Med J*. 2014.

5. London Ambulance Service (LAS). Caring for frequent callers; 2017. Available from:. https://wwwengland.nhs.uk/statistics/statistical-work-areas/ambulance-qualityindicators/ambulance-quality-indicators-data-2017-18/. Accessed January 24, 2024.
6. NHS England. Ambulance Quality Indicators; 2017. Available from: https://www.england.nhs.uk/statistics/statistical-work-areas/ambulance-qualityindicators/ambulance-quality-indicators-data-2017-18/. Accessed January 6, 2019.
7. Agarwal G, Lee J, McLeod B, et al. Social factors in frequent callers: a description of isolation, poverty and quality of life in those calling emergency medical services frequently. Scandinavian journal of trauma, resuscitation and emergency medicine. *BMC Public Health*. 2019;19 (1):684. doi:10.1186/s12889-019-6964-1
8. Scott J, Strickland AP, Warner K, Dawson P. Describing and predicting frequent callers to an ambulance service: analysis of 1 year call data. *Emerg Med J*. 2014;31(5):408–414. doi:10.1136/emermed-2012-202146
9. Stevens S. *Five Year Forward View*. London: NHS England; 2014.
10. Smith D Frequent caller: identification and management policy. North West ambulance service NHS trust; 2015. Available from: https://www.nwas.nhs.uk/media/387174/frequent_callers_policy_final_v2_0_ds.pdf. Accessed January 24, 2024.
11. Liberati MA, Altman DG, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med*. 2009;6(7):7. doi:10.1371/journal.pmed.1000100
12. Ohlén G. Cochrane, (2021). *Cochrane Database Syst Rev*. 2021;33(8):20–45.
13. Critical Appraisal Skills Programme. CASP (insert name of checklist i.e. Case Control Study) Checklist; 2021.
14. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*. 2021;372: n71. doi:10.1136/bmj.n71
15. Andersen MH, et al. *Scandinavian J Trauma Resuscitation Em Med*. 2018;26:2
16. Hansagi H, Olsson M, Hussain A, Ohlén G. Is information sharing between the emergency department and primary care useful to the care of frequent emergency department users? *Eur J Emerg Med*. 2008;1(1):34–39. doi:10.1097/MEJ.0b013e3282aa4115
17. Kashima H, et al. Association Between Remoteness to a Health Care Facility and Incidence of Ambulance Calls in Rural Areas of Japan. *Health Services Res Managerial Epidemiol*. 2015:2333392815598294. doi:10.1177/2333392815598294
18. Watson A, Clubbs Coldron B, Wingfield B, et al. Exploring variation in ambulance calls and conveyance rates for adults with diabetes mellitus who contact the Northern Ireland Ambulance Service: a retrospective database analysis. *Br Paramedic J*. 2021;vol. 6(3):15–23. doi:10.29045/14784726.2021.12.6.3.15
19. Hyeon SP, Young HL. Two-Tiered Ambulance Dispatch and Redeployment considering Patient Severity Classification Errors. Hindawi. *J Healthcare Eng*. 2019;14. doi:10.1155/2019/6031789
20. Kitamura T, Taku I, Takashi K, Chika N. Ambulance calls and prehospital transportation time of emergency patients with cardiovascular events in Osaka City. *Japanese Assoc Acute Med*. 2014. doi:10.1002/ams2.25A
21. Norman C, Mello M, Choi B. Identifying Frequent Users of an Urban Emergency Medical Service Using Descriptive Statistics and Regression Analyses. *West J Emerg Med*. 2016;17(1):39–45. doi:10.5811/westjem.2
22. Bevan G, Richard H. Hitting and missing targets by ambulance services for emergency calls: effects of different systems of performance measurement within the UK. *Part*. 2007;172(1):161–190.
23. Phillips SE, Gaskin PS, Byer D, Cadogan WL, Brathwaite A, Nielsen AL. The Barbados Emergency Ambulance Service: high Frequency of Nontransported Calls. *Em Med Int*. 2012;2012:1–6. doi:10.1155/2012/659392
24. Young V, Elizabeth R, Mihailidis A. Exploratory analysis of real personal emergency response call conversations: considerations for personal emergency response spoken dialogue systems. *J Neuroeng Rehabil*. 2016;13:(1):97. doi:10.1186/s12984-016-0207-9
25. Viglino V, Vesin A, Ruckly S, et al. Daily volume of cases in emergency call centers: construction and validation of a predictive model. *Scandinavian J Trauma Resuscitation Em Med*. 2017;25(1):86. doi:10.1186/s13049-017-0430-9
26. Steru D, et al. Health status in the ambulance services: a systematic review. *BMC Health Serv Res*. 2006:1–10.
27. Duncan N, Best C, Dougall N, et al. Epidemiology of emergency ambulance service calls related to mental health problems and self harm: a national record linkage study. Scandinavian journal of trauma. *Scandinavian J Trauma Resuscitation Em Med*. 2019:1–8. doi:10.1186/s13049-019-0611-9
28. Sariyer G, Ataman MG, Akay S, Sofuoglu T, Sofuoglu Z. An analysis of Emergency Medical Services demand: time of day, day of the week, and location in the city. *Turkish J Em Med*. 2017;17(2):42–47. doi:10.1016/j.tjem.2016.12.002
29. Logan PA, Coupland CAC, Gladman JRF, et al. Community falls prevention for people who call an emergency ambulance after a fall: randomised controlled trial. *BMJ*. 2010;340(111):c2102–c2102. doi:10.1136/bmj.c2102
30. Rabeea'h WA, Helen S, Alison P. STRategies to Manage Emergency Ambulance Telephone Callers with Sustained High Needs: An Evaluation Using Linked Data (STRETCHED). *BMJ*. 2022;12:e053123.
31. Edwards MJ, Bassett G, Sinden L. Frequent callers to the ambulance service: patient profiling and impact of case management on patient utilization of the ambulance service. *Emerg Med J*. 2015;32:392–396.
32. Hedman K. Managing Medical Emergency calls. *Faculty Social Sci Dep Sociol*. 2016.
33. Linell P, Adelswärd V, Sachs L, Bredmar M, Lindstedt U. Expert talk in medical contexts. *Res Language and Ocial Interaction*. 2002;35 (2):195–218. doi:10.1207/S15327973RLSI3502_4
34. Svensson M. *Routes, Routines and Emotions in Decision Making of Emergency Call Taking*. Karlskrona: School of Management Blekinge Institute of Technology; 2012.
35. Mercer T, Bae J, Kipnes J, Velazquez M, Thomas S, Setji N. The highest utilizers of care: individualized care plans to coordinate care, improve healthcare service utilization, and reduce costs at an academic tertiary care center. *J Hosp Med*. 2015;10(7):419–424. doi:10.1002/jhm.2351