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REVIEW

INCIDENCE AND OUTCOMES OF ADULT SYNCOPE PRESENTATIONS TO EMERGENCY MEDICAL SERVICES: A SYSTEMATIC REVIEW

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ABSTRACT

Objective: The objectives of this systematic review were to evaluate the incidence, patient demographics, and associated outcomes of adult syncope presentations to emergency medical services (EMS) within current literature.

Methods: Inclusion criteria were EMS contact, a provisional diagnosis of syncope, and epidemiological data regarding EMS contact with these patients. Exclusion criteria were all non-primary studies, patients given an alternative provisional diagnosis or who received life supporting interventions, studies that examined only presyncope presentations or were limited to paediatric patients, or that examined syncope within highly specific non-generalisable settings. Databases were searched on April 5th, 2022, and included Emcare, AMED, Medline, and CINAHL Plus. Quality assessment was conducted using the National Heart, Lung, and Blood Institute quality assessment tool. Data were manually extracted and collated with results synthesised using descriptive statistics and a narrative synthesis.

Results: Twelve studies were included in this review. Studies were primarily completed in Europe or the USA, and sample sizes ranged from 500 to 16 million. Most studies were rated as good to fair in quality. No studies specifically looked at the incidence or outcomes of syncope presentations to EMS. The reported incidence of syncope ranged between 0.09% and 24%.

Discussion: Most studies were generalised epidemiological studies looking at EMS presentations. There were no studies that specifically looked at the incidence and outcomes of syncope presentations to EMS together. Instead, they were either large scale epidemiological studies that lack detailed analysis or had small samples focusing only on certain patient characteristics or presentations. An improved understanding of the epidemiological features of syncope presentations within the prehospital setting and their associated outcomes are of critical importance for the determination of risk stratification that can help guide clinical decision making by EMS.

INTRODUCTION

Syncope is defined as a sudden transient loss of consciousness followed by spontaneous and complete recovery without intervention (Brignole et al., 2018; Thiruganasambandamoorthy et

al., 2022). It is caused by transient global cerebral hypoperfusion due to either decreased cardiac output, excessive vasodilation, or a combination of both (Thiruganasambandamoorthy et al., 2014; A. Ungar et al., 2010). Syncope can be broadly categorised as reflex syncope (including vasovagal syncope), orthostatic hypotension, or cardiac syncope (Sutton, Ricci, & Fedorowski, 2022). Causes of syncope range from benign conditions such as a vagal response to fear, to life threatening conditions such as lethal arrhythmias, structural heart defects, or an aortic dissection (Thiruganasambandamoorthy et al., 2014).

The incidence of syncope in the setting of the emergency department (ED) is generally reported to be between 1-3% and outcomes associated with ED presentations are well reported (Anand et al., 2018; Bernier, Tran, Sheldon, Kaul, & Sandhu, 2020; Long, Serrano, Cabanas, & Bellolio, 2016). However, the incidence of syncope in the prehospital setting remains largely unknown. Some studies suggest that more than 50% of presentations to ED for syncope arrive by emergency medical services (EMS) transport (Bernier et al., 2020; Long et al., 2016; Somani, Baranchuk, Guzman, & Morillo, 2012; V. Thiruganasambandamoorthy et al., 2013; Yau et al., 2019). Furthermore, Yau et al. (2019) showed that of the 70% of syncope patients to arrive by ambulance only 17% were admitted.

Historically, syncope has presented a significant health burden. The overall admission to hospital was disproportionately high, as clinicians sought to mitigate the risk of life-threatening conditions associated with syncope (Bernier et al., 2020; Long et al., 2016; Somani et al., 2012). An understanding of the epidemiology, risk factors and associated outcomes for syncope within the ED has been integral in the development of risk-stratification tools and guidelines that have helped reduce unneccesary hospitalisations by more than 40% (Anand et al., 2018). A similar understanding of the epidemiology, risk factors and associated outcomes related to EMS presentations specifically, could therefore help to reduce unnecesary ED transportations.

The primary objective of this systematic review was to evaluate the incidence of adult syncope presentations to EMS amongst the current literature. The secondary objective was to evaluate patient demographics and any outcomes relating to syncope presentations such as transportation rates, the incidence of adverse events, and any other commonly reported outcomes.

METHODS

This systematic review was guided by JBI's manual for evidence synthesis; systematic reviews of prevalence and incidence (Munn Z, 2020). It was reported in accordance with the updated 2020 guidelines for the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Page et al., 2021). It was prospectively registered with the International Prospective Register of Systematic Reviews (PROSPERO ID # 323284). The review was conducted with methodological support from Monash University.

Search Strategy and Information Sources

A search strategy using the PECO structure was performed as outlined in the protocol and Appendix 1. As all epidemiological outcomes were sought, there was no control required and specific outcomes were avoided to prevent exclusion of relevant results. A pre-established and validated paramedic filter was used to identify any prehospital

non-physician healthcare provider with any educational level or experience (Olaussen, Semple, Oteir, Todd, & Williams, 2017). To ensure that all possible papers were included, the paramedic filter with greater sensitivity (98.4%) was used (Olaussen et al., 2017). The search strategy was conducted in Emcare, AMED and Medline (R) via OVID, and CINAHL Plus via EBSCO Host, from their individual commencement dates until December 20th, 2022.

Eligibility Criteria and Screening

The results were uploaded into the automated screening and data extraction tool Covidence (2022), where duplicates were automatically removed. A title and abstract review of all articles was completed independently by MC, with a secondary review (by AD, MW-S and AO) against the inclusion/exclusion criteria. For inclusion, papers must have provided epidemiological data conducted in the prehospital setting on patients with a clinical impression or primary complaint of syncope. A full exclusion criterion is provided in Appendix 2. Conflicts were resolved via discussion among the three investigators where two out of four disagreed initially. A full text review was independently completed on all the remaining articles by MC, with a secondary review by either MW-S or AO, focusing on key exclusion criteria. Conflicts were resolved via discussion among the three investigators, where one out of the three disagreed. Interrater reliability was calculated using Cohen's kappa. A final forwards and backwards citation search was conducted on all included text using the automated process Citation chaser, with papers manually reviewed (N. R. Haddaway, Grainger, & Gray, 2021).

Data Extraction and Synthesis of Findings

Data were manually extracted and outcomes manually collated by a single investigator (MC). Data extracted for study characteristics included country of study, EMS qualifications, study design, study period, study population, and population characteristics, as well as whether syncope was reported as a primary complaint or clinical impression. The primary patient outcome extracted from the data was the incidence of syncope. The secondary patient outcomes were rates of transport, adverse events, mortality, and all other reported outcomes. Rates were manually calculated where required. Results were produced using a narrative synthesis to identify the primary and secondary objectives.

Assessment of Study Quality

The National Heart, Lung and Blood Institute quality assessment tool was used to conduct a quality assessment of each study (Health, 2013). This questionnaire allowed for the assessment of weakness and/or bias regarding study population and population characteristics, sample size justification and power, evaluation of exposures and outcomes, as well as consideration for confounding variables and blinding of outcome assessors. An overall assessment of quality was summarised as being good, fair or poor (Health, 2013). This questionnaire was uploaded into the data extraction tool Covidence, and each study was independently assessed by two investigators (MC and MW-S) (Innovation, 2022). Interrater reliability was calculated using Cohenss kappa. Conflicts were resolved by an independent review from a third investigator (AO).

RESULTS

Study Selection

The search yielded 3,913 papers, of which 919 were duplicated. A full text review of 62 papers resulted in 11 inclusions and 51 exclusions (Figure 1). The citation search yielded one additional study, resulting in 12 studies being included. Inter-rater reliability for study inclusion was 0.1 for MC and MWS (31% agreement) and 0.71 for MC and AO (66% agreement). All conflicts were resolved via group discussion.

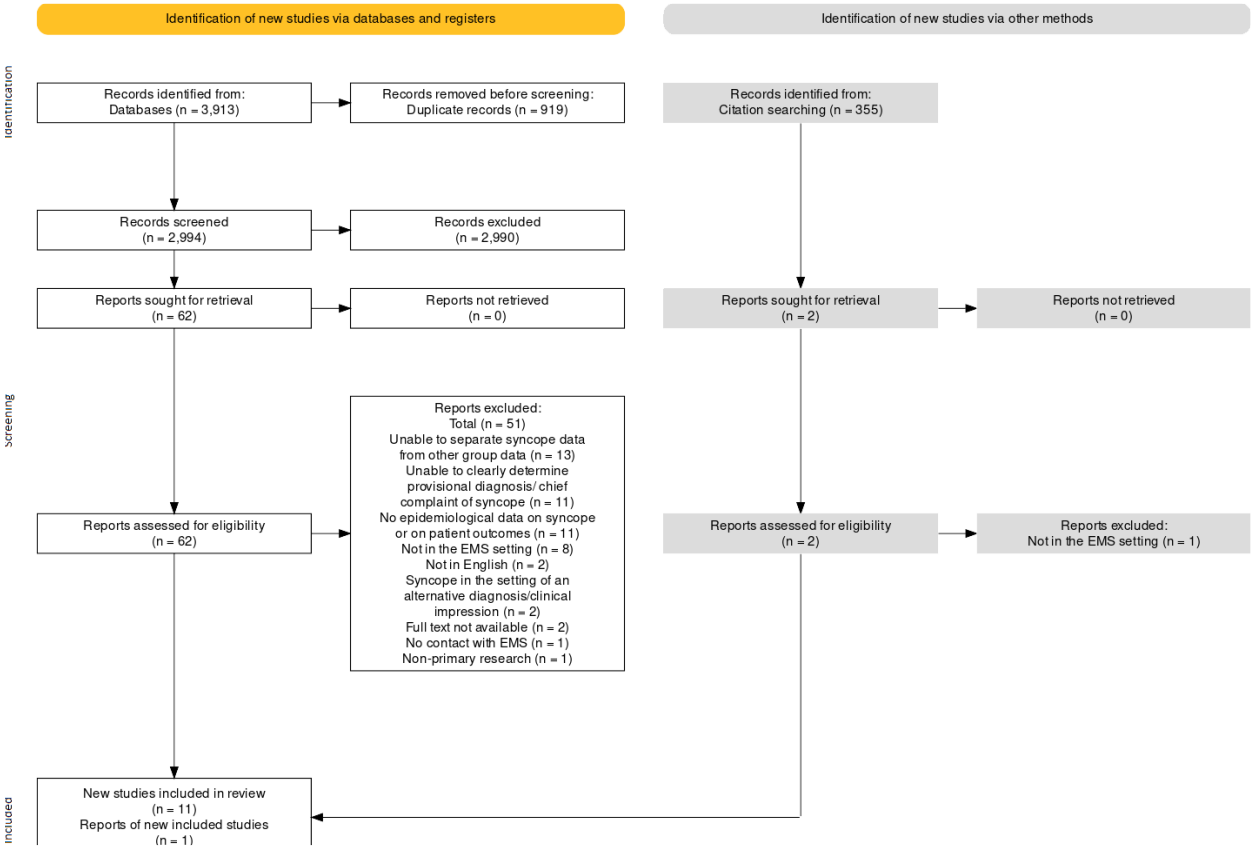

Figure 1. PRISMA flowchart (Neal R. Haddaway, Page, Pritchard, & McGuinness, 2022).

Study Characteristics

Studies were primarily completed in Europe or the USA between 1985 and 2020. EMS qualifications varied widely amongst the studies ranging from emergency physicians to emergency medical technicians, with paramedics being the most common qualification. Sample sizes ranged from 500 to 16 million patients (Table 1).

One study was a prospective cohort study and the remaining eleven were retrospective observational studies. Two studies looked at characteristics of prehospital electrocardiograms (ECGs) and two looked at the diagnostic agreement between prehospital and emergency department diagnosis. Four studies analysed the epidemiology of all EMS presentations, and two looked only at the epidemiology of EMS presentations that were

non-transported. Another study looked to validate a rule for prediction to hospital admission based off patient characteristics from EMS presentations. No study explicitly sought to investigate the incidence of syncope presentations to EMS nor their associated outcomes.

Patient characteristics were heterogenous with five studies including all EMS activations, three studies including only EMS presentations that were transported and two studies including only those not transported. The remaining two studies looked at those who received an ECG or had presented with anginal complaints that included syncope.

Author	Year	Country	EMS Qualification	Study Design	Study Period	Study Druation (Months)	Study Population (n=)	Population Characteristics
Brunetti et al. 2012	2012	Apulia, Italy	RN & Physician	Prospective Cohort Study	Oct 2004 to Apr 2006	18	27,481	EMS presentations who received an ECG which was then transmitted for cardiologist review
Zegre-Hemsey et al. 2019	2019	North Carolina, USA	NR	Retrospective observational Study	Jan 1st 2010 to Dec 31st 2014	60	1,967,542	EMS presentations of chest pain or anginal equivalent complaints that were transported
Cwinn et al. 1988	1988	Denver, USA	Paramedic	Retrospective observational study	Sep 1984 to Sep 1985	12	1,952	Total of all EMS presentations within the airport
Duong et al. 2018	2018	USA	NR	Retrospective observational study	2014	NR	16,116,219	Total of all EMS presentations within USA aged 18 years or over
Panchal et al. 2022	2022	USA	AEMT & Paramedic	Retrospective observational study	2016	NR	13,353,268	Total of all EMS presentations within USA aged 18 years or over
Hensel et al. 2017	2017	Hamburg, Germany	Emergency Physician	Prospective observational study	Jan 2010 to Dec 2014	60	35,390	Total of all EMS presentations to Emergency Physicians between 0700 and 1900
Kucap et al. 2020	2020	Poland	NR	Retrospective observational study	Mar 15th to May 15th in 2018, 2019, 2020	9	1,479,530	Total of all EMS presentations during each 3 month period
Ebben et al. 2019	2019	Region unspecified, Netherlands	RN, NP & Physician assistant	Retrospective observational study	2015	NR	426	Random sample of 500 EMS presentations that resulted in non-transport (from 10,980)
Alzareeni et al. 2016	2016	Riyadh, Saudia Arabia	EMT	Retrospective observational study	Mar to May, 2014	3	1390	Total of all EMS presentations that resulted in non-transport
Meisel et al. 2008	2008	Region unspecified, USA	EMT & Paramedic	Retrospective cohort study	Aug and Dec, 2005	2	401	Total of all EMS activations transported to the two prespecified EDs and that were classified as non-trauma, non-psychiatric and non-labour
Ramadanov et al. 2019	2019	Bad Belzig, Germany	Emergency Physician	Retrospective observational study	Jul 1st 2013 to Jun 30th 2014. Jan 1st to Dec 31st 2015	24	1,055	Total of all EMS activations transported to any Emergency department where corresponding discharge summaries could be obtained.
Schewe et al. 2019	2019	Bonn, Germany	Paramedic & Emergency Physician	Retrospective observational study	Jan to Dec 2004 and 2014	24	1960	Total of all EMS activations aged 18 years and over, transported to any Emergency department where corresponding discharge summaries could be obtained

RN = Registered Nurse,
NR = Not Reported,
ALS = Advanced Life Support,
AEMT = Advanced Emergency Medical Technician,
EMT = Emergency Medical Technician,
NP= Nurse Practitioner

Table 1. Study Characteristics.

Quality Assessment of Studies

Seven studies were rated overall as being of good quality, with four being rated as fair and one as being of poor quality and at significant risk of bias. Lack of detail regarding loss to follow up and independent details, as well as blinding of outcomes by assessors were reasons for the four studies rated as fair (Alrazeeni et al., 2016; Cwinn, Dinerman, Pons, & Marlin, 1988; Duong et al., 2018; Schewe et al., 2019). The study by Ebben et al. was rated as poor quality due to a small sample of only 426 patients drawn from over 10,000 presentations with no explanation as to how the sample was obtained. This raised concerns for selection bias and was acknowledged by the authors (Ebben, Castelijns, Frenken, & Vloet, 2019). Seven studies did not provide a clear definition of syncope or provide criteria for how syncope was diagnosed by their clinicians (Table 2). Six studies reported syncope as being a clinical impression, whilst five studies reported syncope as the primary complaint, and one providing both. Only five studies clearly defined an adult (i.e. either 18 or 21 years) with several studies not specifying whether paediatric patients were included. There was 16% agreement amongst MC and MWS for studies rated as being of good quality, with 83% agreement for studies rates as being of good or fair quality. Inter-rater reliability for study quality was attempted for both measures but could not be calculated. Conflicts were resolved through an independent review by AO.

Evaluation of Primary Objective: Incidence of Syncope Presentations to EMS

The reported incidence of syncope varied between <1% and 24% amongst all studies (Table 3). The incidence rate varied significantly based on sample size and characteristics. The incidence of syncope was significantly reduced amongst studies with a sample size of more than one million (3% to 9%). The incidence was significantly higher in studies where transport was not provided (10% to 24%), compared to those who were transported (3% to 8%). Amongst studies that included all EMS presentations, the incidence was 4% to 11%. Variation in incidence

Study	Definition of Syncope Provided	Syncope as Primary Complaint or Clinical Impression	Definition of Adult	Inclusion of Paediatrics	NIH Quality Rating
Brunetti et al. 2012	Yes	Primary complaint	> 18	Yes	Good
Zegre-Hemsey et al. 2019	No	Primary complaint	21	No	Good
Cwinn et al. 1988	No	Primary complaint	NR	NR	Fair
Duong et al. 2018	No	Clinical impression	18	No	Fair
Panchal et al. 2022	No	Clinical impression	18	No	Good
Hensel et al. 2017	Yes	Clinical impression	NR	NR	Good
Kucap et al. 2020	Yes	Clinical impression	NR	NR	Good
Ebben et al. 2019	No	Clinical impression	NR	Yes	Poor
Alzareeni et al. 2016	No	Primary complaint	NR	NR	Fair
Meisel et al. 2008	No	Primary complaint	>18	No	Good
Ramadanov et al. 2019	Yes	Clinical impression	NR	Yes	Good
Schewe et al. 2019	Yes	Both	18	No	Fair

NR = Not reported.

*Syncope was reported within the study as being either the primary complaint or reason for calling, or as the clinical impression formed by the EMS provider.

Table 2. Quality assessment of studies.

also occurred between whether syncope was recorded as a primary complaint (3% to 24%) or clinical impression (4% to 11%) as well as by the region in which the study was completed (USA; 3 to 9%, EUR; 1% to 11%). Due to the significant heterogeneity amongst the studies (heterogeneity score was 100%), a meta-analysis was not performed (Figure 2).

Evaluation of Secondary Objectives

Transportation Rates

The study by Cwinn et al. (1988), was the only study to report the pre-determined secondary objective of transportation rates. They reported that 60 of 117 patients received transport by ambulance (51.3%) with 33 being patient initiated non-transports (28.2%) and 21 being paramedic initiated (17.9%). This study focused on a single paramedic response unit stationed within an international airport that serviced more than 50,000 people per day. Although the study population formed part of the EMS response catchment, the small sample size and focus on a single response unit not capable of transporting significantly biases this outcome. No other study reported the incidence of transportation. Due to the lack of alternative evidence a true rate of transport cannot be reliably determined.

Incidence of Adverse Outcomes

The study by Brunetti et al. (2012), was the only study to report the pre-determined secondary objective of adverse events. From more than 2648 patients receiving an ECG for a syncope presentation, they reported that the incidence of a severe arrythmia (defined as either a severe bradycardia or tachycardia) was age related (1.45% for those aged 50-60, to 3.13% for those aged 90-100), and that in patients less than 30 years of age, there were no instances of severe arrhythmia. No other study described the incidence of adverse outcomes. There were no studies that reported the incidence of mortality.

Patient Demographics

Study	Study Population (n=)	Incidence of Syncope (n=)	Incidence of Syncope (%)
Brunetti et al. 2012	27,841	2648	9.51[a,b]
Zegre-Hemsey et al. 2019	1,967,542	68,215	3.47[b]
Cwinn et al. 1988	1,952	117	5.99[b]
Duong et al. 2018	Total – 16,116,219	697,726.11[a,b]	4.33[a]
	65 and Older – 6,569,064	373,122.84[a,b]	5.68
	18 to 64 – 9,547,155	324,603.27[a,b]	3.40
Panchal et al. 2022	13,353,268	1,346,549[c]	9.13
Hensel et al. 2017	35,390	3,796	10.73[b]
Kucap et al. 2020	Total – 1,479,530	83,382[a,b]	5.64[a,b]
	2018 – 550,815	34,989	6.35[a,b]
	2019 – 527,837	31,889	6.04[a,b]
	2020 – 400,878	16,504	4.12[a,b]
Ebben et al. 2019	426	42	9.9
Alzareeni et al. 2016	1,390	333.6[a,b]	24
Meisel et al. 2008	401	16.04[b]	4
Ramadanov et al. 2019	1,055	84[c]	7.96[b,d]
Schewe et al. 2019	2004 – 594	-[a]	0.09[b,e]
	2014 – 1,366	-[a]	0.12[b,f]

a Not reported.

b manually generated.

c Number of clinical impressions made. Some patients were given multiple impressions.

d 1,055 patients presented, resulting in 1,378 provisional diagnoses, 84 of which were syncope. Incidence reported in study as 6.1% based on total provisional diagnoses.

e Incidence of syncope reported as 87/100,000 residents/year.

f Incidence of syncope reported as 119/100,000 residents/year.

Table 3. Primary outcome - Incidence of syncope.

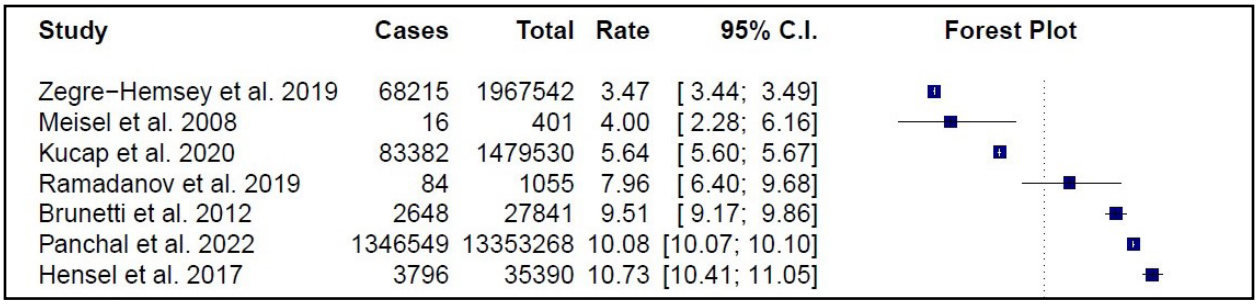

Figure 2. Forest plot of the incidence of syncope from articles rated as good quality.

Description of patient demographics occurred in only three studies and were limited to age and sex. There was agreement amongst the two studies that assessed age. Duong et al. (2018) reported a higher incidence amongst those aged 65 years and older (5.68%), compared to those aged under 65 years (3.4%) from a sample of almost 700,000 syncope presentations. Brunetti et al. (2012), reported a mean age of 66 years (+/-20) amongst their 2,648 syncopal presentations. This suggests that the incidence of EMS syncope presentations may increase with age, however this cannot be reliably concluded due to significant differences in study characteristics.

There were two studies that assessed gender. Brunetti et al. (2012), reported that 53% of all syncope presentation were male, with Hensel et al. (2017) reporting an odds ratio of 1.31 towards female presentations. Although these results may suggest a disagreement of findings, a direct comparison was prohibited due to a difference in sample sizing and reporting measurements.

Other Outcomes

Initial dispatch for syncope was reported by Kucap et al. (2020) and Eben et al. (2019), at 8% and 17% respectively, of all total calls received. As this is higher than the EMS provisional diagnosis of syncope, at 5.64% and 9.9% respectively, this suggests that dispatch may have a lower specificity for syncope. However, this cannot be reliably concluded. Interestingly, Kucap et al. (2020) reported the incidence of both initial dispatch for syncope and provisional diagnosis of syncope reduced by more than 2% during the reported SARS-CoV-2 (COVID-19) pandemic period.

Two studies looked at diagnostic agreement between prehospital emergency physicians and emergency physicians within the ED. Ramadanov et al. (2019) found that diagnostic agreement was achieved 81% of the time from 84 patients. Schewe et al. (2019) reported a drop in diagnostic agreement from 81% in 2004 to 56% in 2014. The authors attributed this drop in agreement to a possible increase in recognition of alternative diagnoses (Schewe et al., 2019). There was no study that looked at diagnostic agreement between EMS providers of other qualification such as paramedics, registered nurses, or Emergency Medical Technicians (EMTs), and in-hospital diagnosis.

DISCUSSION

To our knowledge, this is the first systematic review that has sought to explore the incidence of syncope presentations to EMS and their associated outcomes amongst the current literature. The key finding is that there is no high-quality data specifically looking at syncope presentations and their associated outcomes in the prehospital setting. Instead,

Study	Study Population n=	Initial Dispatch for Syncope n= (%)	T[a] n=(%)	Non-T[a]	Diagnostic Agreement Syncope% (n)	Age	Sex
Brunetti et al. 2012	27,841	NR	NR	NR	NR	Mean age 66 (+/- 20)	53% Male
Zegre-Hemsey et al. 2019	1,967,542	NR	(100)	(0)	NR	NR	NR
Cwinn et al. 1988	1,952	NR	60b	54	NR	NR	NR
Duong et al. 2018	Total – 16,116,219	NR	NR	NR	NR	NR	NR
	65 and Older – 6,569,064	NR	NR	NR	NR	NR	NR
	18 to 64 – 9,547,155	NR	NR	NR	NR	NR	NR
Panchal et al. 2022	13,353,268	NR	NR	NR	NR	NR	NR
Hensel et al. 2017	35,390	NR	NR	NR	NR	NR	1.31 OR Female
Kucap et al. 2020	Total – 1,479,530	119,352[c] (8.07)[c]	NR	NR	NR	NR	NR
	2018 – 550,815	48,121 (8.74)[c]	NR	NR	NR	NR	NR
	2019 – 527,837	45,157 (8.56)[c]	NR	NR	NR	NR	NR
	2020 – 400,878	26,074 (6.50)[c]	NR	NR	NR	NR	NR
Ebben et al. 2019	426	71 (16.7)	(0)	(100)	NR	NR	NR
Alzareeni et al. 2016	1,390	NR	(0)	(100)	NR	NR	NR
Meisel et al. 2008	401	NR	(100)	(0)	NR	NR	NR
Ramadanov et al. 2019	1,055	NR	(100)	(0)	81	NR	NR
Schewe et al. 2019	2004 – 594	NR	(100)	(0)	81	NR	NR
	2014 – 1,366	NR	(100)	(0)	56	NR	NR

a T= Transported. NR = Not reported.
b Three patients also transported by private means.
c Not reported, manually generated.
d Unable to manually generate due to lack of data.

Table 4. Secondary outcomes.

findings are predominantly indirect results from large scale epidemiological studies that lack detailed analysis, or small-scale studies focused only on certain patient characteristics or presentations. Due to the heterogeneity of study characteristics, direct comparisons and conclusions could not be determined. The incidence, risk factors and outcomes of syncope presentations to EMS continue to remain unknown despite the vast research on syncope presentations within the ED and the close interaction between ED and EMS.

Most studies reported an incidence of more than two to three times the reported 1 to 3% incidence of presentations within the ED (Bernier et al., 2020; Long et al., 2016; Somani et al., 2012). However, the incidence of syncope presentations varied significantly, and the significant heterogeneity of studies meant a pooled rate of incidence could not be obtained through meta-analysis. Whilst the rate of transportation remains unknown, prior research has shown that most ED presentations arrive by ambulance (Bernier et al., 2020; Long et al., 2016; Somani et al., 2012; V. Thiruganasambandamoorthy et al., 2013; Thiru-

ganasambandamoorthy et al., 2022; Yau et al., 2019). Given these findings, a significant gap exists within the literature to examine EMS presentations, as well as the relationship between EMS and ED presentations. An understanding of this relationship is essential not only to determine if appropriate transport decisions are being made, but how they are being made and the impacts of these decisions on patient outcomes.

Epidemiological features of patient presentations are of critical importance for the understanding of patient outcomes and determination of risk stratification (Bernier et al., 2020). Studies have shown that the incidence of adverse events within 30 days for patients presenting privately to the ED with syncope to be 10%. However, the incidence amongst those who present to ED via ambulance was found to be even higher at 14.6% (Thiruganasambandamoorthy et al., 2015; Yau et al., 2019). The reasons for this are unknown. Given the transient nature of syncope, most symptoms will have resolved by the time a patient presents to the ED (Somani et al., 2012). EMS providers have the unique advantage of being able to provide early assessment in the field and could be called to presentations that are more severe. In doing so, they may be identifying key findings that would have otherwise resolved prior to arrival at ED (Somani et al., 2012). Alternatively, if EMS providers are possibly attending a higher incidence of syncopal presentations, they may already be diverting patients away from the ED. If so, important questions remain. How are EMS clinicians currently assessing and risk stratifying syncopal presentations? Is this being done safely?

The studies from this review, suggesting that syncope may increase with age and was higher in those aged over 65, is congruent with previous ED research (Brunetti et al., 2012; Duong et al., 2018; Sutton et al., 2022; Yau et al., 2019). However, no study provided a further breakdown of medical history, medications, or other risk factors nor sought to identify a link with patient outcomes. Only the study by Brunetti et al. evaluated the incidence of an adverse event amongst prehospital syncope presentations, finding a positive correlation with age (Brunetti et al., 2012).

Through ED studies such as the EGSYS 2 and RiSEDS study, an understanding of patient outcomes and their relationship to risk factors have been achieved. These studies have then been integral in the development of risk stratification tools to help guide clinical decision making within the ED (Cosgriff, Kelly, & Kerr, 2007; Venkatesh Thiruganasambandamoorthy et al., 2020; Andrea Ungar et al., 2010). These risk stratification tools are cost-effective and are now being shown to effectively reduce patient hospitalisation (Anand et al., 2018; Brain et al., 2023; Zimmermann et al., 2022).

The results from this review show that EMS have a potentially significant role in the initial assessment and management of syncope patients. Despite this, an understanding of the epidemiology and outcomes of syncopal presentations to EMS remains poorly understood when compared to ED. Whilst several risk stratification tools exist within the ED setting for syncope, there is no such tool available within the prehospital setting. The development of a validated risk assessment tool or guideline within the prehospital setting would allow EMS providers to identify, safely and correctly, those requiring emergency care from those of lower risk. This could then reduce unnecessary transports leading to improved and more cost-efficient patient care. For this to be achieved, further evidence is firstly required to provide a greater understanding of the incidence of syncope presentations to EMS and their associated outcomes.

LIMITATIONS

A key limitation within the evidence of this review is that most studies were either large scale epidemiological studies that lack detailed analysis or had small samples focusing on only certain patient characteristics or presentations. Most of the studies did not define syncope and in several studies the inclusion of paediatric presentations could not be reliably removed.

Whilst the definition of syncope seems clear, the aetiology and subsequent diagnosis is less so. The omission of a clear definition for the diagnosis of syncope within certain studies puts into question whether such presentations would have been otherwise included or excluded from similar studies that did provide a definition of syncope. Similarly, different studies determined syncope to be either a primary complaint or clinical impression. The variance in the reported incidence of syncope found in these studies could also be explained if EMS providers are listing syncope as the primary complaint or reason for calling, rather than as a provisional diagnosis after a clinical assessment. Ultimately, these considerations represent a significant limitation upon the reported incidence of syncope.

Limitations of the Review Process

There was significant disagreement between reviewers regarding inclusion of studies which may have produced a bias of results. On investigation of the disagreement regarding inclusion of studies, a key finding was that many studies met the inclusion criteria: where the study sample had contact with EMS, with a primary complaint/clinical impression of syncope, and there was epidemiological data available regarding the EMS contact. However, the studies were still conducted from within the ED setting, using ED data. This meant that the data was not actually obtained from the prehospital setting. Upon further review and discussion, there was consensus that such papers should be excluded as the exclusion criteria could not be reliably determined. In other studies, a clear determination of a provisional diagnosis or clinical impression for syncope could also not be made. Whilst exclusion of these studies may have created a bias within the results, the authors believe this to be minimal.

There was also significant conflict regarding assessment of study quality. Upon investigation, a key finding was the experience between MC and MWS in assessment of studies. This conflict did not impact on the outcomes of this study.

A meta-analysis of the data could not be completed due to insufficient studies available for pooling and the heterogeneity sample characteristics. Similarly, a sensitivity analysis was not appropriate given the low number of studies, and as the heterogeneity of their findings meant pooling of data was inappropriate.

CONCLUSION

There is no high-quality data specifically looking at syncope presentations and their associated outcomes in the prehospital setting within the current literature. Instead, a limited number of studies reported on the incidence, patient demographics, and associated outcomes indirectly from either large-scale epidemiological studies that lack detailed analysis, or small-scale studies focused only certain patient characteristics or presenta-

tions. Syncope presentations in the prehospital setting may be more than two to three times the incidence of presentations within the ED, but the true rate of incidence remains unknown. Despite this finding, there is a further lack of data describing the epidemiology and the associated outcomes of these patients. EMS clinicians could play an important role in assessing and diverting low risk patients away from the ED. For this to be done safely and efficiently, a better understanding of the epidemiology, outcomes, and associated risk factors of syncope patients presenting to EMS is required.

APPENDICES

Population		"AND"	Exposure (18)	
1. Ambulances/	OR		1. exp Syncope/	OR
2. Emergency Medical Technicians/	OR		2. Syncop*.mp.	OR
3. Air Ambulances/	OR		3. "transient loss of consciousness".mp.	OR
4. Emergency Medical Services/	OR		4. Unconsciousness/ or syncope/	OR
5. Paramedic*.tw.	OR		5. "altered level of consciousness".mp.	OR
6. ems.tw.	OR		6. "altered consciousness".mp.	OR
7. Emt.tw.	OR		7. Consciousness disorders/	OR
8. Prehospital.tw.	OR		8. Vasovagal.mp.	OR
9. pre-hospital.tw.	OR		9. Hypotension, Orthostatic /	OR
10. first responder*.tw.	OR		10. Orthostatic hypotension.mp.	OR
11. emergency medical technicians.tw.	OR		11. faint*.mp.	OR
12. ambulance*.tw.	OR		12. collapse.mp.	OR
13. HEMS.tw.	OR		postural hypotension.mp.	
14. field triage.tw.	OR			
15. out-of-hospital.tw.				

Appendix 1. Ovid Search Strategy Using the Boolean Operators.

Inclusion Criteria	
✓	Contact with pre-hospital emergency medical service AND
✓	Primary complaint / clinical impression of syncope AND
✓	Epidemiological data regarding EMS contact with syncope patients, such as incidence, patient demographics and associated outcomes such as EMS interventions, transports vs non-transport, aetiology, mortality, morbidity or adverse outcomes.
Exclusion Criteria	
×	Case reports, literature reviews, perspective or editorials, conference abstracts OR
×	Syncope in the setting of an alternative provisional diagnosis/clinical impression, such as Acute myocardial infarction (AMI). Cardiac arrest. Lethal arrythmia such as ventricular fibrillation (VF) or ventricular tachycardia (VT), stroke or aortic dissection OR
×	Syncope in patients who have received life supporting interventions such as defibrillation, cardioversion, cardiopulmonary resuscitation (CPR), extracorporeal membrane oxygenation, vasopressor or anti-arrhythmic medications OR
×	Pre-syncope or near-syncope only OR
×	Paediatric patients as defined by study authors in individual studies OR
×	Specific settings not generalisable to daily public life OR
×	Specific events such as mass gatherings, sporting events, festivals, or exposure to new environments, such as high altitude
Exclusion Reasons	
×	Not EMS setting
×	Full text not available
×	No contact with registered pre-hospital emergency medical service
×	Unable to clearly determine provisional diagnosis/clinical impression of syncope - Data presented as collapse, or altered conscious state or falls only
×	No epidemiological data on syncope or on patient outcomes
×	Syncope in the setting of an alternative provisional diagnosis/clinical impression
×	Unable to separate syncope data from other grouped data - Syncope data grouped in with other conditions such as seizure, coma, altered conscious state, acute coronary syndrome etc. or age
×	Full text not in English

Appendix 2. Inclusion and Exclusion Criteria.

Section and Topic	Item #	Checklist item	Location Where Item is Reported
TITLE			
Title	1	Identify the report as a systematic review.	Page 1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Attachment
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Page 4
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Page 4
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Table 5
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Page 5
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Table 5
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Page 5
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Page 6
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Page 6
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Page 6
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Page 6
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Page 6
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Page 6
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Page 6
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Page 6
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Page 6
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	N/A
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	N/A
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	N/A

Appendix 3. Prisma Checklist.

Section and Topic	Item #	Checklist item	Location Where Item is Reported
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	N/A
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Page 7
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Figure 1
Study characteristics	17	Cite each included study and present its characteristics.	Table 1
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Page 8
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Table 3
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Page 8
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Figure 2
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	N/A
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	N/A
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	N/A
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	N/A
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Page 12
	23b	Discuss any limitations of the evidence included in the review.	Page 13
	23c	Discuss any limitations of the review processes used.	Page 13
	23d	Discuss implications of the results for practice, policy, and future research.	Page 12
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Page 5
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	Page 5
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	N/A
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Page 15
Competing interests	26	Declare any competing interests of review authors.	Page 15
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	N/A

Appendix 3 (continued). Prisma Checklist.

Section and Topic	Item #	Checklist item	Reported (Yes/No)
TITLE			
Title	1	Identify the report as a systematic review.	Yes
BACKGROUND			
Objectives	2	Provide an explicit statement of the main objective(s) or question(s) the review addresses.	Yes
METHODS			
Eligibility criteria	3	Specify the inclusion and exclusion criteria for the review.	Yes
Information sources	4	Specify the information sources (e.g. databases, registers) used to identify studies and the date when each was last searched.	Yes
Risk of bias	5	Specify the methods used to assess risk of bias in the included studies.	Yes
Synthesis of results	6	Specify the methods used to present and synthesise results.	Yes
RESULTS			
Included studies	7	Give the total number of included studies and participants and summarise relevant characteristics of studies.	Yes
Synthesis of results	8	Present results for main outcomes, preferably indicating the number of included studies and participants for each. If meta-analysis was done, report the summary estimate and confidence/credible interval. If comparing groups, indicate the direction of the effect (i.e. which group is favoured).	Yes
DISCUSSION			
Limitations of evidence	9	Provide a brief summary of the limitations of the evidence included in the review (e.g. study risk of bias, inconsistency and imprecision).	Yes
Interpretation	10	Provide a general interpretation of the results and important implications.	Yes
OTHER			
Funding	11	Specify the primary source of funding for the review.	Yes
Registration	12	Provide the register name and registration number.	Yes

Appendix 4. Prisma Abstract Checklist.

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

For more information, visit: http://www.prisma-statement.org/

REFERENCES

Alrazeeni, D. M., Sheikh, S. A., Mobrad, A., Ghamdi, M. al, Abdulqader, N., Gabgab, M. al, Qahtani, M. al, & Khaldi, B. al. (2016). Epidemiology of non-transported emergency medical services calls in Saudi Arabia. *Saudi Medical Journal, 37*(5), 575–578. https://doi.org/10.15537/smj.2016.5.13872

Anand, V., Benditt, D. G., Adkisson, W. O., Garg, S., George, S. A., & Adabag, S. (2018). Trends of hospitalizations for syncope/collapse in the United States from 2004 to 2013–An analysis of national inpatient sample. *Journal of Cardiovascular Electrophysiology, 29*(6), 916–922. https://doi.org/10.1111/jce.13479

Bernier, R., Tran, D. T., Sheldon, R. S., Kaul, P., & Sandhu, R. K. (2020). A population-based study evaluating sex differences in patients presenting to emergency departments with syncope. JACC. *Clinical Electrophysiology, 6*(3), 341-347. https://doi.org/10.1016/j.jacep.2019.11.002

Brain, D., Yan, A., Morel, D., Ballard, E., Hunter, J., Hocking, J., & Chan, J. (2023). Economic evaluation of applying the Canadian syncope risk score in an Australian emergency department. *Emergency Medicine Australasia, 35*(3), 427-433. https://doi.org/10.1111/1742-6723.14139

Brignole, M., Moya, A., de Lange, F. J., Deharo, J.-C., Elliott, P. M., Fanciulli, A., Fedorowski, A., Furlan, R., Kenny, R. A., Martín, A., Probst, V., Reed, M. J., Rice, C. P., Sutton, R., Ungar, A., van Dijk, J. G., Torbicki, A., Moreno, J., Aboyans, V., … Lim, P. B. (2018). 2018 ESC Guidelines for the diagnosis and management of syncope. *European Heart Journal, 39*(21), 1883–1948. https://doi.org/10.1093/eurheartj/ehy037

Brunetti, N. D., De Gennaro, L., Dellegrottaglie, G., Antonelli, G., Amoruso, D., & Di Biase, M. (2012). Prevalence of cardiac arrhythmias in pre-hospital tele-cardiology electrocardiograms of emergency medical service patients referred for syncope. *Journal of Electrocardiology, 45*(6), 727-732. https://doi.org/10.1016/j.jelectrocard.2012.07.018

Cosgriff, T. M., Kelly, A. M., & Kerr, D. (2007). External validation of the San Francisco Syncope Rule in the Australian context. *CJEM, 9*(3), 157-161. https://doi.org/10.1017/s1481803500014986

Cwinn, A. A., Dinerman, N., Pons, P. T., & Marlin, R. (1988). Prehospital care at a major international airport. *Annals of Emergency Medicine, 17*(10), 1042-1048. https://doi.org/10.1016/s0196-0644(88)80442-6

Duong, H. v., Herrera, L. N., Moore, J. X., Donnelly, J., Jacobson, K. E., Carlson, J. N., Mann, N. C., & Wang, H. E. (2018). National characteristics of emergency medical services responses for older adults in the United States. *Prehospital Emergency Care, 22*(1), 7–14. https://doi.org/10.1080/10903127.2017.1347223

Ebben, R. H. A., Castelijns, M., Frenken, J., & Vloet, L. C. M. (2019). Characteristics of non-conveyance ambulance runs: A retrospective study in the Netherlands. *World Journal of Emergency Medicine, 10*(4), 239-243. https://doi.org/10.5847/wjem.j.1920-8642.2019.04.008

Haddaway, N. R., Grainger, M. J., & Gray, C. T. (2021). citationchaser: an R package for forward and backward citations chasing in academic searching (Version 0.0.3). Retrieved from https://github.com/nealhaddaway/citationchaser

Haddaway, N. R., Page, M. J., Pritchard, C. C., & McGuinness, L. A. (2022). PRISMA2020: An R package and Shiny app for producing PRISMA 2020-compliant flow diagrams, with interactivity for optimised digital transparency and Open Synthesis. *Campbell Systematic Reviews, 18*(2), e1230. https://doi.org/10.1002/cl2.1230

Health, N. I. o. (2013, July, 2021). Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies. Retrieved from https://www.nhlbi.nih.gov/health-topics/study-quality-assessment-tools

Innovation, V. H. (2022). Covidence systematic review software (Version v2859 85cde2b3). Melbourne, Australia. Retrieved from http://www.covidence.org/

Long, B. J., Serrano, L. A., Cabanas, J. G., & Bellolio, M. F. (2016). Opportunities for Emergency Medical Services (EMS) Care of Syncope. *Prehospital & Disaster Medicine, 31*(4), 349-352. https://doi.org/10.1017/s1049023x16000376

Munn Z, M. S., Lisy K, Riitano D, Tufanaru C. Chapter 5: Systematic reviews of prevalence and incidence. In: Aromataris E, Munn Z (Editors). *JBI Manual for Evidence Synthesis*. JBI, 2020. https://doi.org/10.46658/JBIMES-20-06

Olaussen, A., Semple, W., Oteir, A., Todd, P., & Williams, B. (2017). Paramedic literature search filters: Optimised for clinicians and academics. *BMC Medical Informatics and Decision Making, 17*(1), 146. https://doi.org/10.1186/s12911-017-0544-z

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *International Journal of Surgery, 88*, 105906. https://doi.org/10.1016/j.ijsu.2021.105906

Schewe, J. C., Kappler, J., Dovermann, K., Graeff, I., Ehrentraut, S. F., Heister, U., . . . Muenster, S. (2019). Diagnostic accuracy of physician-staffed emergency medical teams: a retrospective observational cohort study of prehospital versus hospital diagnosis in a 10-year interval. *Scandinavian Journal of Trauma, Resuscitation & Emergency Medicine, 27*(1), 36. https://doi.org/10.1186/s13049-019-0617-34

Somani, R., Baranchuk, A., Guzman, J. C., & Morillo, C. A. (2012). The role of Emergency Medical Services in the assessment and management of syncope. International Journal of Cardiology, 154(3), 368-369. https://doi.org/10.1016/j.ijcard.2011.11.066

Sutton, R., Ricci, F., & Fedorowski, A. (2022). Risk stratification of syncope: Current syncope guidelines and beyond. *Autonomic Neuroscience, 238*, 102929. https://doi.org/10.1016/j.autneu.2021.102929

Thiruganasambandamoorthy, V., Hess, E. P., Turko, E., Perry, J. J., Wells, G. A., & Stiell, I. G. (2013). Outcomes in Canadian emergency department syncope patients--are we doing a good job? *Journal of Emergency Medicine, 44*(2), 321-328. https://doi.org/10.1016/j.jemermed.2012.06.028

Thiruganasambandamoorthy, V., Sivilotti, M. L. A., le Sage, N., Yan, J. W., Huang, P., Hegdekar, M., Mercier, E., Mukarram, M., Nemnom, M.-J., McRae, A. D., Rowe, B. H., Stiell, I. G., Wells, G. A., Krahn, A. D., & Taljaard, M. (2020). Multicenter emergency department validation of the Canadian syncope risk score. *JAMA Internal Medicine, 180*(5), 737. https://doi.org/10.1001/jamainternmed.2020.0288

Thiruganasambandamoorthy, V., Stiell, I. G., Sivilotti, M. la, Murray, H., Rowe, B. H., Lang, E., McRae, A., Sheldon, R., & Wells, G. A. (2014). Risk stratification of adult emergency department syncope patients to predict short-term serious outcomes after discharge (RiSEDS) study. *BMC Emergency Medicine, 14*(1), 8. https://doi.org/10.1186/1471-227X-14-8

Thiruganasambandamoorthy, V., Taljaard, M., Stiell, I. G., Sivilotti, M. L. A., Murray, H., Vaidyanathan, A., Rowe, B. H., Calder, L. A., Lang, E., McRae, A., Sheldon, R., & Wells, G. A. (2015). Emergency department management of syncope: need for standardization and improved risk stratification. *Internal and Emergency Medicine, 10*(5), 619–627. https://doi.org/10.1007/s11739-015-1237-1

Thiruganasambandamoorthy, V., Yan, J. W., Rowe, B. H., Mercier, É., le Sage, N., Hegdekar, M., Finlayson, A., Huang, P., Mohammad, H., Mukarram, M., Nguyen, P. A. (Iris), Syed, S., McRae, A. D., Nemnom, M.-J., Taljaard, M., & Silviotti, M. la. (2022). Personalised risk prediction following emergency department assessment for syncope. *Emergency Medicine Journal, 39*(7), 501–507. https://doi.org/10.1136/emermed-2020-211095

Ungar, A., del Rosso, A., Giada, F., Bartoletti, A., Furlan, R., Quartieri, F., Lagi, A., Morrione, A., Mussi, C., Lunati, M., de Marchi, G., de Santo, T., Marchionni, N., & Brignole, M. (2010). Early and late outcome of treated patients referred for syncope to emergency department: the EGSYS 2 follow-up study. *European Heart Journal, 31*(16), 2021–2026. https://doi.org/10.1093/eurheartj/ehq017

Yau, L., Mukarram, M. A., Kim, S.-M., Arcot, K., Thavorn, K., Stiell, I. G., Taljaard, M., Rowe, B. H., Sivilotti, M. L. A., & Thiruganasambandamoorthy, V. (2019). Outcomes and emergency medical services resource utilization among patients with syncope arriving to the emergency department by ambulance. *CJEM, 21*(4), 499–504. https://doi.org/10.1017/cem.2018.464

Zimmermann, T., du Fay de Lavallaz, J., Nestelberger, T., Gualandro, D. M., Lopez-Ayala, P., Badertscher, P., Widmer, V., Shrestha, S., Strebel, I., Glarner, N., Diebold, M., Miró, ., Christ, M., Cullen, L., Than, M., Martin-Sanchez, F. J., di Somma, S., Peacock, W. F., Keller, D. I., … Bürgler, F. (2022). International validation of the Canadian syncope risk score. *Annals of Internal Medicine, 175*(6), 783–794. https://doi.org/10.7326/M21-2313