

Alternatives to Traditional EMS Dispatch and Transport: A Scoping Review of Reported Outcomes

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ABSTRACT

Objectives: Emergency medical services (EMS) programs, which provide an alternative to traditional EMS dispatch or transport to the emergency department (ED), are becoming widely implemented. This scoping review identified and catalogued all outcomes used to measure such alternative EMS programs.

Data Source: Broad systematized bibliographic and grey literature searches were conducted.

Study Selection: Inclusion criteria were 911 callers/EMS patients, reported on alternatives to traditional EMS dispatch OR traditional EMS transport to the ED, and reported an outcome measure.

Data Extraction: The reports were categorized as either alternative to dispatch or to EMS transport, and outcome measures were categorized and described.

Data Synthesis: The bibliographic search retrieved 13,215 records, of which 34 articles met the inclusion criteria, with an additional 10 added from reference list hand-searching ($n = 44$ included). In the grey literature search, 31 websites were identified, from which four met criteria and were retrieved ($n = 4$ included). Fifteen reports (16 studies) described alternatives to EMS dispatch, and 33 reports described alternatives to EMS transport. The most common outcomes reported in the alternatives to EMS dispatch reports were service utilization and decision accuracy. Twenty-four different specific outcomes were reported. The most common outcomes reported in the alternatives to EMS transport reports were service utilization and safety, and 50 different specific outcomes were reported.

Conclusions: Numerous outcome measures were identified in reports of alternative EMS programs, which were catalogued and described. Researchers and program leaders should achieve consensus on uniform outcome measures, to allow benchmarking and improve comparison across programs.

RÉSUMÉ

Objectif: Les programmes de services médicaux d'urgence (SMU), qui offrent une solution de rechange à la répartition traditionnelle des SMU ou au transport classique des

malades aux services des urgences (SU), gagnent de plus en plus de terrain. Dans l'examen d'établissement de la portée décrit ici, les auteurs ont relevé et classé tous les résultats utilisés pour mesurer l'efficacité de ces programmes novateurs de SMU.

Sources des données: Les auteurs ont entrepris une vaste recherche systématisée de références bibliographiques, et effectué des recherches méthodiques dans la documentation parallèle.

Sélection des études: Les critères de sélection comprenaient les appels faits aux services d'urgence 911 ou les malades examinés par les SMU, inscrits dans les rapports de solutions de rechange à la répartition traditionnelle des SMU OU au transport classique des malades au SU par les SMU, ainsi que l'existence d'un critère d'évaluation.

Extraction des données: Les rapports ont été classés soit dans la catégorie des solutions de rechange à la répartition des services, soit dans la catégorie des solutions de rechange aux transports effectués par les SMU; quant aux critères d'évaluation, ils ont été classés et décrits.

Synthèse des données: La recherche dans les références bibliographiques a permis de relever 13 215 documents, dont 34 articles répondaient aux critères de sélection; à cela s'ajoutent 10 autres documents provenant d'une recherche manuelle dans des listes de références ($n = 44$ documents sélectionnés). Quant à la recherche dans la documentation parallèle, elle a permis de relever 31 sites Web, dont 4 répondaient aux critères de sélection; ils ont tous été extraits ($n = 4$ sites Web sélectionnés). Dans 15 rapports (16 études), il y avait une description des solutions de rechange à la répartition des SMU, et, dans 33 rapports, une description des solutions de rechange au transport par les SMU. Les résultats indiqués le plus souvent dans les rapports de solutions de rechange à la répartition des SMU étaient l'utilisation des services et la justesse des décisions; se sont dégagés des documents 24 résultats différents. Les résultats indiqués le plus souvent dans les rapports de solutions de rechange au transport par les SMU étaient l'utilisation des services et la sécurité; se sont dégagés des documents 50 résultats différents.

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Conclusions: De nombreux critères d'évaluation ont été relevés dans les rapports de programmes de SMU novateurs, critères qui ont été classés et décrits. Les chercheurs et les responsables des programmes devraient établir un consensus sur des critères uniformes d'évaluation afin de permettre

l'établissement de normes de référence et d'améliorer les comparaisons entre programmes.

Keywords: emergency medical services, dispatch, transport, alternatives, scoping review

INTRODUCTION

In recent years, there has been an increase in emergency medical services (EMS) services that are alternatives to EMS dispatch or EMS transport to the emergency department (ED). Traditionally, ambulances are dispatched for all 911 callers. All patients are transported to the ED, unless the patient or decision maker refuses transport. A "multiple option decision point" has been previously described as an alternative, in which a decision on the need for EMS transport could be made at two points: at the EMS dispatch centre and on scene,^{1,2} in an attempt to "get the right patient to the right place at the right time" (Figure 1).

Emergency medical dispatching conceptually consists of two major tasks: call processing and dispatching of EMS resources. Call processing can be further broken down into: 1) triage (deciding whether to send emergency resources or not); 2) prioritization (how quickly to send resources; and 3) choosing the level of resources required.³ Alternatives to EMS dispatch may be decided during the triage or choosing resources stages. On-scene alternatives to EMS transport to the ED include protocols to treat the patient and leave them on scene ("treat and release"), or to treat and refer to other parts of the healthcare system. These types of alternatives have been included in the expanding

scope of "community paramedicine," also more recently described as "mobile integrated healthcare" and "patient-centered EMS."⁴

A narrative literature review of on-scene alternatives to ED transport conducted by Snooks and colleagues 10 years ago found that there were few comparative studies and that data were too scarce to determine the safety of such programs.⁵ More recently, a community paramedicine systematic review drew similar findings.⁶ This variance in the interventions studied, methods used, and outcomes measured led to a body of knowledge that is difficult to synthesize and interpret, and nearly impossible to generalize to local settings.

To aid future researchers and those measuring quality and safety in such alternative EMS programs, this broad scoping review sought to identify, catalogue, and describe the outcome measures reported by such programs.

METHODS

Study design

This scoping review was based on Arksey and O'Malley's methodological framework,⁷ and consisted of three searching techniques: 1) a systematic search of bibliographic databases for research literature on the topic; 2) a hand search of websites for grey literature; and 3) a snowball search of the reference lists of articles that met the inclusion criteria. The bibliographic and grey literature searches were purposefully broad in order to capture as much of the research conducted in this field as possible.

Data source

The bibliographic database search was developed using a pearl growing search strategy, in which key articles identified by the investigators were mined for index terms and keywords.⁸⁻¹¹ Seven articles were used for this purpose.¹²⁻¹⁸ The database search was conducted in

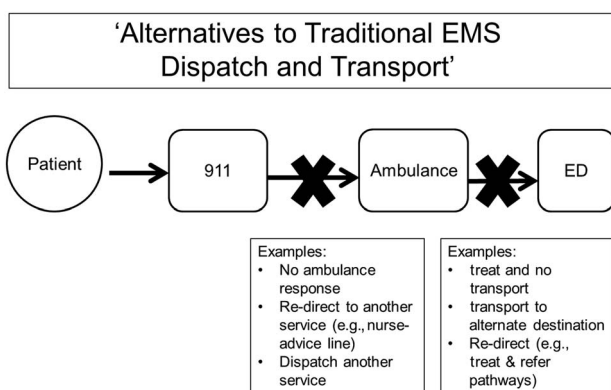


Figure 1. Alternatives to Traditional EMS Dispatch and EMS Transport to the ED.

PubMed, EMBASE, CINAHL and the Cochrane Library in 2012 and repeated on May 19, 2014. The search was created using a combination of Medical Subject Headings (MeSH) and keywords in PubMed, and mapped to the other databases using their designated thesauri. The three main concepts of interest in this search were: 1) 911 callers/EMS patients; 2) interventions and services provided by EMS; and 3) decision making. These were combined with “AND,” and “OR” (Appendix A). English and human subject limiters were applied.

The grey literature search was conducted from November 4, 2012 to December 4, 2012 by two investigators and a paramedic, who hand-searched a list of websites (Appendix B). This list was generated from suggestions made by investigators, as well as an exploratory search of government and health association websites for possible sites of interest.^{19,20} The searches and findings were documented, along with any links followed. The snowball search was conducted by reviewing the titles of articles in the reference lists of included articles.

Study selection

For a record to be included, it had to contain each of the following: a) the population was 911 callers or EMS patients, b) it described an alternative to traditional EMS dispatch OR to transport to the ED, and c) it reported an outcome measure. Abstracts were excluded. Reviews were not included, although reference lists were hand-searched for primary reports.

Review for inclusion of the bibliographic database search was first conducted by title by a single author. Review for inclusion by abstract, full text article, and retrieved grey literature was conducted by two independent authors with a third author serving as adjudicator.

Data extraction

The intervention described in each report was categorized as either an alternative to EMS dispatch or alternative to EMS transport to ED. Each outcome reported in the included reports was categorized into one of the following categories, which were determined a priori by study team knowledge of the literature and consensus: 1) clinical, 2) safety, 3) service utilization, 4) patient satisfaction, 5) cost, 6) accuracy of decision,

Table 1. Level of evidence scale (adapted from the International Liaison Committee on Resuscitation³⁹)

1	randomized controlled trials or meta-analyses
2	study with non-randomized comparison group
3	study with retrospective comparison group
4	study with no comparison group
5	from different population, quality assurance project, model, simulation, survey

7) process outcome, and 8) other. The included reports were divided among team members for abstraction. Study team members determined the Level of Evidence (Table 1), Direction of Evidence and outcome category for each study through discussion and consensus. The Direction of Evidence for each study was based on the results of the primary outcome (adapted from the Canadian Prehospital Evidence-based Practice Project).⁴⁰

RESULTS

In total, 13,215 records were retrieved through the bibliographic database searches, including the seven pearl articles. These were imported into the reference management citation software Refworks (Proquest, Bethesda, MD, USA); 2,598 duplicates were then eliminated, leaving 10,617 unique records. Thirty-seven websites were hand-searched for grey literature, in which 31 records of interest were identified. A total of 48 records met the inclusion criteria: 34 from the bibliographic search, four from the grey literature search, and 10 from the snowball search (Figure 2).

Outcome measures reported on alternatives to EMS dispatch

Fifteen reports were categorized as alternatives to EMS dispatch (Table 2). One report described two separate studies.²⁵ Articles were from the UK ($n = 6$), the United States ($n = 6$), Canada ($n = 2$), and Iran ($n = 1$). Eleven of these EMS systems were paramedic-based,^{12,13,15,16,18,21-26} two were physician-based with basic emergency medical technicians,^{3,27} and in one report the type of EMS system was unclear.²⁸ The following interventions were studied: transferring 911 callers to nurse-advice lines ($n = 6$), EMS dispatch providing advice or self-care instructions ($n = 4$), alternative EMS response being dispatched ($n = 3$), and

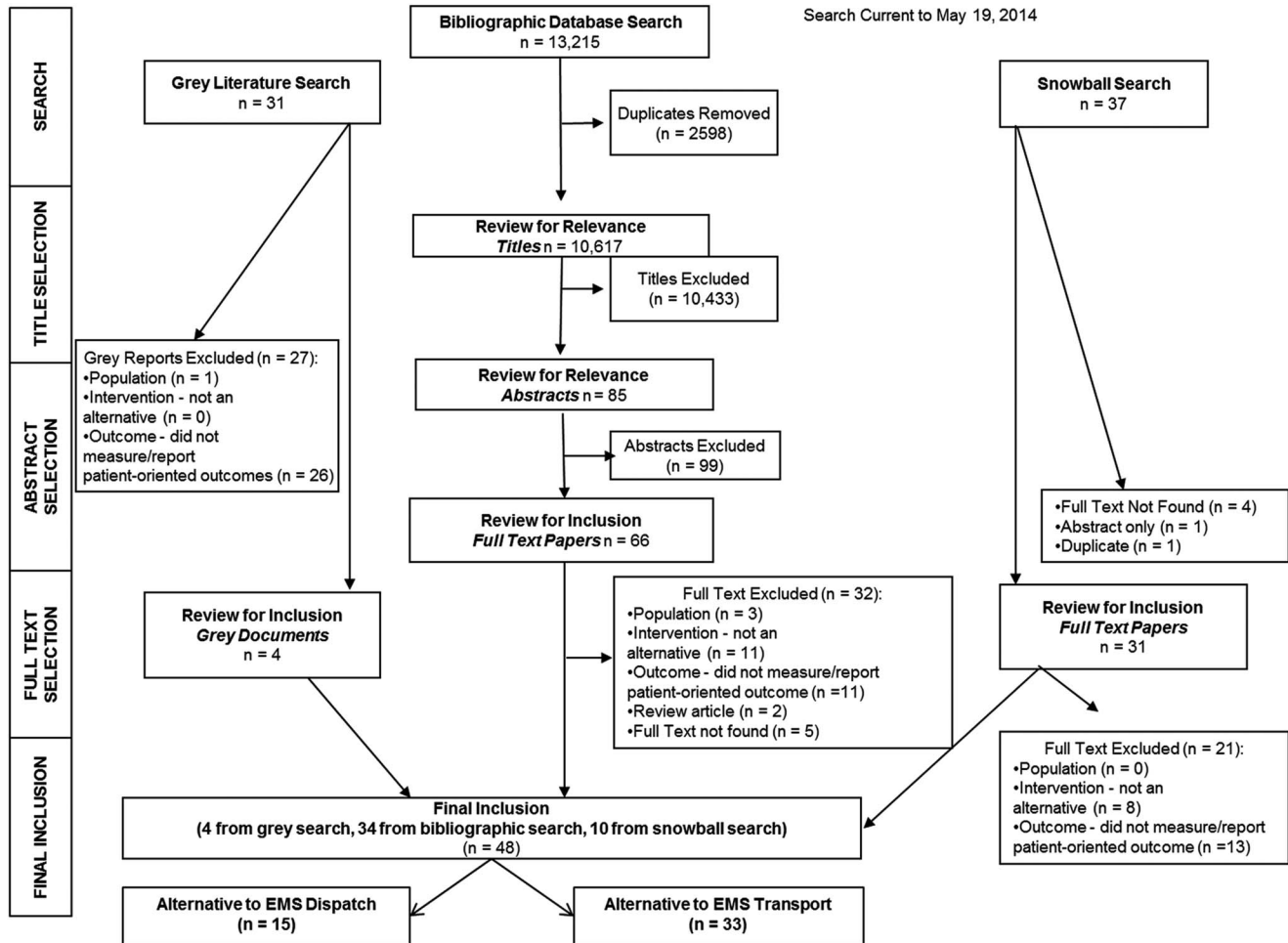


Figure 2. Scoping review flow diagram.

identification of low acuity calls that do not require EMS response ($n = 2$). Studies were most commonly those without a comparison group (6/16), and studies with alternative designs, such as patient surveys or models (4/16). There were two uncontrolled designs with a comparison group, three studies with a retrospective comparison group and one controlled trial. The results of five studies were considered supportive of the intervention, 10 studies had neutral results and one study had opposing results. The outcome categories, reported by the greatest number of reports, were service utilization ($n = 12$) and decision accuracy ($n = 7$) (Table 2). In total, there were 24 unique outcomes reported. The outcome categories with the greatest number of specific different outcomes were service utilization ($n = 8$), accuracy of decision ($n = 4$), safety ($n = 3$), call times ($n = 3$), cost ($n = 3$), patient satisfaction ($n = 2$), and process outcomes ($n = 1$).

Outcome measures reported on alternatives to EMS transport

Thirty-three reports were categorized as alternatives to EMS transport to the ED, all of which were from paramedic-based systems (Table 3). Sixteen studies were from the UK, 13 were from the US, two from Australia, one from Sweden and one from Canada. Twelve reported on expanded-scope EMS programs (such as the UK emergency care practitioner), 10 reported on EMS-initiated non-transport, six described programs in which calls were referred to another health service, three were of treat-and-release protocols, one assessed using telemedicine to expand consults by EMS for non-transport, and one studied providing patients with an alternative mode of transport to the ED (via taxi). The majority of study designs were those without a comparison group ($n = 14$), followed by studies with a retrospective comparison group ($n = 6$). There were

Table 2. Characteristics and outcomes reported: alternatives to EMS dispatch

First Author	Year of Publication	Country	Service Studied	n	Level of Evidence of Study Design	Direction of Evidence of Primary Outcome	Outcome Category	Specific Outcome Reported
Agency for Healthcare Research and Quality ²¹	2012	USA	911 call to alternative EMS response	186	4	Supportive	Service Utilization Service Utilization Cost	Number of responses by EMS ED bed hours Annual EMS transport cost estimates
Alizadeh ²⁸	2012	Iran	Identify low-acuity calls that did not require ambulance response	200	3	Supportive	Service Utilization	Unnecessary missions
Crowther ²²	2009	UK	911 callers to nurse-advice line	3041	4	Supportive	Service Utilization	911 calls directed to alternative
Dale ¹³	2004	UK	Provided advice or self-care instructions	239	5	Supportive	Safety Accuracy of Decision	Panel assessment of whether decision was safe Triage decision compared to expert panel
Farand ³	1995	Canada	Provided advice or self-care instructions	1006	5	Supportive	Accuracy of Decision	Triage decision compared to expert panel
Infinger ²⁶	2013	USA	911 callers to nurse- advice line	329	4	Neutral	Service Utilization Patient Satisfaction	911 calls directed to alternative Patient satisfaction
Studnek ¹⁸	2012	USA	911 callers to nurse-advice line	1078 intervention, 1862 control	4	Neutral	Accuracy of Decision	Triage decision compared to subsequent ED attendance or hospital admission
Widiatmoko ⁴¹	2008	UK	911 call to alternative EMS response	198 intervention, 2583 control	3	Neutral	Cost	Incremental cost-effectiveness analysis
Turner ²⁵ (a)*	2006	UK	911 callers to nurse-advice line	1766 intervention, 2158 control	1	Neutral	Service Utilization Time Patient Satisfaction Accuracy of Decision Cost Safety	Calls returned from nurse advice line back to EMS dispatch EMS response intervals, total episode time, EMS job cycle time Patient satisfaction and acceptability of new service Final disposition of nurse assessment Economic analysis modelling Adverse events

Table 2. (Continued)

First Author	Year of Publication	Country	Service Studied	n	Level of Evidence of Study Design	Direction of Evidence of Primary Outcome	Outcome Category	Specific Outcome Reported
Turner ²⁵ (b)	2006	UK	911 callers to nurse-advice line	2276	4	Neutral	Service Utilization	Proportion of calls passed to nurse line Calls returned from nurse advice line back to EMS dispatch Transports to hospital
Dale ¹²	2003	UK	Provided advice or self-care instructions	635 intervention, 611 control	2	Neutral	Time Accuracy of Decision	EMS response times Triage decision compared to subsequent ED attendance or hospital admission
Key ²⁴	2003	USA	911 call to alternative EMS response	330 intervention, 290 control	2	Neutral	Time Accuracy of Decision	EMS response intervals (dispatch to arrival on scene), EMS job cycle time
Schmidt ¹⁵	2003	USA	Identify low-acuity calls that did not require ambulance response	656	4	Neutral	Service Utilization Process Outcomes Safety	EMS calls resulting in transport ALS interventions administered Important EMS or ED finding (e.g., EMS medications administered)
Smith ¹⁶	2001	USA	911 callers to nurse-advice line	133 intervention, 38 control	2	Neutral	Service Utilization Patient Satisfaction Safety	Number of responses by EMS Calls returned from nurse advice line back to EMS dispatch Patient satisfaction Adverse events
Leprohon ²⁷	1995	Canada	Provided advice or self-care instructions	50	5	Neutral	Accuracy of Decision	Triage decision compared to expert panel
Gray ²³	2008	UK	911 call to alternative EMS response	3955	5	Opposing	Accuracy of Decision	Accuracy of dispatch software to identify appropriate cases

*total greater than number of included reports because Turner 2006 report contained two studies with different patient samples²⁵

Table 3. Characteristics and outcomes reported: alternatives to EMS transport studies

First Author	Year of Publication	Country	Service Studied	n	Level of Evidence of Study Design	Direction of Evidence	Outcome Category	Specific Outcome Reported
Alpert ⁴²	2013	USA	Call or refer to other health service	811,306	5	Supportive	Cost	Potential savings to Medicare
Jensen ⁵⁸	2013	Canada	Expanded scope EMS	140 intervention, 98 control	3	Supportive	Safety	Unplanned medical attention after being seen/relapse EMS calls
Gray ⁴⁸ (b)	2008	UK	Expanded scope EMS	119 intervention, 67 control	3	Supportive	Service Utilization Safety	Number of non-transport Unplanned medical attention after being seen/relapse EMS calls
Halter ^{<52>}	2008	UK	Expanded scope EMS	9183 intervention, 143613 control	3	Supportive	Service Utilization Service Utilization Process Outcomes	Hospital admissions Number of non-transport How practitioners make decisions
Halter ⁵³	2007	UK	Expanded scope EMS	111	5	Supportive	Patient Satisfaction Process Outcomes	Patient perception of care received Patient compliance with treatment recommendations given
Mason ⁵⁹	2007a	UK	Expanded scope EMS	1549 intervention, 1469 control	1	Supportive	Clinical Service Utilization Safety	Quality of life ED Attendance or hospital admission after EMS episode Unplanned medical attention after being seen/relapse EMS calls
Mason ⁶⁰	2007b	UK	Expanded scope EMS	245 intervention, 279 control	3	Supportive	Times Patient Satisfaction Safety	Time from call to discharge Patient satisfaction Unplanned medical attention after being seen/relapse EMS calls
Halter ⁵¹	2006	UK	Expanded scope EMS	888	5	Supportive	Patient Satisfaction Cost Process Outcomes Patient Satisfaction Patient Satisfaction	Patient satisfaction Cost to system Number of investigations Patient satisfaction Patient perception of care received

Table 3. (Continued)

First Author	Year of Publication	Country	Service Studied	n	Level of Evidence of Study Design	Direction of Evidence	Outcome Category	Specific Outcome Reported
Snooks ¹⁷	2004a	UK	Treat and Release (includes assessment tools to leave patients)	409 intervention, 425 control	1	Supportive	Safety	Unplanned medical attention after being seen/relapse EMS calls
							Service Utilization	Number of non-transport
							Times	EMS job cycle time
							Patient Satisfaction	Patient satisfaction
Cooper ⁴⁵	2004	UK	Expanded scope EMS	170 intervention, 331 control	2	Supportive	Service Utilization	Number of non-transport
							Clinical	Diagnosis/chief complaint
							Process Outcomes	Paramedic documentation
Lerner ⁵⁷	2003	USA	Treat and Release (includes assessment tools to leave patients)	36	4	Supportive	Safety	Complications after call
							Patient Satisfaction	Patient satisfaction
							Process Outcomes	Paramedic compliance with protocols
Schaefer ¹⁴	2002	USA	Call or refer to other health service	1016 intervention, 2617 control	3	Supportive	Safety	Case review
							Service Utilization	ED Attendance after EMS episode
							Service Utilization	Number of clinical referrals
							Service Utilization	Number of non-transport
							Accuracy of Decision	Appropriate decision for alternative to ED care
Coates ⁴⁴	2012	UK	Expanded scope EMS	172	4	Neutral	Accuracy of Decision	Whether decision resulted in avoided ED visit or hospital admission
Dixon ⁴⁷	2009	UK	Expanded scope EMS	1446 intervention, 1408 control	1	Neutral	Cost	Economic evaluation
Knapp ⁵⁶	2009	USA	Alternative mode of transport to ED	93	4	Neutral	Clinical	Hospital admission
							Times	Diagnosis/chief complaint
								Time to ED triage
Cooper ⁴⁶	2008	UK	Expanded scope EMS	611	4	Neutral	Clinical	Diagnosis/chief complaint
							Times	EMS time on scene
							Service Utilization	Number of non-transport
							Accuracy of Decision	Between dispatch, ECP and 24 hour hospital diagnosis

Table 3. (Continued)

First Author	Year of Publication	Country	Service Studied	n	Level of Evidence of Study Design	Direction of Evidence	Outcome Category	Specific Outcome Reported
Mason ⁶¹	2008	UK	Expanded scope EMS	2025	4	Neutral	Safety	Unplanned ED attendance
Hjalte ⁵⁵	2007	Sweden	EMS-initiated non-transport (includes determinations of medical necessity)	604 intervention, 1373 control	3	Neutral	Other	Patient characteristics of those paramedics felt were medically unnecessary
Haines ⁴⁹	2006	USA	EMS-initiated non-transport	704	4	Neutral	Safety	Unplanned medical attention after being seen/relapse EMS calls
Halter ⁵⁰	2005	UK	Treat and Release (includes assessment tools to leave patients)	488 intervention, 736 control	2	Neutral	Patient Satisfaction Safety Service Utilization Accuracy of Decision	Patient satisfaction Adverse events Hospital admissions Use of assessment tool compared to findings of review panel to transport or not
Snooks ⁶⁵	2004b	UK	Call or refer to other health service	251 intervention, 537 control	2	Neutral	Service Utilization	Number of clinical referrals
Gratton ¹	2003	USA	EMS-initiated non-transport (includes determinations of medical necessity)	825	4	Neutral	Accuracy of Decision	Decision on medical necessity (if patient required ED care)
Haskins ²⁹	2002	USA	Expanded consult by EMS (e.g. telemedicine)	345	4	Neutral	Service Utilization Service Utilization Other	Hospital admissions Predicted EMS utilization To identify target populations
Schmidt ⁶³	2001	USA	EMS-initiated non-transport (includes determinations of medical necessity)	1300	4	Neutral	Accuracy of Decision Accuracy of Decision Accuracy of Decision	Safety of EMT decision to assign transport options Under-over-triage rate Appropriate decision for alternative to ED care

Table 3. (Continued)

First Author	Year of Publication	Country	Service Studied	n	Level of Evidence of Study Design	Direction of Evidence	Outcome Category	Specific Outcome Reported
Hauswald ⁵⁴	2002	USA	EMS-initiated non-transport (includes determinations of medical necessity)	183	4	Opposing	Accuracy of Decision	Decision on medical necessity (if patient required ED care)
Silvestri ⁶⁴	2002	USA	EMS-initiated non-transport (includes determinations of medical necessity)	313	4	Opposing	Accuracy of Decision	Decision on medical necessity (if patient required ED care) documented by paramedics compared to care actually received in ED
Kamper ³⁰	2001	USA	EMS-initiated non-transport (includes determinations of medical necessity)	1103	4	Opposing	Other	To identify target populations
Pointer ⁶²	2001	USA	EMS-initiated non-transport (includes determinations of medical necessity)	1180	4	Opposing	Accuracy of Decision Accuracy of Decision	Decision on medical necessity (if patient required ED care) Under/over-triage rate
Zachariah ⁶⁸	1992	USA	EMS-initiated non-transport	93	4	Opposing	Clinical Safety	Hospital admission Unplanned medical attention after being seen/relapse EMS calls
Mikolaizak ³¹	2013	Australia	Call or refer to other health service	0	1 (Protocol)		Patient Satisfaction Clinical Service Utilization	Patient satisfaction Subsequent fall Number of contacts with health system
Snooks ⁵⁷	2012	UK	Call or refer to other health service	0	1 (Protocol)		Process Outcome Service Utilization Clinical	Uptake of recommendations by patient Effect on EMS system performance measures Deaths Hospital admission Subsequent fall Quality of life Quality-adjusted life years
							Patient Satisfaction Cost	Patient satisfaction Patient care costs

Table 3. (Continued)

First Author	Year of Publication	Country	Service Studied	n	Level of Evidence of Study Design	Direction of Evidence	Outcome Category	Specific Outcome Reported
Arendts ⁴³	2011	Australia	Call or refer to other health service	0	1 (Protocol)		Clinical	Deaths
							Safety	Hospital admission
								Unplanned medical attention after being seen/relapse EMS calls
								Adverse events
							Times	Deaths after call
		Time to contact with definitive care (ED or primary care)						
		Service Utilization	Number of contacts with health system					
		Service Utilization	Number of non-transport					
		Cost	Cost benefit analysis					
		Process Outcomes	Number of investigations					
Snooks ⁶⁶	2010	UK	EMS-initiated non-transport	0	1 (Protocol)		Service Utilization	Number of contacts with health system
								Effect on EMS system performance measures
								Number of referrals to referral pathway
								Hospital admission
								Deaths
								Subsequent fall
								Event-free period
								Quality of life
								EMS job cycle time
								EMS time on scene
								Episode of care time
								Time to contact with definitive care (ED or primary care)
								Length of hospital stay
	Patient Satisfaction	Patient satisfaction						
	Cost	Patient care costs						
		Cost to system						
	Process Outcomes	Paramedic compliance with protocols						
		Decision support algorithms						
		Paramedic documentation						

Table 4. Outcome categories, specific options and measurement considerations

Outcome Type (Structure, Process, System, Outcome)	Outcome Category	Specific Outcome Options	Measurement Considerations
Outcome	Clinical	<ul style="list-style-type: none"> • Deaths^{43,66,67} • Hospital admission^{43,48,56,59,66-68} • Subsequent fall^{31,66,67} • Event-free period⁶⁶ • Quality of life^{59,66,67} • Quality-adjusted life years⁶⁷ • Diagnosis/chief complaint^{45,46,56} 	
Outcome	Safety	<ul style="list-style-type: none"> • Deaths after call^{14,43} • Unplanned medical attention after being seen/relapse EMS calls^{17,43,48,49,58-60,68} • Complications after the call⁵⁷ • Adverse events^{16,25,43,50} 	<ul style="list-style-type: none"> • Criteria should include consideration if cause of death was for a reason unrelated to EMS call. • Define ideal length of time to follow patients, for example: 24 hours,⁶¹ 48 hours,⁵⁸ 28 days⁴⁸. • Options for data collection are to contact patient to determine outcome after non-transport⁴⁹ or from clinical or administrative data (including EMS dispatch, EDs, hospital, family physician, other). • Consensus needed for what is considered a “complication.” • Data may be collected from patients or chart review.¹⁶ • Consensus required on adverse event definitions, such as: A serious adverse event is “an unpredicted death or admission to hospital within two weeks of the original attendance.” An adverse event is “an unpredicted use of the health service within two weeks of original attendance.”⁵⁰
Process	Time	<ul style="list-style-type: none"> • EMS response intervals^{12,25} • EMS job cycle time^{17,24,25,66} • EMS time on scene^{46,66} • Episode of care time⁶⁶ • Time to contact with definitive care (ED or primary care)^{43,66} • Time to ED triage⁵⁶ • Length of hospital stay⁶⁶ • Time from call to discharge⁵⁹ 	<ul style="list-style-type: none"> • Choose time points in which data entry for these fields by dispatch, EMS clinicians or hospital staff is mandatory, to minimize missing data. • Consensus required on clear definitions for each time point and interval. Report each time point and interval clearly.

Table 4. (Continued)			
Outcome Type (Structure, Process, System, Outcome)	Outcome Category	Specific Outcome Options	Measurement Considerations
System	Service Utilization	<ul style="list-style-type: none"> 911 calls directed to alternative^{14,22,26,65,66} Calls returned from alternative (e.g., nurse advice line) back to EMS dispatch^{16,25} Number of EMS responses^{16,21} Unnecessary missions²⁸ Predicted EMS utilization²⁹ Number of non- transports^{14,17,24,29,43,45,46,50,52,66} Effect on EMS system performance measures^{66,67} ED attendance or hospital admission after EMS episode^{14,59} ED bed hours²¹ Hospital admissions^{48,49} Number contacts with health system^{31,43,66} 	<ul style="list-style-type: none"> Clearly define study patients, e.g., number of calls referred/total eligible calls.^{22,26} Consensus required on what a “successful” referral is, e.g., calls that are referred and referral agency does not return call back to 911. Reported as: number of calls “successfully” referred/total eligible calls.²⁶ May be defined as: number of EMS responses for all EMS patients, for all those eligible for response, or for those pre-enrolled in alternative program.²¹ EMS calls are reviewed and judged if unnecessary by an expert panel.²⁸ Multidisciplinary panel should be independent from study and members should have an understanding of EMS practice. May be defined as: how many previous EMS calls appear to meet criteria for alternative program.²⁹ A non-transport may be defined as paramedics not transporting the patient from scene. There could be various reasons. Consensus on which system performance measures are most important, e.g., emergency call response time. Between 0 – 28 days after EMS episode⁵⁹
Outcome	Patient Satisfaction	<ul style="list-style-type: none"> Patient satisfaction^{16,17,25,26,49,51,57-60,66-68} Patient perception of care received^{51,53} 	<ul style="list-style-type: none"> Collect by follow-up patient interview.^{16,26,51,53} Collect by follow-up patient interview.^{16,26,51,53}
System	Cost	<ul style="list-style-type: none"> Annual EMS transport cost estimates²¹ Economic analysis modelling²⁵ Incremental cost-effectiveness analysis⁴¹ Patient care costs^{66,67} Cost benefit analysis⁴³ Cost to system^{60,66} Economic evaluation⁴⁷ 	<ul style="list-style-type: none"> Clearly report on what costs are included in analysis Categorize methodological approach if potential savings/cost⁴² or actual savings/cost^{60,66}.

Table 4. (Continued)			
Outcome Type (Structure, Process, System, Outcome)	Outcome Category	Specific Outcome Options	Measurement Considerations
Process	Accuracy of Decision	<ul style="list-style-type: none"> • Accuracy of dispatch software to identify appropriate cases²³ • Safety of EMT decision to assign transport options⁶³ • Under/over-triage rate^{62,63} • Decision on medical necessity (if patient required ED care), triage decision^{1,14,18,44,54,62,63} • Accuracy of diagnosis⁴⁶ 	<ul style="list-style-type: none"> • Decision should be categorized and reported by provider type.¹² • Paramedic documented decision compared to patient outcome^{62,64} or expert panel decision and reported with sensitivity and specificity⁶² • Paramedics answer the following questions for each patient (standard paramedic management delivered): “Could this patient have been safely transported by a non-medical transport service?” and “Could this patient have been safely transported to a clinic or urgent care center?”⁵⁴ • Clinician decision may be compared to expert panel or physicians,^{1,3,13,27,50} or if patient seen in ED or admitted to hospital^{12,18,44}. • Agreement should be measured and reported with sensitivity and specificity.^{1,50} • Consensus definition of “medical necessity” and “appropriate decision” required, and should be clearly reported. • Clinician diagnosis can be compared to “gold standard,” such as diagnosis at 24 hours.⁴⁶
Process	Process Outcomes	<ul style="list-style-type: none"> • ALS interventions administered²⁴ • Number of investigations^{43,60} • Paramedic compliance with protocols^{57,66} • Decision support algorithms used and followed⁶⁶ • Patient compliance with treatment recommendations given^{31,53} • Paramedic documentation^{45,66} • To identify target populations^{29,30,55} • How practitioners make decisions⁵² 	<ul style="list-style-type: none"> • Characteristics of patients who paramedics judged were “medically unnecessary” to transport to ED described.⁵⁵ • Analyze cases to determine key aspects of decision making styles.⁵²

three randomized controlled trials, three studies with a non-randomized comparison group, and three studies from another population or simulation. There were four protocols of controlled trials. The outcome categories most reported were service utilization ($n = 14$), safety ($n = 12$), patient satisfaction ($n = 10$), accuracy of decision ($n = 9$), and clinical outcomes ($n = 9$) (Table 3). In total, there were 50 different unique outcomes reported. The outcome categories with the greatest number of specific different outcomes were service utilization ($n = 8$), accuracy of decision ($n = 7$), clinical outcomes ($n = 7$), call times ($n = 7$), process outcomes ($n = 6$), safety ($n = 6$), cost ($n = 5$), patient satisfaction ($n = 2$), and other ($n = 2$).

DISCUSSION

The purpose of this broad scoping literature review was to identify and catalogue the outcome measures used to study and report on alternatives to EMS. Scoping reviews are valuable for mapping complex topics to increase understanding.⁷ As we sought to identify all outcome measures used in any type of “alternative to traditional EMS dispatch or transport” program, this approach was most suitable. Forty-eight publications of over 1,000,000 patients for a wide variety of programs and interventions were located and included. These publications were very heterogeneous in design, population, and outcomes. The categories of outcomes most reported in the alternatives to traditional EMS dispatch reports were service utilization and accuracy of decisions, with 12 different sub-categories. In the alternatives to traditional EMS transport reports, the outcome categories with the most reported outcomes were service utilization, safety, clinical outcomes, and call times, with 29 sub-categories. This review revealed that similar outcomes are measured in many different ways. For example, adverse events have been examined by asking patients directly, through retrospective examination of health records, and through panel assessments of whether decisions were safe.^{13,16,25} This variance was also identified in a recent focus group study of US EMS services, in which safety was assessed in multiple ways, including by retrospective chart reviews and follow-up phone calls with patients.⁴

Just as this review was useful for identifying outcomes that are used frequently, it is also valuable to shed light on under-reported outcome categories. In the alternatives to dispatch studies, clinical outcomes were not

reported, and process outcomes were only reported in one study. The least-used outcome category in the “alternatives to transport” studies was the “other” outcomes to identify a potential target program population, reported in two studies,^{29,30} and uptake of advice by patients was even more infrequent, studied in just one publication.³¹ There are additional outcomes that could be of great value but that have not been used in any of these studies. For example, it would be of great value to assess the effect of such services on the response times of other EMS units as a times outcome.

Alternative to dispatch

As noted in a recent systematic review, ambulance-dispatch-based secondary triage has been implemented in many locations, as a strategy to avoid dispatching ambulances to low-priority calls, which may also help with ED overcrowding challenges.³² Our scoping review captured the same articles included in this review by Eastwood et al, with the exception of a descriptive publication that did not report on outcomes.³³ Our review located 15 publications (16 studies), of which the majority reported on EMS dispatch programs that diverted callers to either nurse-advice lines or alternate EMS services (other than standard emergency ambulance dispatch). The remaining programs provided advice or self-care instructions, or identified low-acuity patients who did not require an EMS response. To fully understand the effect of all of these programs that are alternatives to EMS dispatch, uniform outcome measures need to be employed across studies. This review examined the structure, safety, and success of such systems, and found evidence from six studies that the services were safe and patients were satisfied. Success of referrals, an outcome of the review, was not well-addressed in the results. Recent studies with supportive results were of low quality and with small- to moderate-sized samples. These studies focused on reporting outcomes on service utilization.

Alternatives to transport

Previous authors have noted that determining the need for EMS transport cannot be solely based on the medical necessity for the patient to be seen in the ED.³⁴ As noted by Chu et al, any tools to evaluate eligibility of low-acuity patients for an alternative to ambulance transport must include assessing patient ability to

ambulate.³⁵ Some studies have explored the complexity of transport decisions and the many factors that must be considered by EMS responders.^{36,37} Many of the 33 studies included in this review include strategies within the programs reported to provide patients with access to other services, expanded care on scene, or other means of transport to the ED. The body of knowledge related to “mobile integrated healthcare” or “community paramedicine” has become multi-faceted and complex, with many services tailored specifically for the population or community they are aiming to better serve. This reinforces the need for consistent outcome measures for evidence-users to increase their understanding of the effects of such programs. In our review, recent supportive studies included a randomized controlled trial and a large comparison study, both of which reported on service utilization outcomes, and a cost analysis based on a large sample.^{42,52,59} There were four studies included that contained opposing evidence, all of which were studies without a comparison group. Also included were four protocol manuscripts, which describe upcoming randomized trials, which will add valuable high-quality evidence.

Next steps

Two key challenges have been identified that impede further evidence synthesis in this body of literature. 1) The programs or interventions studied are extremely heterogeneous. We appreciate the importance of developing programs that meet specific community needs. However, these programs or interventions should be grouped into main categories that will facilitate comparison and pooling of findings. For example, studies should first be categorized according to whether they were an alternative to EMS dispatch or transport. If it is an alternative to EMS dispatch, the intervention service may be categorized as: to nurse-advice line, to referral pathway (such as family practice clinic), to alternative EMS response, given advice or self-care instructions, or other. If it is an alternative to EMS transport, the intervention service may be categorized as: paramedic treat and release, EMS-initiated non-transport, call or refer to another health service or referral pathway, consult with a physician or other provider, expanded scope EMS delivery, alternative mode of transport to the ED, or other. 2) Many different approaches have been used to measure similar outcomes. What is now required is to carry out a

consensus project to determine which outcomes are most important to use. A taxonomy of standard terms as well as outcome definitions would allow valid comparisons across systems. In the US, a consensus session led to the publication of a National Agenda for Community Paramedicine Research,³⁸ which determined research priorities, but did not give direction on which are the ideal outcomes to use, and what method(s) to use. Categorizing outcomes into type by process (measures of actions or functions), system (measures of how the system works), and outcome (patient-related changes in outcome that are attributable to care received) would further harmonize research comparisons (Table 4).

LIMITATIONS

A scoping review was determined to be an appropriate evidence synthesis strategy for this topic, as opposed to a structured systematic review, as the topic was multi-faceted, the question could not be narrowly defined, and it was important to map all studies conducted and include all levels of evidence, all of which are key strengths of the scoping review approach.⁷ There are many different types of alternative EMS programs included in this body of literature, which spans over two decades, during which time EMS has changed significantly, all of which may affect the suitability of the outcome measures collected. These alternative EMS programs have often developed out of local needs in attempts to better serve their patient population with the resources that are available.³² While appropriate, this leads to difficulty in understanding what the findings mean in aggregate, and certainly prohibits quantitative pooling in a systematic review. This heterogeneity can also significantly limit the generalizability of the findings to contemporary EMS systems; however, the outcomes used can still be considered for use in modern research and quality projects. Some publications provided limited information on their EMS settings or programs.

CONCLUSION

In this broad scoping review on alternatives to traditional EMS dispatch and transport, numerous outcome measures used to measure and report on these interventions and programs were identified and catalogued. Researchers and program leaders should achieve consensus on the most important outcome measures to be

used in future research studies, program evaluations and quality assessments of these programs.

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SUPPLEMENTARY MATERIAL

To view supplementary material for this article, please visit <http://dx.doi.org/10.1017/cem.2014.59>

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