Paramedic Intercepts with Basic Life Support Ambulance Services in Rural Minnesota

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Abbreviations:
ALS = advanced life support
BLS = basic life support
EMS = emergency medical services
MPDS = Medical Priority Dispatch System

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Abstract

Introduction: In rural Minnesota, it is common for paramedics providing advanced life support (ALS) to rendezvous with ambulances providing only basic life support (BLS). These "intercepts" presumably allow for a higher level of care when patients have certain problems or need ALS interventions. The aim of this study was to review and understand the frequency of paramedic intercepts with regard to the actual care rendered and transport urgency (lights and sirens vs. none).

Methods: All paramedic intercepts occurring between January 2003 and December 2007 for one multi-site emergency medical services (EMS) provider were reviewed for ALS interventions and treatments provided. In addition, the urgency of responses to the dispatch call or "intercept" and transport to a receiving facility were analyzed.

Results: During the study period, 1,675 paramedic intercepts occurred and were reviewed. The ALS ambulances responded to the dispatch emergently (lights and sirens) in 97.5% of intercepts (1,633), but emergently transported only 24.2% of the patients (405). Paramedics performed no interventions above BLS levels in 11.6% (194) of the cases. Of the remaining 1,481 patients who received ALS interventions, 955 (64.4%) received no treatment or diagnostic testing other than electrocardiographic monitoring, intravenous access, or both.

Conclusions: A significant discrepancy between emergent responses and actual ALS care rendered during intercept calls was demonstrated. Given the significant rate of EMS worker fatalities and transferable patient care costs, further study is needed to determine whether costs and safety are potentially improved by decreasing emergent responses. Future directions include developing or emulating Medical Priority Dispatch System triage protocols for advanced services providing intercepts. In addition, further study of patient outcomes between intercept and non-intercept cases is necessary.

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Introduction

Ambulance services providing basic life support (BLS) are widespread in Minnesota and Wisconsin. These services often are volunteer-based and serve small, rural communities. However, with state licensing and educational limitations on assessments and treatments they can provide, BLS services are not able to adequately manage some more serious patient conditions. If a particular patient needs advanced life support (ALS) services, such as electrocardiographic monitoring, needle thoracostomy, medication administration, or intravenous therapy, a communication center will dispatch an ALS paramedic unit to meet (intercept) the BLS ambulance at the scene or during transit to the hospital. These ALS intercepts become necessary to provide advanced prehospital care for patients with certain life-threatening conditions and needs beyond the BLS scope of practice.

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Figure 1—Cities in Minnesota and Wisconsin served by the emergency medical services provider in the current study

Emergency medical service (EMS) workers have relatively high transportation fatality rates—more than four times the average for all workers in the United States.[1] Intercepts primarily occur in rural areas, typically on highways, where the risk of death is almost two times higher than in urban areas.[2] Intercepts in the rural system potentially create a high-risk scenario for crash incidents as two ambulances (ALS and BLS) are converging emergently for the same incident. Although no data currently exist, presumably decreasing unnecessary emergent ambulance traffic would decrease the risk of ambulance crashes and the subsequent injury or death of EMS workers and patients. The need for or value of "lights and sirens" responses in intercept situations has not been evaluated although evidence does exist that ALS level of care does not improve patient outcomes. Time saved using lights and sirens has been reported as minimal.[3]

Intercept practices and procedures differ geographically in the sample area. The current study is an observational, descriptive analysis focusing on one EMS system providing ALS services in Minnesota and western Wisconsin. No analysis of the current system's functions, deficiencies, strengths, or needs for improvement has been published. In addition, there is a paucity of data on emergent responses to intercepts and the services provided. The primary aim of this study was to review the frequency of paramedic intercepts along with a comparison of ALS intervention to transport urgency (lights and sirens vs. none).

Methods

This study is a retrospective, descriptive analysis of intercepts from a single, large, corporate ALS provider serving 10 sites throughout Minnesota and two sites in western Wisconsin (Figure 1). Intercepts were identified from the prehospital electronic record by searching a required field entitled "run outcome" for selections of "intercept." All paramedic intercepts for all adult and pediatric patients between January 2003 and December 2007 were identified. *Emergent* (defined as use of red lights and sirens) responses to the dispatch call and emergent patient transports to receiving facilities also were examined. The interventions and treatments performed by the intercepting crew were collected and analyzed by the provider's initial (primary) clinical impression of the patient's condition.

The system used in this study utilizes the Medical Priority Dispatch System (MPDS) for 9-1-1 calls only and not for intercepts. Due to difficulty in obtaining patient information from intercept requesting services or dispatch centers, this system's ambulances generally are sent to intercepts emergently.

The definition of *ALS* for this study is skills or interventions provided above BLS-level care (Table 1). Simple descriptive data were collected and analyzed using Microsoft Excel (Microsoft Corp., Redmond, WA) and JMP software (SAS Institute Inc., Cary, NC). This study was approved by the Mayo Clinic Institutional Review Board.

Results

A search of the database identified 1,675 intercepts, all of which were included for analysis. The median age of all of the patients was 60 years; 930 (55.5%) were male and 745 (44.5%) were female. Distribution of intercepts by site, demographic information, and average miles traveled to the scene are shown in Table 2.

"Primary impression" refers to the intercepting paramedic's impression of the patient's primary medical condition or reported problem. These impressions are part of a drop-down list in the patient care report. Each primary impression, as listed in Table 3, was classified into general categories by the study team. Cardiac chest pain accounted for the most intercepts with 24.1% of the total (404/1,675), followed by traumatic injuries with 14.0% (234), and respiratory with 11.9% (199).

Using the definitions of life support interventions provided before the arrival of the ALS unit, described previously, the ALS crews performed either no or only BLS interventions in 194 cases (11.6%). Of these, 184 (94.8%) were transported by the ALS personnel. The remaining 10 (5.2%) were evaluated by a paramedic but transported by the original BLS crew. Of the 184 patients transported by ALS crews, 30 (16.3%) were transported to the destination hospital emergently (lights and sirens) despite no ALS-level care being provided.

Patients who did receive ALS interventions accounted for the remaining 88.4% of cases (1,481/1,675). Two prominent interventions were examined: cardiac monitoring and intravenous access. These two interventions contributed to the call being categorized as ALS in most of the cases. Of the 1,481 patients who received ALS interventions, 955 (64.5%) received no treatment, procedures, or diagnostic testing other than one or both of these two interventions.

The intercepting ALS ambulance responded to the dispatch emergently for 97.5% of the responses (1,633/1,675). In contrast, patients were transported to the hospital emergently in only 405 cases (24.2%). Among the 405 patients transported emergently, half (204, 50.4%) only had electrocardiography or intravenous access provided by the intercepting team. The top three primary impressions for emergently transported patients were cardiac arrest (18.3%), cardiac chest pain (16.8%), and trauma (13.3%). Of the 76 patients with cardiac arrest, 74 (97.4%) were transported emergently.

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Basic Life Support Interventions	Advanced Life Support Interventions
Oxygen	IV access
Cardiopulmonary resuscitation	
Sublingual nitroglycerin	Basic fluid administration (normal saline)
Blood glucose monitoring	
Automated external defibrillators	
Nebulized albuterol	Any advanced monitoring procedure (ECG or 12-lead ECG, end-tidal CO_2)
Bandaging	
Pulse oximetry	Any IV, subcutaneous, or intramuscular medication
Physical restraints	
Any splinting, including the use of long back boards and/or cervical collar placement	Any advanced airway procedure (needle chest decompression, surgical airway, CPAP)
	Manual defibrillation

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Table 1—Basic vs. advanced prehospital interventions (CPAP = continuous positive airway pressure; ECG = electrocardiography; IV = intravenous)

Site	No. of Intercepts	No. (%) of Adults	Mean Distance, mi*
1	851	779 (91.5)	13.4 (n = 849)
2	257	244 (94.9)	14.9 (n = 256)
3	134	121 (90.3)	10.7
4	85	76 (89.4)	11.4
5	73	68 (93.2)	23.6 (n = 69)
6	72	64 (88.9)	9.6
7	61	53 (86.9)	10.6 (n = 60)
8	58	56 (96.6)	8.3 (n = 57)
9	38	34 (89.5)	8.8
10	27	24 (88.9)	37.1 (n = 25)
11	18	18 (100.0)	7.1 (n = 17)
12	1	1 (100.0)	25.0
Total	1,675	1,538 (91.8)	

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Table 2—Characteristics of intercepts by site
*One way; if data were missing regarding distance
n = average number of available intercepts.

Of a total of 1,675 intercepts, 137 patients (8.2%) were <18 years of age. The median age for children was 14 years, and 59.1% were male. Dispatches for pediatric problems were responded to emergently in 131 (95.6%) of the cases, with only 20 patients (14.6%) being transported emergently. Basic life support interventions were performed for 42 children (30.7%), with an additional 53 (38.7%) receiving no more intervention than intravenous access or cardiac monitoring.

Discussion

The EMS system in this analysis uses no clearly defined guidelines that designate emergent or non-emergent responses for intercepts. Generally, it is considered standard practice to send an ambulance emergently when responding to requests made by area BLS services due to the unknown condition of the patient. The high proportion of emergent responses in this study supports this conclusion. However, this practice is not consistent across all types of ambulance calls. The dispatch center in this study uses the MPDS, which is designed to serve as a triage tool to assigning patient conditions and appropriate response levels for 9-1-1–type responses.[4] Dispatch programs based on these standards are used in many places across the United States.[5] The system has been evaluated and found to identify patients who do not demonstrate high acuity illness or injury more than 99% of the time.[6] However, in this EMS system, the MPDS is not used to determine the severity or acuity of patients needing intercept calls as the requests are made by a separate local dispatch center rather than the patient (9-1-1 call) or BLS provider needing aid.

It is difficult to use a triage tool like the MPDS for intercept calls as it requires a certain amount and degree of details regarding the patient and their symptoms. While useful in the 9-1-1 setting, first responder call volume can be safely decreased.[7] However, that information in this system is limited as the originating call went to a separate, local dispatch center.

The amount of information needed for MPDS to be effective may be minimal. The triage standards have been shown to accurately differentiate dispatching of low acuity and non-cardiac arrests by using minimal information such as patient movement or ability to speak.[8]

The findings suggest that cardiac monitoring and intravenous access are two key reasons that intercepts are coded as requiring ALS. It does not suggest that incorporating these two interventions into BLS practice would decrease the number or frequency of intercepts. However, BLS systems that choose to implement these measures (many already have intravenous access capability) may see a decrease in the need for ALS assistance. Conversely, the value of an ALS assessment to these BLS services is unknown and not accounted for in this study. Increasing

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Primary Impression	No. (%)	Intervention		
		BLS or None	ALS (IV/ECG only)	ALS (Beyond IV/ECG)
Alcohol	8 (0.5)	4 (50.0)	3 (37.5)	1 (12.5)
Allergic reaction	11 (0.7)	1 (9.0)	8 (72.7)	2 (18.0)
Altered status, unresponsive	123 (7.3)	14 (11.4)	78 (63.4)	31 (25.2)
Behavioral issue	25 (1.5)	3 (12.0)	16 (64.0)	6 (24.0)
Bleeding	24 (1.4)	4 (16.7)	16 (66.6)	4 (16.7)
Cardiac arrest	76 (4.5)	2 (2.6)	9 (11.8)	65 (85.5)
Cardiac–chest pain	404 (24.1)	17 (4.2)	268 (66.3)	119 (29.5)
Cardiac–dysrhythmia	59 (3.5)	6 (10.2)	26 (44.0)	27 (45.8)
Diabetic complication	73 (4.4)	11 (15.0)	31 (42.5)	31 (42.5)
Nausea/vomiting	24 (1.4)	3 (12.5)	17 (70.8)	4 (16.7)
Environmental*	4 (0.2)	0 (0.0)	4 (100.0)	0 (0.0)
General medical	43 (2.6)	4 (9.3)	33 (76.7)	6 (14.0)
Head injury	12 (0.7)	1 (8.3)	6 (50.0)	5 (41.7)
Headache	21 (1.3)	4 (19.0)	14 (66.7)	3 (14.3)
Malaise, flu	9 (0.5)	4 (44.4)	4 (44.4)	1 (11.1)
No complaints†	19 (1.1)	8 (42.1)	11 (57.9)	0 (0.0)
OB/GYN	14 (0.8)	2 (14.3)	11 (78.6)	1 (7.1)
Pain, medical	99 (5.9)	11 (11.1)	55 (55.6)	33 (33.3)
Poisioning/overdose	22 (1.3)	3 (13.6)	16 (72.7)	3 (13.6)
Respiratory	199 (11.9)	35 (17.6)	115 (57.8)	49 (24.6)
Seizure	73 (4.4)	17 (23.3)	30 (41.1)	26 (35.6)
Stroke	58 (3.5)	3 (5.2)	50 (86.2)	5 (8.6)
Syncope	11 (0.7)	1 (9.1)	9 (81.8)	1 (9.1)
Trauma	234 (14.0)	31 (13.2)	101 (43.2)	102 (43.6)
Weakness	30 (1.8)	5 (16.7)	24 (80.0)	1 (3.3)
Total	1,675 (100.0)	194 (11.6) 95% CI 10.1%–13.2%	955 (57.0) 95% CI 54.6%–59.4%	526 (31.4) 95% CI 29.2%–33.7%

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Table 3—Intercepts by paramedics' primary impression, and life support services provided (ALS = advanced life support; BLS = basic life support; ECG = electrocardiogram; IV = intravenous; OB/GYN = obstetric/gynecologic)
*Describes conditions that are caused by the external environment, such as hypothermia, hyperthermia, electrical burns, or chemical exposures.
†Refers to a patient awake and alert, but without problems according to the ALS crew. Problems may have existed before the intercept.

BLS provider education requirements may have a negative effect on volunteerism given course costs and time required to complete further training.

For some types of medical problems, the reduction or elimination of intercepts might be possible. Strokes, syncope, environmental issues (e.g., hypothermia, hyperthermia, electrical burns, chemical exposure), and obstetrical/gynecological emergencies all had a less than 10% rate of ALS treatment other than intravenous or electrocardiographic interventions. Decreases in these specific intercepts may be made with further education of the BLS providers. Decreasing the number of these intercepts would presumably increase the availability of resources for EMS systems and decrease the costs to the patient.

Limitations

Data were self-reported by paramedics. Due to the retrospective method of this study, verification of reported data was not possible. The reasons that intercept requests were made by BLS services was not examined.

As with many BLS services in Minnesota, the use of sublingual nitroglycerin, nebulized albuterol, glucagon, and

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epinephrine pens is allowed, but in at least one geographic area, at the demand of the BLS services medical director, any use of these medications requires the ambulance service to request an intercept. That variable could not be accounted in this study, nor is it known if other areas within this study have similar requirements.

Transport times and miles traveled were especially difficult to collect. Crews often are outside of radio range of the dispatch center, increasing the chance that mileages and times are not effectively communicated to dispatch centers and, hence, not documented. Both may potentially be confounding; however, intercepts primarily occur outside of the main ALS service area.

Conclusions

A significant discrepancy between emergent responses and actual ALS-level care rendered during intercept calls was demonstrated. Given the significant rate of EMS worker fatalities and transferable patient care costs, further study is needed to determine whether costs and safety are potentially improved by decreasing emergent responses. Future directions also include developing or emulating MPDS triage protocols for advanced services providing intercepts. In addition, further study of patient outcomes between intercept and non-intercept cases would be helpful.

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