Eur J Trauma Emerg Surg
DOI 10.1007/s00068-010-0022-0

ORIGINAL ARTICLE

Prehospital triage, discrepancy in priority-setting between emergency medical dispatch centre and ambulance crews

A. Khorram-Manesh · K. Lennquist Montán · A. Hedelin · M. Kihlgren · P. Örtenwall

Received: 4 January 2010 / Accepted: 12 January 2010

Abstract
Background The timely provision of emergency medical services might be influenced by discrepancies in triage-setting between emergency medical dispatch centre and ambulance crews (ACR) on the scene resulting in overloaded emergency departments (ED) and ambulance activities. The aim of this study was to identify such discrepancies by reviewing ambulance transports within a metropolitan city in the western region of Sweden.
Methods All data regarding ambulance transports in Gothenburg, Sweden, during a 6-month period were obtained and analyzed by reviewing the available registry.
Results There was a discrepancy between emergency medical dispatch centre and ACR in priority setting, which may result in a number of unnecessary transports to the hospital with consequent overloading of ED and a negative impact on ambulance availability.
Conclusion Appropriate ambulance use is one important part of emergency preparedness. Overuse results in decreased emergency medical services (EMS) availability and ED-overcrowding. Several factors, such as an imprecise triage system and increased public demands, may influence such overutilization. Improving the triage system and comprehensive public education on appropriate use of ambulances are two important steps toward a better use of national EMS resources.

Keywords Ambulances · Emergency Medical Services · Triage

A. Khorram-Manesh (✉) · K. Lennquist Montán · A. Hedelin · M. Kihlgren · P. Örtenwall
Prehospital and Disaster Medicine Centre,
Svangatan 4 Regionens Hus, 405 44 Gothenburg, Sweden
e-mail: amir.khorram-manesh@surgery.gu.se

Published online: 04 May 2010

Introduction

Recently, it was reported that the hospital-related incidents within the western region of Sweden (Region Västra Götaland), with over 1.5 million inhabitants, have increased more than 15 times from four incidents in 2006 to 65 incidents in 2008 [1]. One reason for such increase may be overloaded emergency departments (ED), which in turn may be due to increased inflow of patients, who in part are transported to ED by ambulances. The timely provision of emergency medical services (EMS) is one of the key factors in the management of emergency situations. Better planning and integration of EMS, at all levels (regional, national) is essential for maintaining a secure and reliable public healthcare system [1, 2]. ED-overcrowding, which is also linked to a hospital's resource constraints, may result in ambulance diversions and overloading of ambulance capacity and endanger patients' safety and disaster preparedness [1, 3–8].

In Sweden, the majority of persons calling the emergency medical dispatch centre (SOS Alarm) for help are provided with ambulance transport. In earlier published reports, the appropriateness of ambulance transports has been evaluated based on EMS personnel triage on the scene or the physicians' diagnosis at the ED [9, 10]. However, an ambulance transport actually starts at the emergency medical dispatch centre (EMDC), where the dispatchers set the priorities and decide on transport options, based on the information given through the telephone call. Many of these transports end at the hospitals ED, but are not always medically justified. There are also reports indicating an increasing number of ambulance transports, substituting taxi-transports, used by patients that are not critically ill and, as mentioned before, many ambulances may also be diverted to nearby hospitals by EMDC when the target

hospital is overloaded [1, 10, 11]. Thus, one key factor influencing the activities of ambulances and overloading of ED is a correct triage coordinated between EMDC and ambulance crews (ACR) to minimize discrepancies between the first priority setting at the EDMC, at the scene and in the ED.

The aim of this study was to identify such discrepancies by reviewing ambulance transports within a metropolitan city in the western region of Sweden during a 6-month period.

Materials and methods

General

All registered ambulance transports in Gothenburg during a 6-month period (2008) were obtained by reviewing Ambulink™ [12]. AmbuLink is a web-based ambulance medical file, in which all information about patients' medical conditions and all activities during the transports are registered. The study population consists of normal population in Gothenburg (population around 0.5 million people, age > 1 year). To obtain exact age of the study population, thorough study of each medical file is necessary as the registry itself does not offer this information. For the present study the following variables were extracted and studied;

- Total number of transports
- Type of transports
- Priorities set by the emergency dispatch centre
- Priorities set by the ambulance personnel on site
- Severity and grade of the patient's condition at the time of arrival in the ED
- The distribution of different diagnosis and specialties

Triage methods

The first priority is set by the ambulance dispatcher (EMDC). All ambulance dispatchers have formal training in triaging and are also able to give treatment directions before ambulances reach the scene. A printed "index" is used as adjunct to perform a structured interview of the caller, to set a priority and give a treatment direction. The index was initially produced in the USA in the late 1970s and was applied in many states. It was later adapted by Norwegian prehospital authority for use in Norway, and around 1995 it was reviewed and reproduced by national medical specialist groups and committees in Sweden for national use. To the best of our knowledge the index has not been validated internally in Sweden, but there are publications from other countries dealing with its accuracy [13, 14]. Three priorities are used for ambulance transports; (1) P1: Acute life threatening condition; immediate dispatch (90 s) with blue lights and sirens. (2) P2: Acute but not life (ANL) threatening; dispatch as soon as an ambulance becomes available. (3) P3: Other missions; can wait up to 90 min. (4) P4: A forth category is also used for patients needing a litter transport, but without any need for medical care or monitoring ("stretcher taxi"). Based on the priorities and in consequent orders, different units are dispatched.

The second priority is set by ACR. All units are staffed with at least one registered nurse (RN). Some units have additional RNs (specialist nurses in anesthesiology) and physicians (anesthesiologist). The same triaging criteria were used by ACR when assessing the patients on the scene. If possible both of these priorities were compared with the patient's condition on arrival at ED.

Ambulance types

There were four different transport types; OLA, an ambulance equipped and staffed for the most severe cases. Ordinary emergency ambulances (EA), usually having one nurse, specialist in emergency medicine or anesthesia and an ambulance technician. Patient transport vehicles (PT) deal mainly with patients who do not need special medical care in transit. AD is a special transport accompanied by a physician and can offer more treatment on the scene and during transport.

Statistic

Data was transferred to Excel (Microsoft Corp, USA). No statistical analyses were performed.

Results

Type of transports versus priorities made by EMDC versus ACR

A total number of 35,893 transports were identified. Transports registered twice or unclear were excluded. The remaining 27,318 transports (patients) were prioritized by EMDC as P (priority) 1; 9,208, P2; 7,918, P3; 3,154, and P4; 7,038. The reported priorities made by ACR on site are shown in Table 1. Of 9,208 patients with P1, 2,512 (27%) were found to have priority 1 by ACR. More than 50% of P1 patients were found to be P2. Additionally 301 patients were prioritized as P1 of ACR, but were primarily prioritized as P2–4 by EMDC [27% (P1), 53% (P2), 82% (P3), and 99% for P4].

Table 1 Distribution between type of transports and each priority

*	Total	P1 = 9,208				P2 = 7,918				P3 = 3,154				P4 = 7,038			
**		P1	P2	P3	P4	P1	P2	P3	P4	P1	P2	P3	P4	P1	P2	P3	P4
OLA	1,227	658	296	148	74	4	11	1	0	3	5	25	1	1	0	0	0
EA	19,161	1,843	4,629	1,207	327	271	5,334	1,779	497	18	168	2,540	363	0	2	12	171
PT	6,887	4	1	0	6	0	1	4	0	0	0	2	20	4	2	31	6,812
AD	43	10	7	1	0	1	8	4	3	0	1	7	1	0	0	0	0
Total	27,318	2,512	4,933	1,356	407	276	5,354	1,788	500	21	174	2,574	385	4	4	43	6,987
% Right priority		27	54				53	18				82					99

It also shows the total number primarily prioritized as *P1–4* by the emergency dispatch center (* first row) and the secondary priorities based on the outcome **. *P1* acute life threatening conditions. *P2* acute but not life threatening conditions. *P3* other missions; can wait up to 90 min. *P4* patients needing a litter transport, but without any need for medical care or monitoring

OLA advanced emergency ambulances, *EA* emergency ambulance, *PT* patient transport vehicle, *AD* ambulance with a doctor

Priorities 1–4 (Table 1)

The number of patients prioritized as P1 by EMDC was 9,208 out of 27,318 (33.8%) patients. ACR prioritized 2,813 (10.3%) patients as P1; 2,512 in P1, 276 in P2, 21 in P3 and 4 in P4 groups. In total 27% of priority-setting in P1 made by EMDC was in agreement with ACR (73% over-triage). Another 301 patients prioritized as P1 by ACR were grouped under P2–4 (1% of all patients). The number of P2 prioritized by EMDC was 7,918 out of 28,318 (28.9%) patients. ACR prioritized 10,465 (38.3%) patients as P2; 4,933 in P1, 5,354 in P2, 174 in P3 and 4 in P4 groups. In total 53% of priority-setting in P2 made by EMDC was in agreement with ACR and another 5,111 patients were grouped as P1, P3 and P4 (18.0% over-triage and 6.0% under-triage). The number of P3 prioritized by EMDC was 3,154 out of 28,318 (11.6%) patients. ACR prioritized 5,761 (21.1%) patients as P3; 1,356 in P1, 1,788 in P2, 2,574 in P3 and 43 in P4 groups. Around 82% of priority-setting in P3 made by EMDC was in agreement with ACR and another 3,187 patients were grouped as P1, P2 and P4 (1.5% over-triage and 0.1% under-triage). The number of P4 prioritized by EMDC was 7,038 out of 28,318 (25.7%) patients. ACR prioritized 8,279 (30.3%) patients as P4; 407 in P1, 500 in P2, 385 in P3 and 6,987 in P4 groups. Around 99% of priority-setting in P4 made by EMDC was in agreement with ACR (1.0% under-triage). Another 51 patients were grouped as P1, P2 and P3.

Severity and grade of disease versus priority and definitive priority outcome (Table 2)

All patients were prioritized at the arrival to the ED as; AL, acute and life threatening (P1); ANL, acute and not life threatening (P2), and NOA, not acute (P3 and P4). The table shows all prioritized patients and their definitive priority on admission to the ED. Information could be obtained in 21,421 patients. A total number of 2,023 patients were classified as AL, 10,755 as ANL and the remaining 8,643 as NOA. There was a discrepancy between priorities in all three groups. During this period different triage scoring systems were used in the regions different hospitals. However, the condition of all patients on arrival at ED was registered as AL. ANL, and NA at all hospitals (see "Materials and methods").

Priorities, disease severity versus institutional diagnosis (Table 3)

The distribution of different priorities and the diagnosis on admission to the hospital for 21,418 patients are presented in this table. Data for three patients were not available. Most of the P1 patients were acute (life threatening or not). Patients in need of surgical treatment and those with circulatory diseases were over-represented. All patients were admitted irrespective of their priorities and the severity of their disease.

Discussion

Our data show that there is a discrepancy between EMDC and ACR in current priority setting. Consequently, a number of transports to the hospital are unnecessary and may cause overloading of ED and negative impact on ambulance availability. In addition over-triaging patients lead to waste of resources, while under-triaging may endanger patient safety and cause unfavorable outcome. Readily available EMS units are one of the important key factors for national and regional preparedness in case of major incidents/disaster. Overloading ED and inappropriate use of ambulances reduce such functionality [1, 15, 16].

As shown in the current study, a discrepancy between EMDC and ACR in setting the priorities is one reason for

Table 2 Severity and grade of disease versus priority and definitive priority outcome

Priority emergency dispatch centre	Priority made by ambulance crews	Total number	AL	ANL	NOA
1	1	2,308	1,717	575	16
8,422 patients	2	4,801	47	4,332	422
	3	1,257	3	174	1,080
	4	56	0	0	56
2	1	274	210	63	1
9,814 patients	2	5,280	28	4,789	463
	3	3,955	4	473	3,478
	4	305	0	4	301
3	1	21	11	7	3
3,041 patients	2	169	3	153	13
	3	2,536	0	179	2,357
	4	315	0	1	314
4	1	1	0	1	0
144 patients	2	3	0	3	0
	3	13	0	0	13
	4	127	0	1	126
Total		21,421	2,023	10,755	8,643

AL acute life-threatening, *ANL* acute not life threatening, *NOA* not acute

Table 3 Relation between first priority-setting, patient's condition and diagnosis obtained at the emergency departments

P	Status	NO	AIR	CIRC	TOX	GYN	INF	SURG	MED	NEURO	ORT	PSYC	TRAU	OTHER	Sum
1	AL	1,767	166	507	230	28	16	90	42	300	34	3	320	31	1,767
	ANL	5,062	611	1,070	332	111	105	477	346	894	172	65	768	111	5,062
	NOA	1,588	171	221	106	31	42	150	155	243	58	79	215	117	1,588
	Sum	8,417	948	1,798	668	170	163	717	543	1,437	264	147	1,303	259	
2	AL	241	39	69	19	3	1	45	8	28	6	1	16	6	241
	ANL	5,330	519	638	227	82	145	1,071	328	646	722	46	735	171	5,330
	NOA	4,246	256	324	127	55	143	833	463	518	571	119	477	360	4,246
	Sum	9,817	814	1,031	373	140	289	1,949	799	1,192	1,299	166	1,228	537	
3	AL	14	4	2	0	0	0	2	1	1	0	0	1	3	14
	ANL	340	24	44	2	5	21	63	42	31	51	6	26	25	340
	NOA	2,686	76	426	25	28	140	478	311	167	387	130	97	421	2,686
	Sum	3,040	104	472	27	33	161	543	354	199	438	136	124	449	
4	AL	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	ANL	5	1	2	0	0	0	1	1	0	0	0	0	0	5
	NOA	139	5	7	1	1	3	13	7	4	16	11	3	68	139
	Sum	144	6	9	1	1	3	14	8	4	16	11	3	68	
	Total	21,418													

All patients transported by ambulances are admitted to the hospital irrespective of their disease severity or their primary priority-setting

AIR airway symptoms, *CIRC* circulatory symptoms, *TOX* intoxication, *GYN* gynecological condition, *INF* infectious disease, *SURG* surgical conditions, *MED* medical condition, *NEURO* neurological conditions, *ORT* orthopedic conditions, *PSYC* psychiatric conditions, *TRAU* trauma, *AL* acute life threatening, *ANL* acute not life threatening, *NOA* not acute

improper use of resources. This discrepancy could be due to a substantial safety margin in the priority assessment made by EMDC operators. Although over-triage is primarily accepted by ACR, it consequently results in 30% of unnecessary transports [10]. In our study, the difference between EMDC and ACR in priority-setting varied between 70% in P1 and 1% in P4. Although the national expert panel on field triage in the USA has reported a normal rate of under- and over-triage of 1–5 and 25–50%, respectively, the goal must be to improve the selection

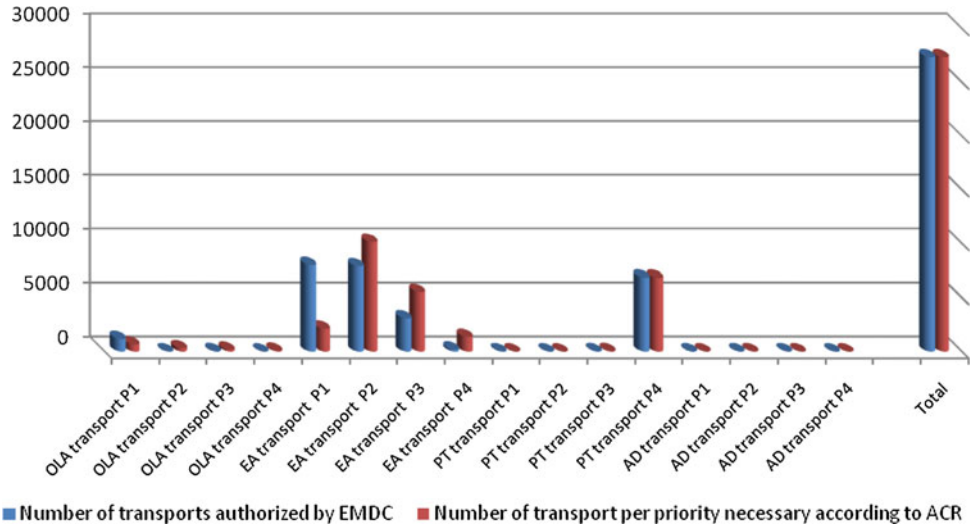

Fig. 1 Differences between different types of transport based on the priority-setting by EMDC and ACR. *OLA* advanced emergency ambulances, *EA* emergency ambulance, *PT* patient transport vehicle, *AD* ambulance with a doctor, *EMDC* ambulance dispatch centre, *ACR* ambulance crews, *P1* acute life threatening condition, *P2* acute but not life threatening conditions, *P3* other missions, *P4* patients needing a litter transport, but without any need for medical care or monitoring

process to downgrade priorities whilst maintaining patient safety [17, 18]. An improved system should also enable transport of patients directly from the scene to different healthcare centers based on their needs ("short tracks"). Current policy in our region indicates that almost all patients transported by an ambulance should be delivered to the ED. Many patients are not in need of the hospital facilities. Some might need hospital admission, but don't need the pre-admission work-up and may bypass ED [11]. Thus, ACR should have the mandate to evaluate the patient and change the priority or refuse a medically unjustified transport. This kind of decision-making is, however, not easy and needs training, practice and legislative changes [19–21]. Adequate triage setting is also important for the choice of transport. As shown in our study, many over-triaged patients were transported by high quality EMS units. Besides being unnecessary, these are costly alternatives to cheaper and more adequate transports, if the right decision is made early.

Another reason for inappropriate use of ambulances is the increased public demands for being transported to the healthcare facilities. Different studies have shown that there is a discrepancy between healthcare providers' and the public's beliefs and definition of what an appropriate indication for ambulance transport is [9]. A person's decision to call an ambulance in a non-emergency situation may be influenced by various socioeconomic factors, e.g. age, gender, household income, and possession of a car. On the contrary, other factors, e.g. hesitation to use an ambulance and the knowledge of nearest hospital's location may limit ambulance overuse [22]. There are other reports indicating that many patients using an ambulance for transport to the hospital, would be willing to consider other means of transport to the ED, if one was offered [23]. In another report a directed campaign to the public for appropriate ambulance use, reduced the ambulance transports during the study period [24]. There is thus enough evidence to believe that public demands may be altered by adequate information and improvement within the metropolitan infrastructure and transport system.

An interesting question is if the presence of a physician (e.g. anesthesiologist) may increase the accuracy of triaging in the prehospital setting. Earlier experience of using physician at dispatch centres has shown the importance of better protocols and not the physician's presence. However, there are reports indicating that physician staffed ambulances increases the chance of survival and reduces mortality in patients with severe conditions [25–27]. In our study (Fig. 1), physician staffed ambulances were rarely used. The reason for the scarce use of these units is unknown, but one reason may be the fact that within the urban areas the principal of "load and go", and not "stay and play", is often advocated.

In conclusion, appropriate ambulance use is one important part of emergency preparedness. Overuse results in decreased EMS availability and ED-overcrowding. Several factors, such as an imprecise triage system and increased public demands, may influence such overutilization. Improving the triage system and comprehensive public education on appropriate use of ambulances are two important steps toward a better use of national EMS resources.

Conflict of interest statement None.

References

1. Khorram-Manesh A, Hedelin A, Örtenwall P. Hospital-related incidents; causes and its impact on disaster preparedness and prehospital organizations. Scand J Trauma Resusc Emerg Med. 2009;17:26.
2. Cherry RA, Trainer M. The current crisis in emergency care and the impact on disaster preparedness. BMC Emerg Med. 2008;8:1–7.

3. Marinovich A, Afilao J, Afilalo M, Colacone A, Unger B, Giguére C, Léger R, Xue X, Boivin JF, McNamara E. Impact of ambulance transportation on resource use in the emergency department. Acad Emerg Med. 2004;11:312–5.
4. Brokaw J, Olson L, Fullerton L, et al. Repeated ambulance use by patients with acute alcohol intoxication, seizure disorder, and respiratory illness. Am J Emerg Med. 1998;16:141–4.
5. Camasso-Richardson K, Wilde JA, Petrack EM. Medically unnecessary pediatric ambulance transport: a medical taxi service? Acad Emerg Med. 1997;4:1137–41.
6. Billittier AJ, Moscati R, Janicke D, et al. A multisite survey of factors contributing to medically unnecessary ambulance transport. Acad Emerg Med. 1996;3:1046–52.
7. Strange GR, Chen EH, Sanders AB. Use of emergency departments by elderly patients: projections from a multicenter data base. Ann Emerg Med. 1992;21:819–24.
8. Ruger JP, Richter CJ, Lewis LM. Clinical and economic factors associated with ambulance use to the emergency department. Acad Emerg Med. 2006;13:879–85.
9. Richards JR, Ferrall SJ. Inappropriate use of emergency medical services transport: comparison of provider and patient perspectives. Acad Emerg Med. 1999;6:14–20.
10. Hjälte L, Suserud BO, Herlitz J, Karlberg I. Initial emergency medical dispatching and prehospital needs assessment: a prospective study of the Swedish ambulance service. Eur J Emerg Med. 2007;14:134–41.
11. Hjälte L, Suserud BO, Herlitz J, Karlberg I. Why are people without medical needs transported by ambulance? A study of indications for prehospital care. Eur J Emerg Med. 2007;14:151–6.
12. Ambulink. http://www.zait.se.
13. Cooke MW, Morrell R, Wilson S, Bridge P, Edwards S, Allan TF, Holder RL. Does criteria based dispatch of 999 calls adequately detects the critically ill and injured? Prehosp Immed Care. 1999;3:191–5.
14. Hinchey P, Myers B, Zalkin J, Lewis R, Garner D. Low acuity EMS dispatch criteria can reliably identify patients without high-acuity illness or injury. Prehosp Emerg Care. 2007;11:42–8.
15. Widgren B, Jourak M. Medical emergancy triage and treatment system (METTS): a new protocol in primary triage and secondary priority decision in emergency medicine. J Emerg Med. 2008 [Epub ahead of print].
16. Clawson J, Olola CHO, Heward A, Scott G, Patterson B. Accuracy of emergency medical dispatchers' subjective ability to identify when higher dispatch levels re warranted over a medical priority dispatch system automated protocol's recommended coding based on paramedic outcome data. Emerg Med J. 2007;24:560–3.
17. O′cathain A, Webber E, Nicholl J, Munro J, Knowles E. NHS direct: consistency of triage outcomes. Emerg Med J. 2003;20:289–92.
18. Guidelines for Field Triage of Injured Patients. Recommendations of the National Expert Panel on Field Triage. Morbidity and Mortality Weekly Report 2009; 58: RR-1. (http://www.cdc.gov/mmwr).
19. Squires JP, Mason S. Developing alternative ambulance response schemes: analysis of attitudes, barriers, and change. Emerg Med J. 2004;21:724–7.
20. Gray JT, Wardrope J. Introduction of non-transport guidelines into an ambulance service: a retrospective review. Emerg Med J. 2007;24:727–9.
21. Snooks HA, Dale J, Hartley-Sharpe C, Halter M. On-scene alternatives for emergency ambulance crews attending patients who do not need to travel to the accident and emergency department: a review of the literature. Emerg Med J. 2004;21:212–5.
22. Kawakami C, Ohshige K, Kubota K, Tochikubo O. Influence of socioeconomic factors on medically unnecessary ambulance calls. BMC Health Serv Res. 2007;7:120.
23. Yarris LM, Moreno R, Schmidt TA, Adams AL, Brooks HS. Reasons why patients choose an ambulance and willingness to consider alternatives. Acad Emerg Med. 2006;13:401–5.
24. Ohshige K. Reduction in ambulance transports during a public awareness campaign for appropriate ambulance use. Acad Emerg Med. 2008;15:289–93.
25. Ramanujam P, Guluma KZ, Castillo EM, Chacon M, Jensen MB, Patel E, Linnick W, Dunford JV. Accuracy of stroke recognition by emergency medical dispatchers and paramedics—San Diego experience. Prehosp Emerg Care. 2008;12:307–13.
26. Kindberg K, Nielsen SL, Møller AM. Physician-based prehospital units in Denmark. Ugeskr Laeger. 2009;171:2553–7.
27. Ringburg AN, Frissen IN, Spanjersberg WR, Jel G, Frankema SP, Schipper IB. Physician-staffed HEMS dispatch in the Netherlands: adequate deployment or minimal utilization? Air Med J. 2005;24:248–51.