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Assessment of the Status of Prehospital Care in 13 Low- and Middle-Income Countries

Katie Nielsen, MD¹, Charles Mock, MD, PhD¹, Manjul Joshipura, MBBS², Andres M. Rubiano, MD, MPH³, Ahmed Zakariah, MD, MPM, EMBA, MPhil⁴, and Frederick Rivara, MD, MPH¹

¹Harborview Injury Prevention and Research Center, University of Washington, Seattle, WA, USA

²Academy of Traumatology (India), Ahmedabad, Gujarat, India

³Emergency and Critical Care Units, Neiva University Hospital/South Colombia University, Neiva (Huila), Colombia

⁴National Ambulance Service, Ministry of Health, Accra, Ghana

Abstract

Objectives—Injury and other medical emergencies are becoming increasingly common in low- and middle-income countries (LMICs). Many to most of the deaths from these conditions occur outside of hospitals, necessitating the development of prehospital care. Prehospital capabilities are inadequately developed to meet the growing needs for emergency care in most LMICs. In order to better plan for development of prehospital care globally, this study sought to better understand the current status of prehospital care in a wide range of LMICs.

Methods—A survey was conducted of emergency medical services (EMS) leaders and other key informants in 13 LMICs in Africa, Asia, and Latin America. Questions addressed methods of transport to hospital, training and certification of EMS providers, organization and funding of EMS systems, public access to prehospital care, and barriers to EMS development.

Results—Prehospital care capabilities varied significantly, but in general, were less developed in low-income countries and in rural areas, where utilization of formal emergency medical services was often very low. Commercial drivers, volunteers, and other bystanders provided a large proportion of prehospital transport and occasionally also provide first aid in many locations. Although taxes and mandatory motor vehicle insurance provided supplemental funds to EMS in 85% of the countries, the most frequently cited barriers to further development of prehospital care was inadequate funding (36% of barriers cited). The next most commonly cited barriers were lack of leadership within the system (18%) and lack of legislation setting standards (18%).

Conclusions—Expansion of prehospital care to currently under- or un-served areas, especially in low-income countries and in rural areas, could make use of the already existing networks of first responders, such as commercial drivers and lay persons. Efforts to increase their effectiveness, such as more widespread first aid training, and better encompassing their efforts within formal EMS, are warranted. In terms of existing formal EMS, there is a need for increased and more regular funding, integration and coordination among existing services, and improved organization and leadership, as could be accomplished by making EMS administration and leadership a more desirable career path.

Address for correspondence: Charles Mock, Harborview Injury Prevention and Research Center, Box 359960, Harborview Medical Center, 325 Ninth Avenue, Seattle, WA 98104, Phone: 1-206-744-9430, cmock@uw.edu.

DECLARATIONS OF INTERESTS

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

Keywords

developing country; emergency; emergency medical services; global; injury; low income country; low or middle income country; middle income country; prehospital care; trauma

INTRODUCTION

Until recently, efforts to reduce mortality globally have focused predominately on communicable diseases. However, injuries from multiple causes are becoming a significant contributor to overall mortality and morbidity. The World Health Organization (WHO) estimates that 5.8 million deaths annually are attributable to injuries, 90% of which occur in low-and middle-income countries (LMICs). Moreover, rates of one of the main causes of death, road traffic crashes, are increasing in most LMICs (1). Likewise, the burden due to non-communicable diseases, such as cardiac and vascular disease, is growing. Almost all injuries and a substantial proportion of non-communicable diseases present acutely and necessitate emergency care, both in hospital and in the prehospital setting. Similarly, a proportion of communicable diseases and many obstetrical conditions also demand emergency treatment (2).

Capabilities for emergency care in hospital are gradually being addressed (2). Capabilities for prehospital care must also be examined and improved. As regards injury, the preponderance of deaths occurs outside the hospital in countries at all economic levels. However, the proportion of deaths that occur outside the hospital is higher in most LMICs than in high-income countries (3). Thus any efforts to address injury related deaths globally must also include the prehospital setting.

Efforts to strengthen prehospital care in LMICs are hampered by many considerations, including lack of a clear path to follow in initiating new formal emergency medical services (EMS) where none currently exist, the lack of evidence as to what elements of such formal EMS are cost-effective and in which circumstances, and a paucity of studies on alternatives to formal EMS, such as widespread first aid training for first responders (4–5).

Despite increased awareness of the global impact of injury and the need for emergency services for many medical conditions, no broader assessment of prehospital care systems in the developing world has been published. Understanding the current status is essential in order to guide future efforts to strengthen prehospital care systems and ultimately reduce the burden of injury and other medical conditions needing emergency care. Thus, this study sought to better understand the methods of transport to the hospital, training and certification of EMS providers, organization and funding of EMS systems, public access to prehospital care, and barriers to further prehospital care development in a wide range of LMICs.

METHODS

A standardized 32 question, five-page questionnaire was developed. This was derived from needs assessment forms originally created by WHO, based on the *Prehospital Trauma Care Systems* publication (5) and which had been pilot tested and refined in several countries previously (Mozambique, Ghana, Mexico, Vietnam). The form for the current study was further revised by the co-authors, many of whom also had prior experience using the preceding WHO needs assessment forms. The form was used provisionally in the first few countries to be surveyed, with minor alterations thereafter. This questionnaire focused on the methods of transport to the hospital, training and certification of EMS providers, organization and funding of EMS systems, public access to prehospital care, and barriers to further prehospital care development. Questions were primarily open ended, allowing for

recording of information in the respondents' own words. This allowed for later qualitative analysis.

This study sought to administer this questionnaire to EMS leaders in several countries in each of the main three developing regions (Africa, Asia, Latin America). We approached this research project as a qualitative research study. Given the available resources for the project, we realized that a representative sample of EMS programs in low and middle-income countries around the world would not be feasible. We therefore followed a qualitative research approach and did purposeful sampling to capture the range of approaches to EMS care in these countries. This type of sampling is appropriate when developing an understanding of general approaches to a problem (6–7).

Several of the co-authors led data collection efforts in their regions (MJ for Asia, AR for Latin America, and AZ for Africa). National leaders in EMS were identified in countries on each continent through personal contacts. When available, these were people who headed governmental agencies whose portfolio encompassed prehospital care. When such individuals or agencies did not exist, information was gathered from leading professionals in each country who have been at the forefront of EMS development or related research. This study sought to sample at least three countries from each major region.

Information was gathered via a combination of personal visits, phone interviews, email, and letters. Data were gathered during 2009–2010. Respondents were asked to give averages for the country overall to the best of their knowledge. As many important variables such as access to EMS would be expected to vary across nations and states, opinions were sought on many of these variables for rural vs urban differences.

Each country was classified into low-income, lower-middle-income, and upper-middle-income according to the World Bank Atlas Method (8). In general, the data were presented by country, with the exception of India. Given India's high population and the significant variation among Indian states, data are presented by individual Indian state.

Data were analyzed qualitatively as to major findings and regional variations. A characteristic of qualitative research is that the approach relies less on numerical data than on synthesis of observations across the spectrum of models, in this case for EMS care. The data analysis was one of reducing the large amount of data collected to understand key themes of EMS care in these countries; it is not meant to be a quantitative data analysis of a random sample of programs (6–7). The tables reported in the results reflect this qualitative approach. The major emphasis in data analysis was to identify factors in prehospital care that could serve as solid foundations to build upon in future EMS development and to identify barriers and gaps that needed to be addressed. Responses were collated and themes across countries were identified.

For purposes of the questionnaire and the analysis, the following definitions were used: Emergency Medical Services (EMS) referred to formal prehospital services, within a defined organization and most often with ambulances. Prehospital care was a broader concept, encompassing EMS, but also first aid and prehospital transport provided by commercial drivers, private citizens, and other laypersons, whether as part of a formal system or not.

This study was deemed exempt from review by the University of Washington IRB.

RESULTS

Data were obtained from 13 countries (Figure 1). From one of these countries (India), separate responses were obtained from three states. These countries and states represented a wide geographic and economic spectrum. There were at least three countries from each major developing region (Africa, Asia, Latin America) and at least three from each economic stratum (Table 1). Respondents came from several backgrounds, as shown in Table 2. A national or state EMS director existed and provided data in 7 countries or Indian states. The most common respondents for the other sites were clinicians involved with EMS development. Three other countries (Rwanda, Togo, Venezuela) were approached for the study but did not participate.

Methods of Transport

Among participating sites, there was wide variation in the method of transporting emergency patients to the hospital (Table 3). Advanced life support capabilities during transport were only available to a significant number of persons in two of the upper middle income sites (South Africa and Panama). Basic life support capabilities were available to more than half of people only in South Africa and Gujarat State, India. Pakistan and Maharashtra State, India made substantial use of EMS with care provided by attendants with on-the-job experience, but no formal emergency medical technician training. Delhi, India made substantial use of police and fire department personnel for transport. For almost all countries, especially those in the low-income and lower-middle-income strata, a substantial number of emergencies were transported by commercial (e.g. taxi, minibus) and private vehicles. In Sri Lanka, the majority of emergencies were transported via non-motor means, primarily rickshaws.

Training

All sites except Pakistan and Gujarat State, India had some level of training available for first responders, such as firefighters, police, and lay persons (Table 4). In most sites this was training in first aid, but two also had basic life support training available for certain categories of first providers, such as police, firefighters, and civil defense personnel. It could not be determined to what extent these were utilized, nor what percent of first responders had received such training.

Almost all countries had several levels of training for EMS providers, with some utilizing doctors and nurses for portions of this level of care. However, the type of certification available and whether certification was required or merely offered varied tremendously by country.

Organization

EMS systems were organized at many different levels, including national, regional/state, and local levels (Table 5). National level organization could include either the setting of national policy on EMS (as in Vietnam and Colombia) or an actual nationally organized ambulance service (as in Ghana). Independent of the level of organization, most countries regulated ambulances. However, many of the low income countries did not have standards. When transporting patients to the hospital, EMS providers communicated with the receiving facility only part of the time in most countries. Mobile phones and radios were used equally frequently.

Funding

Almost all countries, with the exception of Kenya, provided some level of transportation to patients free of charge that was funded by the government or obligatory motor vehicle

insurance (Table 6). However, transportation for non-emergencies or to private facilities was typically not covered, and patients needed to pay out of pocket for these services.

Access

All sites, except Maharashtra State and Mexico, had a common emergency access number available to the public (Table 7). However, despite the availability of this number, the access to services within 1 hour varied tremendously, from nearly 100 percent in urban Brazil, Colombia, and Maharashtra State to very low in Kenya, Pakistan, Sri Lanka, and Vietnam. As would be expected, access to services was better in urban than in rural areas. Prehospital times could be up to 1 – 2 days in rural areas of Africa.

Access to care was also partially reflected in utilization rates (Table 7). In some cases there were nationwide or statewide data that were available from centralized ambulance services (e.g. Ghana, Gujarat state). In other cases, data from smaller geographic areas or individual services were utilized. There were very wide variations, from 0.2 to 72 runs/thousand population/year.

Barriers

Twenty-two separate entries were provided regarding barriers to provision of EMS services (with some respondents mentioning none and some one or more). The predominant barrier was inadequate funding (36%). The next most commonly cited barriers were a lack of leadership within the system (18%) and a lack of legislation to set standards (18%). Other common barriers included a lack of integration among multiple systems (14%) and no standard accreditation for EMS providers/paramedics (14%).

STUDY LIMITATIONS

This study sought to characterize prehospital care capabilities in a range of LMICs focusing on types of services available, access to those services, and the overall organization and funding of the services. By so doing, we sought to provide information that would be useful in planning of efforts to strengthen and expand prehospital care capabilities globally.

Although this is the most comprehensive study of this kind to date and did evaluate countries across a wide spectrum of geography and economic levels, there are several limitations. First, the study sought to obtain information from someone in charge of EMS either nationally or in a given state or jurisdiction. In many cases, there was no individual or agency designated as being in charge of EMS. In these cases, knowledgeable respondents were identified through personal contacts. It cannot be known if these were always the persons with the best information about a given location.

Second, although components of the data gathered were objective (such as ambulance standards, training of EMS providers, availability of uniform access numbers), much of the data were subjective and based on estimates rather than data obtained from existing databases (such as percent of persons with access to care under one hour).

Third, even when data did exist (such as for utilization rates per population served), it often existed only for specific areas. There were indeed some cases in which fairly reliable national data are available, such as for the National Ambulance Service in Ghana. For many locations however, it was not known how data from different locations could reliably be scaled up to reflect nationwide patterns of care. This was especially problematic as in most countries there were large discrepancies in the availability of prehospital care between urban and rural areas.

Fourth, this qualitative study utilized a purposeful sampling method that selected known leaders in prehospital care. This would tend to bias the findings towards locations with better developed systems, as less developed systems would tend to have less well known or externally visible leaders, if indeed anyone could even be considered a leader. This would in turn result in the findings showing prehospital capabilities to be better developed than for other LMICs that were not sampled. Thus, the problems and barriers identified in this paper are likely to be even more pronounced globally.

DISCUSSION

Despite these limitations, this study provides useful information about the current status of EMS development globally that will assist in future efforts to expand and strengthen prehospital care globally. Several major themes emerged from the data.

This survey could not provide direct estimates of unmet need for prehospital services, such as the percent of seriously ill or injured persons who would benefit from an ambulance but who do not receive it because of either geographic or financial accessibility. In part, however, unmet need can be inversely reflected in the utilization rates for EMS (9). There was a wide variation in utilization of EMS from 0.2 to 72 runs/year/thousand population. Differences in reporting likely account for part of this wide variation. Nonetheless, it is also likely that the lower end of the spectrum (e.g. utilization of less than 1 – 10 runs per year per 1000 population) represent considerable unmet need, with large proportions of severely ill or injured persons not yet able to receive formal EMS. By comparison, Seattle, USA (a city with a very highly utilized EMS) has approximately 100 runs/1000 population/year (10).

Although formal EMS appeared to have good coverage in middle-income countries and in some urban areas of low-income countries, its availability more generally in low-income countries remains low. Many severely ill and injured persons still come to hospital (when they do) by less formal means, such as commercial and private vehicles or non-motorized means, usually with considerable delays and with no first aid delivered. This supports the findings of other studies. In Mumbai, Roy et al found that only 35% of trauma patients were transported to the main trauma center via ambulance (11). In Kumasi, Ghana, half of trauma patients requiring admission were transported by commercial vehicles. Only 9% were transported by ambulance, almost all of whom were transferred from other hospitals, rather than directly from the field (12). Globally, it has been roughly estimated that 50–75% of the world's people do not have access to a formal EMS system (13).

A wide variety of institutional arrangements were reported as to the level of government involved (national, state, local) in EMS administration and as to types of EMS providers (doctors, nurses, paramedics, etc) and their training requirements. The data presented do not allow conclusions to be drawn about whether or not one system might offer advantages compared to others. However, commonly cited barriers to improvement and expansion of EMS coverage were lack of integration of different services, lack of standards, and lack of leadership, which cut across the different systems and institutional arrangements. Other studies have cited similar considerations, including the fact that few doctors or other more highly trained professionals are interested in devoting significant portions of their career to EMS (13–16). There is thus a need, globally, to make EMS leadership a more desirable and valid career path.

The most commonly cited barrier to improvements and expansion of prehospital care cited in this study was inadequate funding. This is despite the fact that most countries had some mechanisms in place to provide funding for EMS, such as taxes or funds deriving from

mandatory motor vehicle insurance. Clearly greater reliability of such funding mechanisms is needed (5).

The literature provides some useful ideas on potential solutions to the above-identified barriers to expansion of prehospital care to rural and other currently underserved areas. An approach that has not been given sufficient attention in many countries is greater usage of first responders, such as commercial drivers and other lay persons who are already providing a significant amount of the prehospital transport of severely ill and injured persons and who, in many areas, constitute a *de facto* EMS. Several programs and efforts in different countries have shown the potential benefit of such approaches. For example, a program that provided basic first aid training to taxi and bus drivers in Ghana resulted in 61% of drivers providing first aid to injured or severely ill persons in the following year, with a considerable increase in the provision of appropriate basic first aid measures to these persons (17). Jayaraman *et al* surveyed commercial drivers and community volunteers who often provided prehospital care in Kampala, Uganda and found that 48% had not received any first aid training. After a targeted one day training course, there was a significant improvement in fund of knowledge, both immediately after training and 6 months later (18).

In landmine infested areas of Cambodia and Iraq, one innovative program instituted widespread first aid training and provided basic supplies to a network of thousands of village volunteers. This resulted in a sustained decrease in mortality among victims of landmine injuries and other types of trauma, from 40% to 8% (19). Such methods to better train and involve first responders are a potential fruitful avenue to scale up globally. The current study did indeed demonstrate that most countries were making some effort in this regard. However, no consistent large scale efforts were reported. There are of course affordable and sustainable means to expand and strengthen existing formal EMS. For example, in Monterrey, Mexico increased number of sites of ambulance dispatch and improved training of paramedics through regular in-service training courses resulted in improve process of care and decreased mortality (from 10% to 7%) among injured persons cared for by the EMS in that city. This came at an increase of 16% in the EMS budget, which was affordable and which has been continued to be supported by the local government (14–15). In this regard, it should be noted that more costly advanced life support techniques have not been shown to be of significant benefit in the prehospital setting (14, 20–21). Rather, more widespread access to basic life support capabilities should be a greater priority, especially for areas that have currently limited access, such as many of the rural areas reported in this study.

One technical aspect of EMS to improve access is the establishment of a uniform emergency access telephone number. In the current study, most countries did report such a uniform emergency access number. However, WHO's *Global Status Report on Road Safety* reported that 56 countries (31%) out of 178 surveyed did not have such numbers. Moreover, among those that did, 13 countries had up to three different national telephone numbers and a further 25 had regional or local numbers, making for confusion and delays if someone was not familiar with the access number in that area (22). It is interesting to note the corroboration between what was reported in this study and the *Global Status Report on Road Safety*. Most of the 13 countries in the current study were reported to have a universal access number in both studies. Mexico was reported to not have one in both studies. However, Colombia, Ecuador, Kenya, Ecuador, Panama, and Peru were all reported to have an access number in the current study but were either reported not to have such a number or did not have the information available for the Global Status Report. In these cases, it is likely the uniform access number, if it even does exist, is not well known or utilized.

Many of the above issues could be comprehensively addressed by legislation on prehospital care and EMS, the lack of which was cited as one of the most frequent barriers to EMS development. Legislation can encompass elements such as establishing a statutory lead agency if none exists. It also encompasses setting and promoting standards on training, communications, equipment and supplies, and financing of the system. Two countries that have enacted such EMS legislation in an exemplary fashion recently have been Colombia and Romania. In both cases the legislation resulted in documented improvements in the care received by victims of injury and other medical emergencies, such as decreases in prehospital times (9).

CONCLUSIONS

This global survey has shown that indeed much is being done well in many countries and that there are dedicated professionals and volunteers often working against considerable odds to provide and improve prehospital care in their areas. Their efforts could be aided by several measures, based on the findings of this study. These include: greater expansion of services to currently under- or un-served areas, especially in low-income countries and in rural areas everywhere. Such expansion could make better use of the already existing networks of first responders, such as commercial drivers and lay persons. Efforts to increase their effectiveness, such as more widespread first aid training, and better encompassing their efforts within formal EMS, in a tiered fashion, are warranted. In terms of existing formal EMS, there is a need for increased and more regular funding, integration and coordination among existing services, and improved organization and leadership, as could be accomplished by making EMS administration and leadership a more sought after career path and by national or statewide prehospital and EMS legislation that addresses many of the above elements in a comprehensive fashion.

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References

1. World Health Organization. Injuries and Violence: The Facts. Geneva: World Health Organization; 2010. available from http://www.who.int/violence_injury_prevention/key_facts/en/index.html
2. Kobusingye, O.; Hyder, A.; Bishai, D.; Joshipura, M.; Romero-Hicks, E.; Mock, C. Emergency Medical Services. In: Jamison, D., et al., editors. Disease Control Priorities in Developing Countries. 2. Washington: The International Bank for Reconstruction and Development/The World Bank; 2006. p. 1261-79.
3. Mock CN, Jurkovich GJ, nii-Amon-Kotei D, Arreola-Risa C, Maier RV. Trauma mortality patterns in three nations at different economic levels: implications for global trauma system development. *J Trauma*. 1998; 44(5):804–12. discussion 12–4. [PubMed: 9603081]
4. Bunn, F.; Kwan, I.; Roberts, I.; Wentz, R. Effectiveness of Prehospital Care: A report by the Cochrane Injuries Group for the World Health Organization. London: The Cochrane Injuries Group; 2001.

5. Sasser, S.; Varghese, M.; Kellermann, A.; Lormand, J. Prehospital Trauma Care Systems. Geneva: World Health Organization; 2005.
6. Grossman, D.; Rhodes, L. Qualitative methods in injury research. In: Rivara, FPCP.; Koepsell, TD.; Grossman, DC.; Maier, RV., editors. Injury Control A guide to research and program evaluation. New York: Cambridge University Press; 2001. p. 104-15.
7. Patton, M. Qualitative Research and Evaluation Methods. Thousand Oaks, CA: Sage; 2002.
8. World Bank. Country classification: classification of economies. Washington, DC: The World Bank Group; 2011. <http://www.worldbank.org/data/countryclass/countryclass.html>
9. Mock, C.; Juillard, C.; Joshipura, M.; Goosen, J., editors. Strengthening Care for the Injured: Success Stories and Lessons Learned from around the World. Geneva: World Health Organization; 2010.
10. Seattle Fire Department. [accessed May 24, 2011] 2011. www.seattle.gov/fire/statistics/runTotals
11. Roy N, Chowdhury V, Patil S, Supe P, Vaishnav P, Vatkar A. Where there are no emergency medical services - Prehospital care for the injured in Mumbai, India. Prehospital and Disaster Medicine. 2010; 25:145–51. [PubMed: 20467994]
12. Forjuoh SN, Mock CN, Friedman DI, Quansah R. Transport of the injured to hospitals in Ghana: the need to strengthen the practice of trauma care. Pre-hospital Immediate Care. 1999; 3:66–70.
13. Mock C. International Approaches to Trauma Care. Trauma Quarterly. 1999; 14(3):191–348. Theme issue.
14. Arreola-Risa C, Mock C, Herrera-Escamilla A, Contreras I, Vargas J. Cost-effectiveness and benefits of alternatives to improve training for prehospital trauma care in Mexico. Prehospital and Disaster Medicine. 2004; 19:318–25.
15. Arreola-Risa C, Mock CN, Lojero L, Cruz O, Garcia C, Canavati F, et al. Low cost improvements in prehospital trauma care in a Latin American city. J Trauma. 2000; 48:119–24. [PubMed: 10647576]
16. Arreola-Risa C, Vargas J, Contreras I, Mock C. Effect of Emergency Medical Technician certification for all prehospital personnel in a Latin American city. J Trauma. 2007; 63:914–9. [PubMed: 18090026]
17. Mock C, Tiska M, Adu-Ampofo M, Boakye G. Improvements in prehospital trauma care in an African country with no formal emergency medical services. J Trauma. 2002; 53:90–7. [PubMed: 12131396]
18. Jayaraman S, Mbweijano J, Lipnick M, et al. Current patterns of prehospital trauma care in Kampala, Uganda and the feasibility of a lay-first-responder training program. World Journal of Surgery. 2009; 33:2512–21. [PubMed: 19669228]
19. Husum H, Gilbert M, Wisborg T, Heng YV, Murad M. Rural prehospital trauma systems improve trauma outcome in low-income countries: a prospective study from North Iraq and Cambodia. J Trauma. 2003; 54:1188–96. [PubMed: 12813342]
20. Bunn F, Collier T, Frost C, Ker K, Roberts I, Wentz R. Traffic calming for the prevention of road traffic injuries: systematic review and meta-analysis. Injury Prevention. 2003; 9:200–4. [PubMed: 12966005]
21. Hauswald M, Yeoh E. Designing a prehospital system for a developing country: estimated costs and benefits. Am J Emerg Med. 1997; 15:600–3. [PubMed: 9337371]
22. World Health Organization. Global Status Report on Road Safety. Geneva: World Health Organization; 2009.



Figure 1.
Geographic location of countries surveyed.
This map was created using Google Charts API (<http://www.29travels.com/travelmap/>) to highlight selected countries

Table 1

2008 World Bank classification of countries surveyed

World Bank classification	Site	Gross National Income per capita, Atlas Method	Population (million)	Population living on less than \$1 per day (%)	Life expectancy (years)	Infant mortality rate (per 1000 live births)
Low-income	Ghana	810	24	30.0	60	50
	Kenya	660	40	19.7	60	55
	Pakistan	850	132	22.6	63	70
	Vietnam	790	87	21.5	72	19
Lower-middle-income	Ecuador	3060	13.5	4.7	75	18
	India	1000	14	41.6	65	48
			Delhi			
			Gujarat			
	Maharashtra	97				
Sri Lanka	1520	20	14.0	71	14	
Upper-middle-income	Brazil	6110	199	5.2	73	17
	Colombia	4070	45	16.0	76	17
	Mexico	9090	111	<2.0	76	14
	Panama	5550	3.3	9.5	77	17
	Peru	3380	29.5	7.9	76	15
	South Africa	5770	49	26.2	54	41

The World Bank classifies economies based upon 2008 Gross National Income per capita, which is calculated by the World Bank Atlas Method (<http://data.worldbank.org/>). The groups are: low-income, \$995 or less; lower-middle-income, \$996 – \$3,945; upper-middle-income, \$3,946 – \$12,195; and high income, \$12,196 or more. The health indicators were obtained from the WHO Global Health Observatory repository of data by country available at <http://www.who.int/gho/en/>.

Table 2

Types of respondents who provided data.

Site	Government official in charge of EMS for country	Government official in charge of EMS for state or local area	Other government EMS official	Clinician involved with EMS	Non-government organization working with EMS
Ghana	1				
Kenya				2	
South Africa				1	
Delhi				1	
Gujarat		1			
Maharashtra				1	
Pakistan				1	
Sri Lanka	1				
Vietnam					1
Brazil	1			1	1
Colombia	1	1		1	1
Ecuador				2	
Mexico			1	1	
Panama		1		2	
Peru	1	1			1

Table 3
Methods of transport to hospital for victims of injury and other medical emergencies by country (%)

Site	Untrained EMS	BLS	ALS	Police/fire	Commercial	Private	Non-motor	Other
Ghana	++	++	+	0	++	+	+	0
Kenya	+	+	0	0	+++	++	+	0
South Africa	0	+++	++	0	++	++	+	0
Delhi	+	++	0	++	++	++	+	+
Gujarat	+	+++	+	+	+	+	+	+
Maharashtra	++	++	0	+	++	++	0	0
Pakistan	++	0	0	+	+	+++	+	0
Sri Lanka		++		0	++	+	+++	0
Vietnam	0	+	+	0	+++	++	0	0
Colombia	0	+++			++	++	0	0
Panama	+	++	++	++	0	++	0	++

Method not used: 0

<10%: +; 1

0 – 49%: ++;

50%: +++

Data were not provided by Mexico, Ecuador, Peru, and Brazil.

Table 4

Training of first responders and emergency medical services (EMS) personnel

Site	Non-EMS first responders		Training of first responders		EMS providers	
	Type of non-EMS first responders		Training of first responders	Training of EMS providers	Certification required for EMS providers	
Ghana	Commercial drivers		First aid	BLS: EMT course ALS: doctor	EMT	
Kenya	Police, fire		First aid	EMT	none	
South Africa	Community members		First aid	BLS: 6wk training ILS: BLS + 1000 duty hrs + 4mo training ALS: ILS + 1000 duty hrs + 10mo training	BTLS/ACLS/BLS/PEARS/ATLS	
Delhi	Police, fire		BLS	Junior ambulance officers and paramedics	BTLS-/PHTLS-like certification	
Gujarat			Negligible	6 wk training (ALS, BLS)	EMT (6 wk course)	
Maharashtra	Teachers, industry professionals, rickshaw drivers, civil defense		First aid/BLS	Doctor: EMS diploma Paramedic: BLS + EMS certificate	EMT	
Pakistan			Negligible	Most services without, 1 with doctors, 1 with EMTs	none	
Sri Lanka			First aid	EMS levels 1–4	none	
Vietnam	Commercial drivers (motor cycle taxi), community health workers		First aid	Doctor, nurse, and driver	none	
Brazil	Firefighters, police		First aid	Doctor, nurse, nurse tech, first responder: PHTLS, ATLS, ACLS, BLS	BLS, ACLS, PHTLS	
Colombia	First aid: firefighters, civil defense, nurse technicians, laypeople		First aid	Doctor, nurse, prehospital care tech, nurse asst: 20hrs BLS, 48hrs ALS	NA	
Ecuador	Firefighters, civil protection, lay persons		First aid	Some EMT, doctors	None	
Mexico	Firefighters, civil protection, lay persons		First aid	Doctors: some services request ACLS, PHTLS, BLS, and ATLS; EMT	National EMT program; some ACLS, PHTLS, BLS, ATLS	
Panama	Firefighters, police		First aid	Doctor EMT degree	EMT	
Peru	Firefighters, police		First aid	Drivers: CPR Nurse tech, EMT, nurse: prehospital care course; Doctor: EM or critical care transport	BLS, ACLS, PHTLS	

ACLS: Advanced Cardiac Life Support course. ALS: Advanced life support. BLS: Basic life support. ATLS: Advanced Trauma Life Support course. CPR: Cardio-pulmonary resuscitation. EM: Emergency medicine. EMT: Emergency medical technician. ILS: Intermediate life support. Mo: month. NA: Not applicable. PEARS: Pediatric Emergency Assessment, Recognition, and Stabilization. PHTLS: Prehospital Trauma Life Support course. Wk: week.

Table 5

Organization of emergency medical services

Site	Level	Ambulance standards	Communicate with hospital?
Ghana	National, Regional, District/Local	No	Sometimes
Kenya	National	Yes	Radio and phone
South Africa	National, Regional, Local	Yes	Sometimes
Delhi	Regional	Yes	No
Gujarat	State	Yes	No
Maharashtra	Local	Yes	Mobile phone or radio
Pakistan	National, Regional, Local	No	Yes – 1 service
Sri Lanka	Local	No	2 way radio
Vietnam	National, District	Minimal	Personal mobile phone
Brazil	National	Yes	Radio
Colombia	National, Local	Yes	Radio
Ecuador	National	Yes	Mobile phone or radio
Mexico	State	Yes	Mobile phone or radio
Panama	State	Yes	Mobile phone or radio
Peru	National	Yes	Mobile phone or radio

Table 6

Funding of emergency medical services

Site	Method of payment for patients	Source of funding	Type of non-out of pocket funding
Ghana	Free	Government	Taxes
Kenya	Self pay Insurance	Patient	None
South Africa	Free Self pay Insurance	Government or personal medical insurance	Taxes & Insurance
Delhi	Free*	Government	Taxes
Gujarat	Free	Government	Taxes
Maharashtra	Self pay	Patient	None
Pakistan	Free	Government & Private	Donations
Sri Lanka	Free	Local Authority	Taxes
Vietnam	Free Self pay Insurance	Government, insurance companies	Taxes & Insurance
Brazil	Free	Government	Taxes
Colombia	Free** Self pay Insurance	Mandatory motor vehicle insurance	Taxes & Insurance
Ecuador	Varies	Mandatory motor vehicle insurance	Taxes & Insurance
Mexico	Self pay (private) Free (Red Cross/Green Cross)	Government agencies/hospitals	Taxes
Panama	Free	State	Taxes
Peru	Free Self pay (private)	Mandatory motor vehicle insurance & government	Taxes & Insurance

* Self pay for non-emergency transport or transport to private hospital

** For motor vehicle crashes, disasters, terrorism

Table 7

Access to emergency medical services

Site	Common access number?	Access <1 hour (urban/rural) (%)	Volume (runs/thousand population/year)
Ghana	Yes	70/20	0.33
Kenya	Yes	1	ND
South Africa	Yes	60	72 ^a
India	Delhi	Yes	50–70
	Gujarat	Yes	85
	Maharashtra	No	100
Pakistan	Yes	ND	1.6 ^c 15 ^d 0.98 ^e
Sri Lanka	Yes	5	ND
Vietnam	Yes	5	ND
Brazil	Yes	100/variable	36 ^f
Colombia	Yes	100/almost 100 except remote rural areas	31 ^g 33 ^h
Ecuador	Yes	15–30/0	ND
Mexico	No	20 (main cities)	10.5
Panama	Yes	75	ND
Peru	Yes	80–100/0	13.7 ⁱ

^aKwaZulu-Natal province (urban and rural),

^bCalls (urban and rural),

^cAman foundation (urban),

^dEdhi service (urban),

^eRescue 1122 service (urban),

^fSanta Catarina state (urban and),

^gBogota (urban),

^hHuila State and Neiva City (urban and rural),

ⁱLima (urban). Data for Ghana and Mexico are nationwide, reflecting rural and urban together. Data for Delhi are urban only. Data for Gujarat and Maharashtra are statewide, reflecting rural and urban together. ND: No data.