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RESEARCH ARTICLE

A Global Emergency: Identifying Priorities for Reforming International Emergency Medical Systems

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ABSTRACT:

Emergency Medical Systems differ around the world and perform at varying levels of effectiveness. This study analyzed how well countries met the emergency response requirements for emergency medical teams set by the World Health Organization and professional literature recommendations in the three levels of country classifications set by the United Nations. This was conducted through a stratified random sample of ten countries in the categories: developed, economies in transition, and developing, for a total of thirty countries. Each country was qualitatively analyzed for emergency response times, types of public-to-provider communication, insurance/financial coverage, certification level of emergency care provider, and level of emergency hospital care. These areas were compared to the WHO recommendations and the higher standards of care recommended by the professional literature. It was found that 90% of developing countries did not meet the WHO recommendation compared to 50% of transitioning economies, and 10% of developed countries. There was a strong positive correlation between Gross Domestic Product and overall effectiveness of an EMS system. Moving forward, it is recommended that the underlying problems be identified, risk factors evaluated, possible interventions created, and implementing interventions in developing countries to improve communication from public to provider in pre-hospital care, and hospital emergency care.

Introduction:

Injury has always been a part of the human experience, and the emergency care to go along with it is almost as old. There is documentation describing the practices and procedures followed by the ancient Egyptians and Romans which included splinting and cauterization, both of which are comparable to practices used today.1 When an individual is injured, the immediate care they receive can be crucial to their survival. A well-known example of this care is in the treatment for cardiac arrest outside of the hospital setting. If Cardiopulmonary Resuscitation (CPR) is administered immediately after an individual goes unconscious, the chance of that individual surviving doubles, or can even triple.2 This is not the only intervention that should be considered. Something as simple as a tourniquet can stop major life-threatening bleeding in seconds, and medications such as epinephrine (artificial adrenaline) used in resuscitation of cardiac arrest patients, albuterol (used to reverse asthma attacks), and naloxone (an anti-opioid medication to counteract an overdose), can save individuals and restore normal breathing.

Despite the long history of these treatments, the ways they are administered in each country varies greatly, even in developed countries.3 For example, Europe has the philosophy of bringing the hospital to the patient. Some ambulances are manned by board certified physicians that drive to patients and stabilize them on scene. They are then only brought to a hospital if the physician deems it necessary. On the other hand, the American standard treatment involves rapid stabilization of patients by Emergency Medical Technicians (EMT) or paramedics, then transporting them by ambulance to a more advanced facility.4 Other systems, such as the one used in South Africa, rely on having more lower-level health care providers to respond to all emergencies and then deploy higher trained providers when necessary.5

The World Health Organization (WHO) set standards for the "Minimum Technical Standards and Recommendations for Rehabilitation" to set a global standard of care.6 These include standards for training as well as standards for advanced and specialized care. These standards were issued in 2016. In 2018 the WHO, realizing the inability for some countries to meet these standards, released a Global Emergency and Trauma Care Initiative to bridge the gap in emergency care globally. There has been no follow-up since the release of this initiative to assess how the global community is meeting these requirements. Although there have been significant advances in medicine in recent years along with increased ability to meet these requirements, this is not the case for all developing countries. Based on the historical trends of less developed countries lacking medical supplies and training, the question this study seeks to answer is:

Is there a connection between developed countries, economies in transition, and developing countries, per United Nations categories, and their ability to comply with the emergency prehospital care standards? From these findings we hope to identify what areas need to be improved for the future.

Methods:

The study compared a sample of countries' Emergency Medical Systems (EMS) capabilities to the standards set by the WHO and recommendations found in peer-reviewed literature. While assessing the initiative released by the WHO, researchers discovered that the standards were not a holistic approach to emergency medicine. The standards only covered the basics of pre-hospital care and would make it difficult to compare countries that easily went above and beyond the standards. To help balance this, the countries in question would be compared to two scales. The first would be if they met the WHO standards and the second scale would be the parameters that are recommended for EMS by professional literature.

The WHO scale has several basic areas of analysis for each country. They recommend that every country have:

- A unified dispatch system (where calling one number will give an individual access to emergency care)
- Some form of trained provider (advanced life support is not specified)
- A way to transport patients in a timely manner from the scene
- A developed hospital emergency response unit to take the patient to for further treatment.

To summarize, every country needs a way to contact trained medical personnel who are able to quickly arrive on scene and deliver the patient to an appropriate medical center.

On the other hand, the standards recommended by professionals go beyond the basic health requirements. In addition to the WHO guidelines, EMS professionals recommend having:

- Personnel trained in advanced care (medication administration and fluid therapy using intravenous or intraosseous methods)
- They also recommend having a system of insurance in place so the general public can afford emergency care.7

Due to the variety of economic development in the world, a simple random stratified sample was conducted using a random number generator. The categories for each stratum are defined by the United Nations.8 They split each of the countries into developed economies, economies in transition, or developing economies based on their overall economic status. Other criteria are considered, and many of the countries in the "economies in transition" area have attributes that could place them in either of the other areas. For the purpose of this study, the country classifications listed on the United Nations website as of 2014 will be used. To show correlation to wealth and EMS effectiveness, the current Gross Domestic Product (GDP) of each country will also be used for analysis. Each country listed was numbered then, using a random number generator, ten countries from each area were chosen, for a total of 30 countries.

Using Google Scholar and PubMed databases, each country was researched with the name of the country followed by "AND Ambulance care" or "AND Prehospital care." The search criteria were used to narrow down the search results to relevant, prehospital care articles. This provided around 50 to 100 articles in the search feature. Researchers quickly assessed each article to see if it pertained directly to EMS or if they were used for some non-emergent medical care. Only articles directly addressing EMS were used for this research. For each country, between one and four articles were chosen to represent the country's current standing in prehospital care. The most recent and pertinent articles were chosen.

The articles were qualitatively analyzed in five basic areas:

- How long it took to respond to a medical emergency
- If there was an organized dispatch system
- If advanced or basic medical care was available
- How a patient had to pay for services
- What kind of emergency hospital care was given after the patient was delivered from the ambulance.

Each country was given a score based on their adherence to the WHO and professional literature recommendations and then ranked. For example, if a country did not have a unified dispatch system, but did have emergency numbers to call, they would be given half the points for that category. If the country had no way to respond to an emergency, they would be given no points for the emergency response area. If there was no research available in a specific area, the country was given the lowest possible score for that area. GDP was also collected to help rule out confounding variables with the country classifications.

Results:

The results of this study will be broken up into three sections. The first section will compare the country results with the WHO standards, the second section will compare countries with the professional literature recommendations, and the third will show each country compared based on GDP and their overall compliance to the gold standard instead of the United Nations categories.

Out of the 30 counties that were in the study, only 50% were able to meet three out of the four requirements. This was shown in a generally linear trend for each area. Developed economies had 90% compliance, transition economies have 50% compliance, and developing had only a 10% compliance. Ten percent means that most developing countries were unable to provide consistent transport, a way of payment, or sufficient medical expertise in the ambulance.

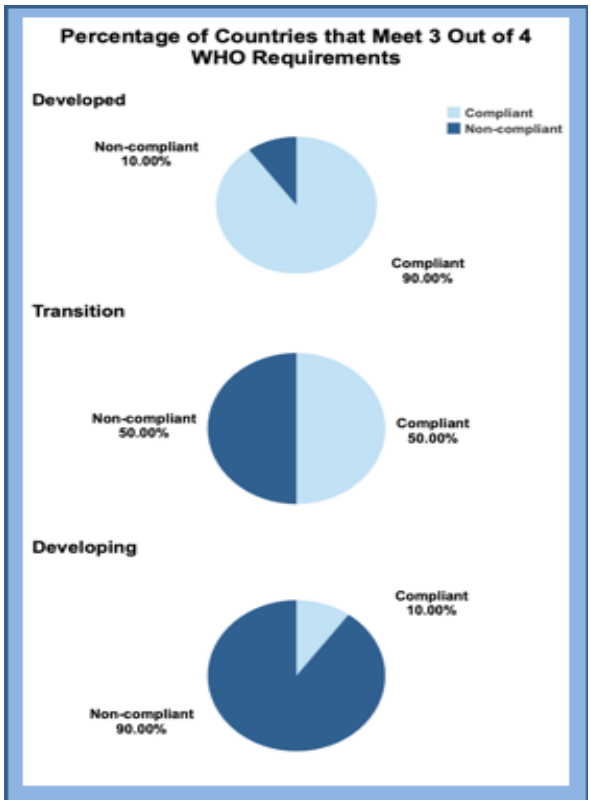

Figure 1: Each pie chart depicts the percentage of countries in each category that can meet 75% of the WHO emergency medical requirements.

The most commonly missed requirements for transition and developing economies are a lack of fast response times (some areas taking over an hour to reach), lack of an

organized dispatch system (such as 911), and lack of continuing care.

Similar trends are found in the compliance to the professional recommendations. The following chart summarizes the findings for each of the country types (see figure 2). This data shows more descriptive trends. We can see that the overall trend is the same as the WHO standards with developed economies, generally all reaching the recommended guidelines (90%) and developing economies typically not reaching the recommendations (10-20%). The trends become more interesting when looking into the economies in transition. The average compliance is 36%, but the individual standards have a much broader spread. Economies in transition have high compliance in areas such as an organized dispatch system (communication) and using advanced life support methods (such as IV use and medication), but have very low compliance with response times as well as having a solid foundation of emergency room care.

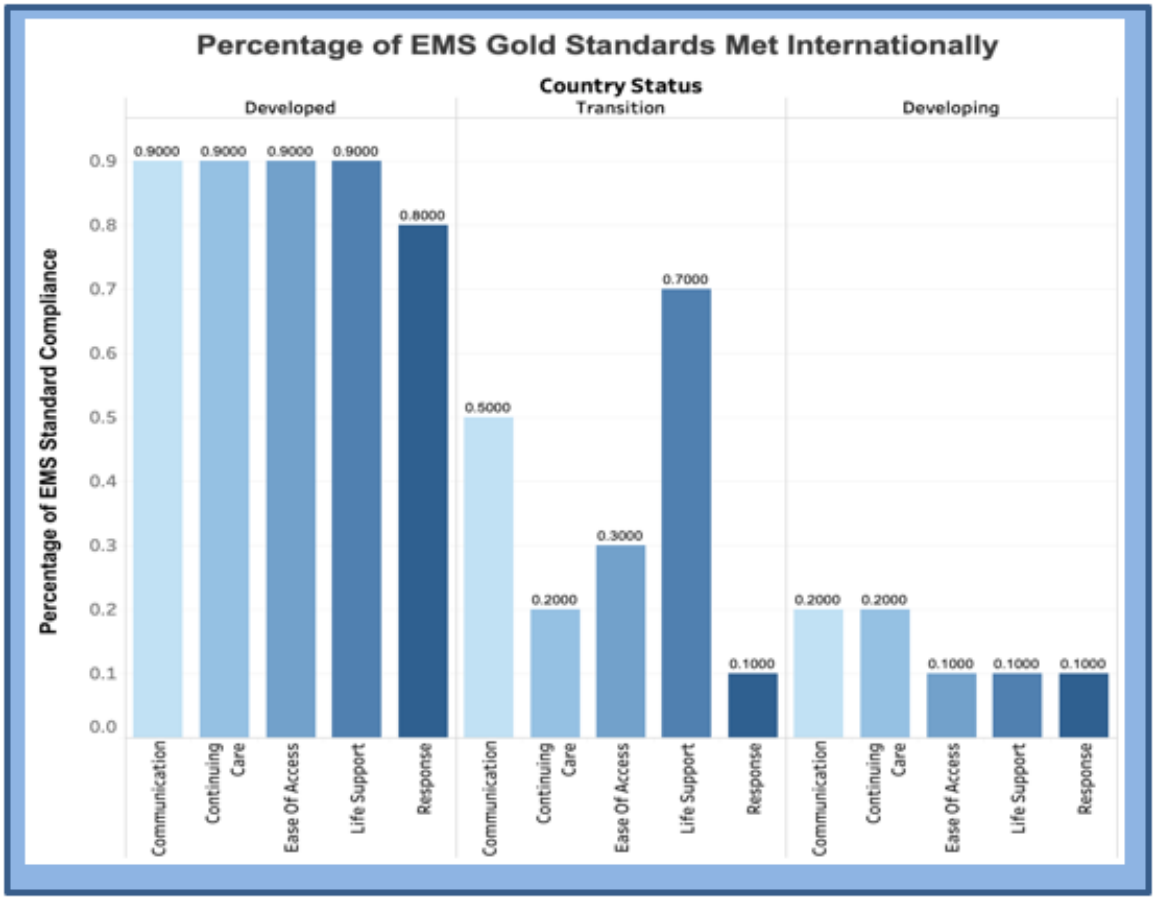

Figure 2: *Each of the three types of countries are displayed with the percentage that meet the professional recommendations. Examples of developed countries include the United States and UK, examples of transition countries are Serbia and Belarus, and examples of developing countries are Gambia and Bangladesh.*

These same trends can be seen when compliance to professional standards is compared to GDP as well (see figure 3). Typically speaking we see that the higher the GDP or the type of economy, the higher they scored on the professional recommendations. There are several outliers, but there appears to be a strong correlation between a country's GDP and their overall EMS score.

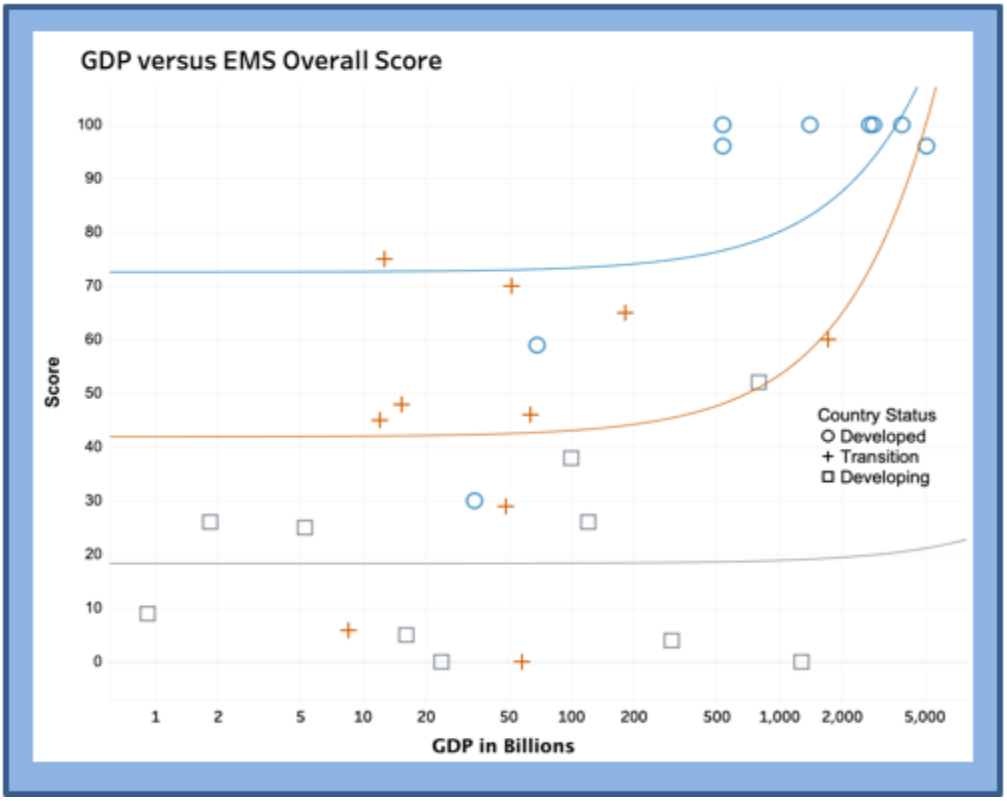

Figure 3: *Depicted is the same information in figure 2, but with the medical care score correlated with Gross Domestic Product rather than percentages. The United States was removed as an outlier to make the data easier to see.*

Discussion:

These statistics show a rising need for improvement of emergency medical resources in the global community. Many countries are unable to meet the recommendations of professionals, or even the lower standards of the WHO. They lacked the basic building blocks of structure such as a way to communicate or a way to respond to emergencies appropriately. To place this disparity in context, many of the WHO standards could be met by someone in the United States with basic First Aid Training driving a van to respond to and transport an injured or ill person.

Much needs to be done to improve these areas. Following the example of developed countries may be one way to so improve developing countries medical response. Most developed countries follow the American system or the European system. The American system consists of bringing the patient to the physician as fast as possible by highly trained emergency personnel, while the European model is to bring the physician to the patient if necessary. Both models scored well against the professional recommendations and WHO recommendations and either could be possible areas for progression for the underdeveloped systems around the world.

Areas that scored the lowest were types of dispatch systems as well as having a timely response to emergency medical situations. Both of these standard elements are directly related to each other. When countries lack communication about medical emergencies, it cripples their ability to respond. Countries with low scores generally had insufficient dispatch systems or a mix of several different dispatch systems. In South America, is was common to have several dispatch systems or, like in Cuba, to call your physician to send an ambulance.9 This meant that the number you needed to call is determined by geography. This is detrimental because it leads to difficulty determining which area should respond as well as confusing patients as to which number they need to call. In Africa, there were several areas with no dispatch system (such as Gambia).10 In order to get an ambulance, an individual would need to send someone to the hospital and then travel back with the ambulance to pick up the patient. For critical patients this adds time which will lower their chances of recovery. This could be a possible area for improvement in many developing countries.

Another roadblock in developing countries is a lack of funding. In the resolutions made by the WHO in 2019, they urged their member countries to create funding for emergency programs.

According to research lack of funding is more common in the underdeveloped countries.11 Due to this lack of funding many of the emergency medical workers in this study lacked training for their jobs. One such example of this would be comparing the United States to areas of Africa. In the United States, there are very strict legal requirements that need to be met in order to practice medicine on an ambulance as an EMT or Paramedic. In some areas of Africa, the personnel that come to pick up a patient may not have any training, or very little training.11 This can also seriously affect patient outcomes due to the lack of life saving care available. If more funding were available increasing the training of personnel would significantly increase global compliance to the WHO standards.

Due to insufficient funds, all areas of emergency care cannot be improved at the same time. Professionals recommend that emergency hospital care should be improved above other emergency care areas such as ambulance quality and equipment, prehospital training, and other prehospital care.12 This finding may seem to be contrary to the current study due to the research primarily being focused on prehospital care, but according to a 2020 study, better patient outcomes were correlated with having more advanced hospital settings rather than advanced prehospital care.7 This is promising for countries that may not have enough funding to improve both in and out of hospital care. More research will need to be done in this field, but funding emergency hospital care may help temporarily relieve the current situation and expand life expectancy in countries with lower socioeconomic status. Thankfully many of the countries who scored low on both scales showed promising growth in this area. Until recently many countries did not have emergency medicine as an area that a doctor could specialize in after medical school. Emergency rooms were typically run by general practitioners or other types of doctors that did not complete a residency in an emergency field. In recent years there has been a surge in the number of countries that are making emergency medicine a specialty and the number of emergency rooms that are staffed by emergency physicians. There is a lot of room for growth in continuing care in medical emergencies, but making emergency medicine its own specialty is a promising step in the right direction.

Conclusion:

Prehospital settings around the world exhibit various states of efficiency for emergency medical systems. Developed countries are typically able to meet professional EMS guidelines but developing countries still have many areas of improvement. Some of the target areas to improve for developing countries are creating a unified dispatch system, increasing funding for emergency medicine, and increasing emergency care in the hospital setting. In the future, more research should be conducted to discover countries that have attempted to build in each of these three ways to find a proposed method for development. With the lack of literature available for many of the developed countries, it would be advisable to search EMS data from the selected countries. This could be done by contacting emergency providers in each country and asking them to do more qualitative analysis. It is our hope that this study serves as a springboard for further research.

Limitations:

This study was done through search engines and online research. It is possible that some of this information is not the most up to date, or is not being implemented the way it is stated in literature. Due to these variables, there are some limitations that should be noted in this study. The first was a lack of availability of research articles for developing countries and countries with economies in transition. For all of the developed countries, many studies and scholarly articles exist explaining how their unique emergency medical systems work. For the other two types of economies, some research has not been done or is in limited supply. Much of the data from those countries is older than 2010 and some date back to the 2000's. As shown by the medical advancement the world has experienced in the last 20 years, there is much that could have changed since these articles were written. Despite this, there are a lot of informational trends that can be useful for further research. These were shown by geographic trends in the data. Within each continent it was very typical for countries near each other to have similar EMS structures and standards of care. This was consistent with recent country information (2015 to the present) and with older information. With this in mind, knowing that some of the data is old or out-of-date may still show trends that can be useful for analysis. Another difficulty with this study is that it only reflects the analysis of what is recorded. This may not be representative of the country as a whole or how well the written protocol is implemented. This is an area that will need to be studied further. For the purposes of this study, how well a country has planned to follow the global standards (as demonstrated through written protocol) will suffice.

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