

## **Promoting emergency medical care systems in the developing world: Weighing the costs**

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Despite the global health community's historical focus on providing basic, cost-effective primary health care delivered at the community level, recent trends in the developing world show increasing demand for the implementation of emergency care infrastructures, such as prehospital care systems and emergency departments, as well as specialised training programmes. However, the question remains whether, in a setting of limited global health care resources, it is logical to divert these already-sparse resources into the development of emergency care frameworks.

The existing literature overwhelmingly supports the idea that emergency care systems, both community-based and within medical institutions, improve important outcomes, including significant morbidity and mortality. Crucial to the success of any public health or policy intervention, emergency care systems also seem to be strongly desired at the community and governmental levels. Integrating emergency care into existing health care systems will ideally rely on modest, low-cost steps to augment current models of primary health care delivery, focusing on adapting the lessons learned in the developed world to the unique needs and local variability of the rest of the globe.

**Keywords:** emergency medicine; global health; health policy; trauma; urbanisation

### **1. Background**

Demand for emergency medical care infrastructures in the developing world has dramatically increased in recent years. Perhaps rightfully so – recent estimates place half of the current global population as living in an urban centre (United Nations 2010). Injuries are leading causes of death worldwide in all age groups. When disability due to injuries is taken into account, the problem becomes even more pronounced – at the turn of the century, an estimated 16% of the world's burden of disease was caused by injuries. Of these injuries, road traffic injuries were the leading cause of both mortality and disability-adjusted life-years (Krug *et al.* 2000). As more of the world's population moves from rural environments to urban centres, the injury-related burden of disease can only be expected to increase.

From a global health policy standpoint, the discourse around health care systems in the developing world has traditionally focused on primary health care delivery. The Declaration of Alma Ata in 1978, and its subsequent derivatives, have all tended to aim at providing basic, cost-effective primary health care delivered at the

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community level, and have concentrated mainly on prevention and simple low-cost interventions (World Health Organization 1978, Walsh and Warren 1979). However, as the nature of disease and disability changes in the developing world, many are now beginning to ask if it makes sense, from a policy standpoint, to scale up the implementation of emergency medical care systems abroad.

The recent attention towards emergency care in the developing world raises a number of important questions. With limited financial resources directed towards global health systems, does it make sense from a cost-benefit standpoint to divert funding from other health interventions into emergency medical care? Should there be global standards for emergency medical care? What are the most effective models for the delivery of emergency care? How can emergency care systems be best integrated into current health care infrastructures? Given the nascence of emergency care in the developing world, there is a paucity of scientifically rigorous data addressing these questions. The evidence is limited, for the most part, to case reports, surveys and observational studies. To that end, this paper does not represent a comprehensive systematic review of the current literature, but rather a discussion of these important questions, citing examples from the literature where relevant.

## **2. Essential elements of emergency medical care**

Ultimately, the goal of any emergency medical care infrastructure is the effective prevention of morbidity and mortality due to time-sensitive health problems. Any system designed to deliver this type of care involves three elements: community resources; transportation resources and health facility resources (Razzak and Kellermann 2002).

Community resources include the ability of a community to recognise an illness or injury as requiring immediate attention, the ability of a community to provide basic care such as cardiopulmonary resuscitation, and access to community-based interventions such as automated external defibrillators. Transportation resources include the ability of patients to access transportation to the health care facility, as well transportation-based care personnel such as paramedics and emergency medical technicians. Health facility resources involve the ability of a particular health facility to respond to acute illness. This includes human resources, medical supplies and facility infrastructure. Importantly, at all of these levels, the crux of emergency medical care relies on triage and risk assessment. No matter what the design or structure, for any system to be effective it must include the capacity to accurately recognise the acuity of illness and respond with appropriate medical interventions.

There exist many variants of this infrastructure all over the world. For example, North American and European prehospital care systems differ dramatically. In the 'Anglo-American' model, the patient is brought to the doctor, utilising prehospital caregivers such as paramedics to provide care during transport while the physician, frequently a trained emergency medicine specialist, remains at the hospital. Conversely, in the 'Franco-German' model, the doctor is transported into the community to provide care en route to the hospital – 'bringing the doctor to the patient'. The Franco-German system generally does not make use of non-physician prehospital caregivers, and frequently uses anaesthesiologists for in-hospital emergency care (Lechleuthner 1994, Dykstra 1997).

The North American and European systems can be contrasted with Hong Kong, a densely populated city where ambulance response times can be upwards of 40 minutes. In this case, the city has motorcycles equipped with defibrillators that can reach a patient in cardiac arrest in a few minutes, while the patient waits for transportation to the hospital (Lee Fu-tat *et al.* 1988). There are clearly a variety of models of emergency care, illustrating the need for emergency medical systems to address local variations in community structure.

### **3. The current state of emergency care in the developing world**

It must be acknowledged that the concept of emergency care in the developing world is not a completely new phenomenon. In 1979, Mozambique recognised the importance of emergency care systems by including emergency care as one of its four priority areas of health (Mcord 1988). In Ethiopia, local health professionals, in collaboration with physicians from Israel and the US, have developed an emergency medicine training programme to advance the level of emergency care in the country, a trend that is being mirrored in other developing nations (Bayleygne *et al.* 2000, World Bank 2000a, 2000b). The WHO and UNICEF recently developed the emergency triage, assessment and treatment (ETAT) guidelines for the triage and care of acutely ill children in developing countries (Gove *et al.* 1999). As global health policy becomes increasingly attentive to the development of emergency medical systems, there has been a movement to try to produce standardised protocols and create replicable models for delivery of care.

That being said, emergency medical care infrastructures in the developing world are still significantly underdeveloped. In a study by Schmid *et al.* (2001) of the Mwanza region of Tanzania, despite a maternal mortality rate 300 times greater than northern Europe, no community had a plan for emergency transportation to the local tertiary care hospital for urgent obstetric care, and most people believed it was the responsibility of the mother or her family. This is a common occurrence in many poor, rural communities (particularly in sub-Saharan Africa and Asia) that lack adequate roads, transportation vehicles, and have long travel distances to nearby hospitals. In the in-hospital setting, although many hospitals have accident and emergency or casualty departments, a significant portion of these are no more than points of arrival for patients with acute medical needs. Many are lacking in basic triage systems to identify the most critically ill patients. Lack of triage in developing countries has been shown to result in potentially harmful delays in treatment (Nolan *et al.* 2001). Even many middle-income countries with moderately developed infrastructures for the delivery of emergency care lack training in basic life-saving protocols that have been proven to increase survival. While the state of emergency care in the developing world has come a long way in recent years, there is clearly enormous room for improvement.

### **4. Rationalising global emergency care**

When evaluating the rationality of promoting emergency medical care systems in the developing world, two main issues immediately arise. First, does the current evidence suggest that developing emergency medical care systems positively affects desired

health outcomes, such as morbidity and mortality? And second, does developing emergency medical systems outweigh the opportunity costs?

#### **4.1. Impact on measurable health outcomes**

In response to the first question, the existing evidence overwhelmingly suggests that emergency medical systems do improve morbidity and mortality. Much of the literature focuses on standardised trauma protocols such as Advanced Trauma Life Support (ATLS) for physicians and Prehospital Trauma Life Support (PHTLS) for paramedics. In Trinidad and Tobago, both the introduction of ATLS and PHTLS have been shown to positively impact trauma patient survival. The latter was also shown to decrease length of hospital stay and reduce the severity of trauma-related morbidity (Ali *et al.* 1993, 1997). In Monterrey, Mexico, an increase in the number of ambulance dispatch sites from two to four, in addition to the training of paramedics in PHTLS, resulted in reductions in trauma-related mortality at a cost of only 16% of the annual ambulance system budget (Arreola-Risa *et al.* 2000). Another study involving three cities at different socio-economic levels – Seattle; Monterrey, Mexico; and Kumasi, Ghana – found that trauma mortality increased with longer transit times to the hospital, and both of these were inversely proportional to the number of emergency dispatch centres (Mock *et al.* 1998).

There are a host of other studies that replicate these findings (Samai and Senegheh 1997, Guiscafré *et al.* 2001, Marson and Thomson 2001). Even in extremely rural areas of Iraq and Cambodia, with prehospital transit times of over 5 hours, a simple, low-cost trauma care training programme for paramedics and laypeople in the community led to a reduction in trauma mortality from 40 to 15% (Husum *et al.* 2003). These studies show that the implementation of simple, standardised protocols at both prehospital and hospital levels and the creation of basic care infrastructures can result in direct improvements in morbidity and mortality, across a variety of different geographies and pre-existing health systems.

#### **4.2. Opportunity costs**

Perhaps a more difficult question is whether it makes sense to divert already-scarce health care dollars in the developing world into emergency medical care systems. One major problem in comparing the cost-benefit ratios of the classic primary health care approach versus emergency medical care is that there is a lack of large-scale data on emergency medicine's overall impact on lives or disability-adjusted life-years saved (Razzak and Kellermann 2002). The dilemma is certainly not trivial. Just as there are huge disparities in GDP across different nations, so too are there parallel disparities in health care expenditures: the US annually spends over US\$3000 per capita on health care, compared to Mexico's \$90 per capita and Tanzania's US\$31 per capita (Reddy 1996, US Bureau of the Census 1996, World Health Organization 2008). Given the extent of financial strain in developing world health care systems, some argue that it makes more sense to focus on alternate strategies, such as immunisation campaigns, screening programmes and other simple primary health services.

A frequently cited example of the potential for emergency medical care systems to waste health care dollars comes from Kuala Lumpur. In a 1997 cost-benefit analysis, it was determined that the establishment of a rudimentary ambulance system, of

which Kuala Lumpur had none, would cost US\$2.5 million annually, and ‘might save seven lives, three of which would be marred by significant neurological injury’ (Hauswald and Yeoh 1997). This would clearly be a poor utilisation of resources. However, the study used Albuquerque, New Mexico’s ambulance system as a model for the analysis, which is arguably an inappropriate model for a major Southeast Asian urban centre with its own unique infrastructure and health problems. Regardless of its potential flaws, the study illustrates the important point that one model of emergency care does not fit all.

This is not to say that emergency care systems should wholly replace current health care systems, or should displace other beneficial non-emergent services. On the contrary, emergency medical care integrally relies on primary care and preventive health services to maintain the baseline health status of the population, and is not designed to efficiently respond to these types of health issues. Conversely, primary health care services are not designed to optimally respond to acute life- or limb-threatening conditions. Thus, it is essential to look at the integration of emergency medical care systems into current health care delivery systems as a stepwise augmentation of services, rather than a matter of ‘replacement’ (Cho *et al.* 2005, Richman *et al.* 2007, Curry 2008). When one frames the problem in this way, given the leading causes of morbidity and mortality in the developing world, it is clear that emergency medical care has the potential to play a large role in lessening global disease burden (World Health Organization 2004).

#### ***4.3. Capacity building and augmentation of humanitarian response***

In recent years, there has been an increased critical awareness of the efficacy of global humanitarian responses to natural disasters. The devastating effects of the Southeast Asian tsunami in late 2004 and the 2010 earthquake in Haiti have shed light on our successes and failures in mounting large-scale emergency responses. A common international perception of emergency humanitarian responses is that a natural disaster wipes away local infrastructures, leaving behind helpless, needy victims and a total destruction of local resources requiring the arrival of largely western non-governmental organisations who rescue local inhabitants with their expertise in emergency response and provide health care, food, water and shelter. This surprisingly widely held perception is, in fact, a gross misunderstanding of the nature of humanitarian response. In reality, local community members provide the vast majority of manpower in emergency responses. Local communities are far more resourceful in their responses to acute emergency situations than is commonly believed (Waldman 2005). In theory, the development of global emergency medical care systems, including the training of local health care professionals and community members in standard emergency care protocols such as those discussed above, would serve to augment the local response to major natural disasters.

#### ***4.4. Local values***

A final, and absolutely crucial, aspect of the argument is whether emergency medical care infrastructures are locally desired. Evidence has shown that community ownership is an essential determinant of success for any health programme, and that improving a health system’s responsiveness to community expectations leads to

increased utilisation of services and better health outcomes (Green and Kreuter 1990, World Health Organization 2000). Ultimately, the discussion of whether it makes sense to implement emergency medical care systems in developing countries is meaningless if they are not desired or understood by local communities and governmental structures.

Evidence would suggest that emergency care systems are, in fact, desired. Studies in rural Nepal, Sri Lanka and southern Nigeria all showed that there was a strong perceived need for emergency medical services among community members. Another common theme in these studies was that community members frequently used traditional home remedies for minor, non-threatening medical conditions, but in acute conditions, community members sought care at their primary health centre (Asowa-Omorodion 1997, MacRorie 1998, Wolffers 1998). This reflects both community desire for increased emergency medical services, as well as the potentially inefficient misuse of primary health care resources for emergency care (the latter of which, unfortunately, is non-existent in many of the communities studied, leading to a necessary reliance on primary care centres for emergencies). In Nigeria, community members specifically identified a desire to have ambulances for transport during medical emergencies (Kobusingye *et al.* 2005).

## 5. Future models for emergency care

Ultimately, what do effective emergency medical care systems 'look' like? The answer is surprisingly heterogeneous. The North American, European and Hong Kong models of prehospital care previously mentioned are illustrative of the vast differences in approach to delivering emergency medical care. Perhaps the best answer to the question is that emergency medical care systems do not 'look' like any one particular entity. It is essential that emergency medical care systems adapt to local demands and to the demographics and epidemiology of disease that are unique to local communities. There is, unfortunately, a scarcity of evidence on just what these local needs are across the globe (Kobusingye *et al.* 2005). Therefore, one central area of policy intervention will be the appropriation of research funds towards understanding the epidemiology of medical emergencies in the developing world.

Finally, it is important to note that emergency care need not be high-tech or expensive, nor need it be a massive paradigm shift in global health policy. Modest, incremental shifts in the education of health care providers and the availability of emergency health care resources can result in dramatic outcomes, as has been illustrated through the examples discussed in this paper. Emergency medical care does not, and should not, equal the American paradigm of ambulances with sirens blaring and busy, high-volume emergency departments. The cost-benefit analysis of prehospital care in Kuala Lumpur is an obvious example of why the global scaling-up of emergency medical care systems should not simply be the blind application of western models of care to developing countries. This would be neither cost-effective nor appropriate. What *is* appropriate is an assessment of the resources that a particular health care system has, and building on those resources in simple ways that have been proven to affect health outcomes.

The concept of emergency care in developing countries is not new. What *is* new is the idea of implementing proven, evidence-based systems of care, and western medicine's interest in assisting developing countries to implement these systems. In

the past three to four decades, western medicine has amassed a growing body of experience in evidence-based emergency medical interventions, and thus western medical institutions are in the position to share this knowledge with the developing world. The challenge in the coming years and decades will be to ensure that western medical values are not blindly imposed on developing countries, and that systems of emergency care are sensitive to unique local medical needs while maintaining their basis in proven, evidence-based practice.

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