

# Where There is No EMS: Lay Providers in Emergency Medical Services Care - EMS as a Public Health Priority

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## Abbreviations:

EMS: Emergency Medical Systems  
HIC: high-income country  
LMIC: low- and middle-income country

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## Abstract

By 2030, road traffic accidents are projected to be the fifth leading cause of death worldwide, with 90% of these deaths occurring in low- and middle-income countries (LMICs). While high-quality, prehospital trauma care is crucial to reduce the number of trauma-related deaths, effective Emergency Medical Systems (EMS) are limited or absent in many LMICs. Although lay providers have long been recognized as the front lines of informal trauma care in countries without formal EMS, few efforts have been made to capitalize on these networks. We suggest that lay providers can become a strong foundation for nascent EMS through a four-fold approach: strengthening and expanding existing lay provider training programs; incentivizing lay providers; strengthening locally available first aid supply chains; and using technology to link lay provider networks.

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## Introduction

Every year, 5.8 million people die from injuries worldwide.<sup>1</sup> This comprises 10% of all deaths, more than malaria, HIV/AIDS, and tuberculosis combined.<sup>2</sup> While injury deaths include homicides, suicides, and diverse accidents, road traffic accidents are responsible for the majority of trauma-related deaths. By 2030, road traffic accidents are projected to be the fifth leading cause of death worldwide: the vast majority of these deaths—approximately 90%—occur in low- and middle-income countries (LMICs), where road traffic accidents account for the second leading cause of death in young adults and children.<sup>3,4</sup> In coming years, the number of injury-related fatalities is expected to increase as rising incomes put more vehicles on the road, outstripping countries' abilities to develop the infrastructure and regulations necessary for safety. The relatively few LMICs with trauma systems could see injury rates that surpass medical capacity, and those without formal trauma systems—especially rural areas—will see a growing, unmet need.

High-quality, prehospital trauma care is crucial to reduce the number of trauma-related deaths. Prehospital trauma deaths are higher in developing countries, where Emergency Medical Systems (EMS) may be basic or absent altogether.<sup>5</sup> Trauma mortality in LMICs can be as high as 40%-50%, with the majority of deaths occurring in the prehospital setting.<sup>6</sup> With road traffic accidents on the rise, improving prehospital trauma care is an important public health priority, with evidence illustrating that improvements in prehospital trauma care are a cost-effective method of reducing trauma mortality in diverse LMICs.<sup>7</sup>

Prior research and interventions in LMICs have found that attempting to imitate high-income country (HIC) prehospital trauma care systems in LMICs often results in high expense and minimally improved outcomes.<sup>7,8</sup> The challenges facing EMS in HICs—defined by the World Bank (Washington, DC USA) as having a gross national income per capita of US\$12,736 or more—are very different from the challenges facing EMS in LMICs.<sup>9</sup> The infrastructure challenges alone in LMICs often prove burdensome: they include unpaved roads, congested traffic, poorly designed (and usually ignored) traffic control systems, unmarked roads and sidewalks, and lack of a universal access phone number. In Kuala Lumpur, Malaysia, ambulances were unable to locate the patient in 20%

of calls due to inadequate infrastructure, such as limited signage.<sup>8</sup> This system was modeled after a North American EMS and designed primarily to respond to cardiac arrests. It was estimated to cost \$2.5 million per year and saved only seven lives.

Attempts to mimic the trauma systems of HICs often perpetuate the myth that trauma care is too expensive and complex to be a priority in resource-poor settings. Investments in expensive equipment, such as ambulances, often fail to create gains in survival as a result of systemic problems, such as insufficient staffing, supply chains, and maintenance.<sup>1</sup> However, significant gains in trauma survival have been made with the relatively low-cost intervention of targeted training programs. A first responder training program in Uganda found that the cost per life-year saved in their program was US\$25–\$150.<sup>10</sup> An Emergency Medical Technician training program in Mexico costs only US\$212 for every death averted.<sup>11</sup> In contrast, the distribution of HIV medication in Uganda costs US\$600 for every life-year saved.<sup>12</sup> This cost effectiveness is not seen in systems that attempt to imitate HIC trauma care; the program in Malaysia costs US \$596,000 per death averted.<sup>13</sup>

In response to the great need for trauma care, informal pre-hospital care networks have spontaneously arisen in LMICs where formal EMS are limited. These informal networks are composed of commercial drivers, police officers, and community members. Even in countries where EMS exist, family members often call commercial drivers rather than EMS to transport trauma victims to a hospital.<sup>14–16</sup> Many of these drivers provide some level of care, regardless of whether they have received training or not.

### A Brief Review of Lay Provider Training Programs

Although lay providers have long been recognized as the front lines of informal trauma care in countries without formal EMS, few efforts have been made to capitalize on these networks, and fewer still have proposed using them as the foundation of an emerging trauma system. While there are a limited number of publications outlining lay provider training programs, the few that have been published suggest that lay providers may provide effective trauma care and reduce prehospital mortality when given appropriate training.<sup>3,5,13,17</sup>

In 2003, Husum et al introduced “The Village University” concept of providing prehospital trauma care in Iraq and Cambodia.<sup>5</sup> These countries shared the challenge of treating trauma inflicted on civilians by land mines leftover from recent conflicts. Their program recruited well-respected, literate students to undergo intensive, paramedic-level training. These students were then responsible for training 50 “village first responders” over a two-day period in their home areas. Trauma mortality decreased from 23.9% to 8.8% within four years. A follow-up study done five years later showed that 70.0% of participants were still working as paramedics in their communities, and prehospital mortality rates had plummeted from 40.0% to 9.0%.<sup>18</sup>

In contrast to the program in Iraq and Cambodia, which trained literate students, a program in Ghana sought to train commercial drivers with varying levels of literacy.<sup>3</sup> This program integrated three approaches in order to accommodate the different degrees of literacy within their training cohort: didactic lectures; hands-on skills learning; and training videos produced by the American Red Cross (Washington, DC USA). This program found that hands-on training was the most effective teaching method for their population.<sup>19</sup>

Another program in Uganda recruited police, community members, and taxi drivers to receive training. Each participant underwent day-long, basic first aid training and was provided with a free trauma kit. Within six months of the training, 97.0% of the participants had used at least one skill taught in the course. At six-month knowledge evaluations, trainees answered 92.0% of questions accurately, with police scoring the highest; however, the trauma kits were rapidly depleted and difficult to restock, even with restocking support provided by the training program.<sup>10</sup>

A taxi driver training program in Madagascar circumvented restocking difficulties by using commonly available materials—like towels and string—in their first responder course.<sup>17</sup> While the effectiveness of this program has not yet been published, focusing on commonly available materials may circumvent the need for establishing supply chains to restock trauma kits.

Given the limited number of published programs, it is important to interpret these positive results with caution. A number of training programs are likely to be unpublished or have null results, and without performing a critical review of these programs, it’s difficult to say whether most lay provider training programs have been a success. However, this limited number of programs suggests that training lay providers can reduce prehospital trauma mortality rates.

### The Role of Lay Providers in EMS: A Four-Fold Approach

While many authors have iterated the practicality of training lay responders in countries with no formal EMS, few efforts have been made to enlarge these training programs. A strong EMS system could arise from these existing networks of lay providers through a four-fold approach: first, strengthening and expanding existing training programs; second, incentivizing providers; third, strengthening supply chains; and fourth, using technology to link lay provider networks.

First, lay provider training programs could be formalized, supported, and enlarged. Many training programs have been stand-alone efforts with limited higher-level support from governments or aid organizations. Most programs have had a limited timeframe without plans for continuation. Furthermore, the majority did not include the “training of trainers” in their courses, limiting the ability of the program to spread beyond its original cohort: the sustained success of the Iraq/Cambodia program provides evidence for the effectiveness of the “training of the trainers” approach.<sup>18</sup>

Second, providers should be given appropriate incentives for providing patient care. It is impractical to suppose these providers would be willing to undergo training and provide a higher level of care without appropriate compensation. While many of the participants in these training programs acted without incentives, the most successful program allocated a modest salary to trainees for providing emergency care, which allowed them to supplement their income from their primary occupation.<sup>5</sup> Appropriate incentives, such as a salary or increased standing within the community, are vital to the long-term survival of these projects. The entity providing these incentives—whether government, aid agencies, or private individuals—is a matter of debate and of local resources.

Third, reliable supply chains should be established to ensure lay providers’ access to necessary materials. While investing in endotracheal tubes may not be a priority when relying on lay providers, ensuring a reliable supply chain of basic first aid supplies is a priority, as shortages were a common challenge among training programs.<sup>5,13</sup> Providing ongoing training is also critical, as at least

two training programs identified persistent knowledge gaps in later evaluations, such as the use of universal precautions.<sup>3,17</sup>

Fourth, using technology to link lay providers could enhance their efficacy with minimal investment. There are five billion cell phone subscriptions worldwide, and 70% of these subscriptions are in LMICs.<sup>20</sup> Despite the widespread availability of cell phones, universal access numbers are either infrequently used or absent in many LMICs, and the numbers connect to ambulance services rather than lay providers. What if universal access numbers were linked to a dispatcher who could use cell phone data to view the GPS coordinates of hundreds of commercial drivers? Dispatchers could then notify the commercial driver closest to the scene of the accident. If the majority of commercial drivers had basic first responder training, this system would capitalize on

the large, pre-existing network of technology with minimum investment.

The use of lay providers is not a perfect solution to providing EMS in LMICs. Regulation of providers may prove challenging, along with standardization of the level of care provided. But while it is an imperfect solution, building on the foundation created by lay providers is a practical method to rapidly develop EMS in LMICs. In order to be successful, prehospital trauma care systems in LMICs should reflect local circumstances, capitalize on available resources, and be viewed as acceptable within the cultural framework. These informal lay provider networks are uniquely well-adapted to these criteria. With proper support and training, these networks can be strengthened, providing opportunities for employment while decreasing prehospital trauma mortality rates.

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