Placing Emergency Care on the Global Agenda

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Emergency care serves a key function within health care systems by providing an entry point to health care and by decreasing morbidity and mortality. Although primarily focused on evaluation and treatment for acute conditions, emergency care also serves as an important locus of provision for preventive care with regard to injuries and disease progression. Despite its important and increasing role, however, emergency care has been frequently overlooked in the discussion of health systems and delivery platforms, particularly in developing countries. Little research has been done in lower- and middle-income countries on the burden of disease reduction attributable to emergency care, whether through injury treatment and prevention, urgent and emergency treatment of acute conditions, or emergency treatment of complications from chronic conditions. There is a critical need for research documenting the role of emergency care services in reducing the global burden of disease. In addition to applying existing methodologies toward this aim, new methodologies should be developed to determine the cost-effectiveness of these interventions and how to effectively cover the costs of and demands for emergency care needs. These analyses could be used to emphasize the public health and clinical importance of emergency care within health systems as policymakers determine health and budgeting priorities in resource-limited settings. [Ann Emerg Med. 2010;56:142-149.]

0196-0644/$-see front matter

doi:10.1016/j.annemergmed.2010.01.013

INTRODUCTION

Establishing a health research agenda in developing countries has increasingly been recognized as crucial in determining health and budgeting priorities in resource-limited settings. Yet the concept of emergency care has largely been overlooked or, at times, disregarded as beyond the reach of health systems in resource-limited settings. Traditionally, research in these settings has generally existed within, as stated by the Commission on Health Research for Development, "vertical programs which are not fully integrated in the national health research picture and therefore do not contribute optimally to the development of a strong and self-reliant national health research system."[1] Certain devastating diseases, such as HIV,[2,3] malaria,[4,5] and tuberculosis,[6,7] have received widespread funding attention, leading to important basic science research, clinical trials, cost-effectiveness analyses, and implementation strategies. However, although these vertical programs help to broaden the frontiers of knowledge concerning specific diseases, there is a paucity of information about how to best deliver care in resource-limited settings.

One area of investigation that has been long neglected on the global health research agenda is that of emergency care in lower- and middle-income countries.[8,9] Significant efforts have been made by those within the emergency medicine community to highlight the need for emergency care research, but outside of this field emergency care has attracted little attention. Acute medical and surgical needs grow increasingly important as populations undergo the epidemiologic transition from communicable diseases to noncommunicable diseases.[10] Thus, policymakers should be increasingly aware of the abilities or inabilities of their health systems to respond to these needs.

Emergency care encompasses more than emergency medicine as practiced in developed countries. It can be conceptualized as the ability of a health system to provide access to acute health care, such as injury stabilization and initial treatment of acute illnesses, many of which are not preventable. However, emergency care can also serve as an access point for other health care services, such as preventive care and more definitive medical care. There is a critical need for documenting the role of emergency care within specific health systems and its effects on overall morbidity and mortality. Emergency care should be thought of more broadly as a means of meeting important health care needs for a population, rather than as just a location of care delivery. We argue that emergency care should be on the list of essential priorities to be studied in lower- and middle-income countries. Research on the importance of emergency care and its cost-effectiveness can enhance a meaningful appreciation of the need for and role of emergency care services in resource-limited settings. Emergency physicians interested in global health should understand these issues to initiate discussions with those outside of the specialty concerning the importance of emergency care in lower- and middle-income countries.

PAUCITY OF DATA ON EMERGENCY CARE IN HEALTH SYSTEMS

Traditionally, emergency care has often been conceptualized as peripheral and costly health care services that only well-developed and well-funded health systems are able to offer, in comparison to primary care services, which are frequently touted as low cost.[11,12] This emphasis on primary care resulted from the International Conference on Primary Health Care, held in Alma-Ata in 1978. The 1978 Declaration of Alma-Ata emphasized primary health care as a method of achieving "health for all." This declaration, adopted by the World Health Organization (WHO), defined primary health care as "essential health care based on practical, scientifically sound and socially acceptable methods and technology made universally accessible to individuals and families in the community . . . ."[13] Although the primary health center has been emphasized as a site for primary health care delivery,[14] in fact emergency and urgent care are also often provided in this setting. Moreover, although primary health care is often equated with the delivery of preventive care, emergency care also has an important role in the prevention of further morbidity and mortality (eg, related to injuries and obstetric conditions). Therefore, it can be and has been argued that emergency care should be regarded as an "essential" service and not solely as a luxury of developed countries.[15] Both primary health care and emergency care services are critical for a functional health care system. Nevertheless, research on essential health care that is time sensitive and emergent has suffered from a relative neglect in the global health agenda, both in terms of health systems and research to guide system development and management.

This problem is highlighted by how health care funds are currently spent in lower- and middle-income countries, particularly for research. Certain diseases and conditions have received disproportionate attention in the public health agenda. Much has been allocated to infectious diseases such as HIV, tuberculosis, and malaria. Addressing the burden of disease attributable to these conditions is a critically important task, but some have voiced concerns that these funds have diverted resources away from other interventions for treatable conditions that could be delivered at reasonable cost within an emergency care setting.[16] For example, road traffic injuries are projected to be the sixth-leading cause of death and third-highest cause of disability-adjusted life-years by 2020, far exceeding the burden from any single infectious disease. Nonetheless, road traffic injuries have received comparatively little attention in lower- and middle-income countries as a major cause of death. The amount of global research dollars on a per-disability-adjusted life-year basis allocated to road traffic injuries ($0.83USD) compared with HIV ($85.21USD) reflects these priorities.[17] Research activity in the field of injury and injury prevention has correlated poorly with the injury burden in resource-limited settings,[18] and little empirical evidence exists in this field to support policymaking. One analysis of 90 randomized controlled trials relevant to the leading causes of disease burden identified only 1 study in the area of road traffic injuries, and this study received the lowest relevance rating by experts who were asked to rate these trials by their importance to international health.[19] Although researchers can launch fruitful careers related to specific diseases, for example, in HIV cost-effectiveness and implementing trials of tuberculosis treatment regimens, few researchers have aggressively pursued important epidemiologic and cost-effectiveness research in health conditions related to emergency care, such as injury and road traffic safety.[20-25]

A significant proportion of emergency care includes surgical care.[26] The second edition of the Disease Control Priorities project has opened a more public discussion of the surgical burden of disease.[27] However, the authors of this chapter observed that there were essentially no data of value available in the literature, and their own estimates were based on only 14 surveys completed by surgeons in various parts of the world and applied to disability-adjusted life-year numbers from the 2002 *World Health Report*. Their initial inquiry revealed that 81% of surgical disability-adjusted life-years result from injuries, malignancies, obstetric complications, congenital anomalies, cataracts and glaucoma, and perinatal conditions.[28] In terms of the cost-effectiveness of surgical interventions, preliminary explorations suggest that hospital-based interventions such as treatment of appendicitis ($36USD per year of life saved) and hernia ($74USD per year of life saved), compared with other interventions such as AIDS treatment ($1,282USD per year of life saved) or packages of infant growth monitoring ($586USD per year of life saved), should be considered in an integrated package of health care services in resource-limited settings. These analyses, however, did not include other broader emergency care or surgical interventions.[29]

Because of the paucity of data, there are considerable challenges specific to the quantitative evaluation of emergency care services. The dearth of information about the basic epidemiology of emergency conditions makes any attempt to evaluate the cost-effectiveness of emergency care formidable. Additionally, the field of economic inquiry within the field of emergency medicine is less developed than in other fields such as infectious disease. For example, health economists have applied Markov modeling and Monte Carlo simulation to study HIV and other infectious diseases, but little has been done in the field of modeling states of health resulting from medical and surgical emergency conditions.

MEASURING THE IMPORTANCE OF EMERGENCY CARE

WHO has suggested a systematic approach to resource allocation for strategic health research that includes calculating the burden of disease, judging the adequacy of the current knowledge base, and assessing the current level of effort.[8] More recently, the Child Health and Nutrition Research Initiative has proposed a systematic methodology for setting health research investment priorities that has been used successfully in a variety of contexts.[30-36] However, this methodological approach to

health systems research has not been applied to emergency care, a field in which the dearth of even basic descriptive statistics limits informed policymaking and resource allocation. Two concepts often used in policymaking to determine priority setting are evaluating the burden of disease and cost-effectiveness analysis. These concepts can be applied to the field of emergency medicine to develop and support research on emergency medical and surgical conditions in lower- and middle-income countries.

Burden of Disease

There has been a significant effort to define the burden of various illnesses and injuries during the past 20 years, including recent efforts associated with revisions of the Disease Control Priorities in Developing Countries project.[27,37,38] However, quantifying the disease burden related to urgent and emergency conditions has been a more difficult task. Burden of disease estimates are traditionally disease focused ("vertical") as opposed to systems based[39] ("horizontal"). Yet a considerable portion of the morbidity from many diseases can present as an emergency. Separating the emergency component of a disease from other aspects can be difficult.

Quantifying the urgent and emergency aspects of disease burden should be approached systematically. For any specific disease or injury, there can be a variety of urgent or emergency presentations, so defining what constitutes an urgent or emergency condition is the first task. Additionally, many individuals in lower- and middle-income countries often do not seek care until a disease is in its later stages,[40-42] in part because of the lack of access to appropriate and affordable health care, and thus they may be at risk for more emergency presentations. Treating those who present with an emergency could significantly reduce the morbidity and mortality of certain conditions. As an example, the treatment of all hernias at risk for strangulation or incarceration would be prevented by elective surgery, but for countries with limited resources and few surgeons (eg, Malawi, with one Malawian general surgeon for the entire country of 12 million people[43]), this may not be a feasible strategy. Yet because the complications of not treating an incarcerated hernia can result in severe morbidity and mortality, it is likely that emergency treatment of this entity could be cost-effective. The relationship of the health care system to these calculations, as with all burden-of-disease calculations, would be dynamic and subject to the ability of the health care system to attend to the needs of its population. Thus, this example illustrates the dynamic nature of need, as well as how existing health services can affect the analysis of cost-effectiveness.

This example also illustrates a second aspect of a comprehensive definition of emergency care as it relates to measuring the burden of disease. Although emergency care is often thought of only as curative medicine, there are important elements of prevention as well. For instance, treatment of a peritonsillar abscess or cellulitis should be regarded as secondary prevention against the development of a retropharyngeal abscess. Similarly, early treatment of a foot ulcer could prevent osteomyelitis. These benefits should also be quantified. In addition, elements of emergency care can be provided in a range of settings, from the community (eg, direct pressure for hemorrhage control after an injury) to the district hospital (eg, emergency cesarean section for obstructed labor) to subspecialty hospitals (eg, removal of epidural hematoma after severe brain trauma).

As shown above, quantifying the burden of emergency need extends beyond simply calculating the incidence and prevalence of traditional diseases. Rather than studying presentations to an emergency department by using cross-sectional surveys, or creating a list of "emergency" entities, we propose an alternative method consisting of using existing burden of disease calculations to model the burden of emergency care. For example, one could theoretically calculate the percentage of chronic obstructive pulmonary disease presenting as acute respiratory distress, benign prostatic hypertrophy presenting as acute urinary retention, or malaria as cerebral malaria. The annual burden of emergency obstetric care could be calculated according to knowledge that 15% of all deliveries will develop emergency complications.[44] Thus, the burden of emergency care could be derived by adding the urgent and emergency components for each disease, across conditions or diseases. Because nearly all injuries have acute presentations, the percentage of a specific injury presenting urgently or as an emergency would be 100%. Thus, it is important to obtain more accurate numbers for the increasing incidence of injuries.[45] Some country-specific modifications of this formula might be needed because the percentage of urgent or emergency presentations for a specific disease may vary, depending on the available access to health care. Finally, sensitivity analyses could be performed to determine how burden of emergency care estimates vary according to specific assumptions in different countries.

Cost-Effectiveness Analysis

Burden of disease is only one important determinant of how health care dollars should be spent. Of equal importance from a health systems perspective is the cost-effectiveness of disease identification and treatment. Conceptually, the idea of cost-effectiveness is well understood by most emergency physicians. Consider the case of intracranial injury or traumatic brain injury, which is the leading cause globally of nonfatal injuries from road traffic injuries, composing almost 25% of all road traffic injuries, at 85.3 per 100,000 persons.[46] In sub-Saharan Africa and Latin American, the rate is nearly twice that (150 to 170 per 100,000 persons).[25] Although intracranial injury is often thought to be fatal, research shows that fewer than 5% of patients with traumatic brain injury die from their immediate injuries.[47] A significant proportion of the remaining patients will experience long-term disability, with lifetime care costs in the United States averaging $600,000 to $1,875,000, a figure that does not include opportunity costs to the individual or family, as well as costs to social services systems.[48] If early

emergency intervention such as intubation to prevent inadequate oxygenation or ventilation or protection from obstruction[48] (which is the standard of care for patients with severe trauma) could reduce the severity and length of required rehabilitation in a developed country from 18 months to 3 months, for example, as well as alleviate the future consequences of traumatic brain injury, then early emergency intervention might be considered cost-effective compared with other interventions with less robust effects on outcomes.

In global health, interventions are typically compared by using a measure of disease burden reduction such as cost per disability-adjusted life-year averted. The calculation of cost-effectiveness ratios requires that both the expense and the effectiveness of an intervention be known, ideally measured for each intervention in the same context.

Although a technical discussion of how to determine true costs is beyond the scope of this article,[49,50] the concept of measuring costs is straightforward. The components of the cost related to delivering emergency care interventions may vary for a specific intervention, depending on the resources available in a specific country. Just as in primary care, emergency interventions require significant investment in infrastructure. However, many emergency interventions may not require the construction of a new emergency facility. In many settings, different types of health care facilities already exist, ranging from primary health clinics, to hospitals staffed by general practitioners or specialists, to tertiary care centers. Emergency delivered care can be incorporated into each of these settings,[51] and portions of those facilities could be transformed into rooms that provide emergency-oriented services for specific times of the day, with personnel trained to perform simple procedures or make appropriate triage decisions and referrals. These facilities need not be staffed with physicians but could in some cases be staffed with paraprofessionals such as assistant medical officers. Such systems interventions could affect the cost component of cost-effectiveness analyses.

Many cost-effectiveness studies of nonemergency interventions may apportion a small overhead or fixed cost of facilities, with an implicit assumption that the existing infrastructure is capable of supporting the new program under investigation. In one review of interventions aimed at reducing mother-to-child HIV transmission in sub-Saharan Africa, only 2 of 9 studies attempted to estimate the cost of additional staff and facility requirements.[52] Cost approximations for emergency interventions therefore need not necessarily assume that the fixed costs of a new site of care must be incorporated into the calculations. In some situations, utilization of existing facilities may be preferred when attempting to estimate the cost-effectiveness of an emergency intervention.

Effectiveness data are often more difficult to obtain but might be extrapolated from similar interventions in high-income countries. In some cases, however, de novo analysis within the local context may be required. As recognized in the literature on the cost-effectiveness of interventions in resource-limited settings, randomized controlled trials may be prohibitively expensive, suggesting a role for modeling techniques instead.[53]

Briefly, the purpose of effectiveness modeling is to represent the complex processes of the real world in a stylized fashion. Modeling techniques in health care range from straightforward decision trees of fixed health states to more complex Markov models that account for transitions to and from different health states.[54] Fortunately, most acute interventions in emergency medicine are well suited for simple decision trees. More complex modeling techniques are generally more appropriate for chronic or infectious diseases, in which patients may transition to and from different states of health during a lifetime. For most emergency and urgent conditions, the interventions performed in the emergency setting are curative (or not) and require less consideration of complex health-state transitions.

In terms of effectiveness measures, there are numerous outcomes that are in current use, with the 2 most common being the quality-adjusted life-year and the disability-adjusted life-year. In general, most developed countries such as Canada and the United Kingdom (where system-wide resource allocation policies are often based on cost-effectiveness studies) use the quality-adjusted life-year,[55] whereas research in resource-limited settings more typically relies on the disability-adjusted life-year.[56]*

With both cost and effectiveness data, the ratio of costs per disability-adjusted life-year can then be calculated for each intervention to address different medical conditions. This calculation could then be added across all interventions to obtain an overall estimate of the cost per all disability-adjusted life-years averted through emergency care or, alternatively, for key interventions to obtain an estimate of disability-adjusted life-years averted from a basic package of emergency care interventions.

The complexities of cost-effectiveness analysis, especially in lower- and middle-income countries, should not be minimized. For example, it may be reasonable to assume in one country a constant return to scale for many health service locations and treatment programs. However, in other settings, a large proportion of the total cost may be driven by fixed costs of capital for facilities and equipment.[57] From a different perspective, it has been proposed that emergency care and trauma care enjoy significant economies of scale so that, once developed, the incremental costs for care decrease as services expand. In studies based on US data, some researchers have found that the marginal cost of emergency care is low.[58,59]

*Traditional cost-effectiveness analyses use dollar amounts to judge the health outcome gained, such as number of cases of poliomyelitis avoided. To obtain a comparable denominator, then, the health economics literature specifically uses the term *cost-utility analysis*. However, the term *cost-effectiveness* is used loosely in this article, as elsewhere in published literature, to connote the idea of measures that allow evaluation of interventions in terms of cost with a comparable health outcome.

In many low-income countries, out-of-hospital and emergency care systems are at nascent stages of development.[60,61] Research studies in emergency and surgical care may be encumbered by questions about whether one should assume that these systems exist, and if they do not exist, how will they be developed. Thus, in development of a cost-effectiveness analysis for a specific country, it may be prudent to begin implementation of those known effective and inexpensive treatment modalities ("low-hanging fruit").

Finally, although there has been little work done on the cost-effectiveness of emergency care as a whole, small studies suggest that district hospitals can provide cost-effective surgical care (much of which consists of surgical procedures or interventions that fit into the definition of emergency care), with some estimates ranging from $33USD per disability-adjusted life-year gained in sub-Saharan Africa to $94USD per disability-adjusted life-year gained in Latin American and the Caribbean.[28] These costs compare favorably with antiretroviral therapy for HIV, which may cost $300 to $1,800USD per disability-adjusted life-year gained.[2,62] In terms of resource allocation, one could see how these estimates of cost-effectiveness at the systems level could be useful in informing decisions to allocate funds to tertiary hospitals compared with district hospitals (which are relatively underfunded[63]), as well as informing decisions to allocate funds to specific diseases. These estimates are extremely approximate, and further research should be undertaken to be able to make true comparisons across interventions or across health system priorities.

In moving ahead with the research agenda for emergency care, cost-effectiveness studies should be completed with knowledge of the existing health systems, rather than considering interventions atomistically. Although cost-effectiveness analyses can be helpful in describing the health care resources needed to treat certain disease presentations, it may be more helpful to develop estimates of costs from a systems perspective. Just as primary health care can be viewed as a "package" of care, emergency and surgical services should begin to receive similar study and attention.

DEVELOPING A RESEARCH AGENDA FOR EMERGENCY CARE IN GLOBAL HEALTH

Research in emergency care falls within, as Jamison et al[64] point out, "core functions" of international health organizations because they can be viewed as public goods. There has been significant effort by some to place the broad concept of emergency care on the global health agenda through such venues as the WHO *Guidelines for Essential Trauma Care*,[65,66] the *Pre-hospital Trauma Care Guidelines*,[67] and the essential obstetric care guidelines.[68] Similarly, the WHO Office of Essential Health Technology produced integrated management for emergency and essential surgical care training tools and a manual, *Surgical Care at the District Hospital*.[69] Yet the ability to implement these guidelines has been hampered by both lack of funding and lack of consistent attention from other global health and funding organizations. In the end, conducting research to quantify the burden of emergency conditions and the cost-effectiveness of interventions will require supported collaboration between researchers and individuals who have knowledge of health services in developing countries or cost-effectiveness analysis. Why has more not been done? One of the main limitations that impedes the understanding and development of emergency systems is that there are few researchers in these contexts who are adequately trained or funded to do this work. The challenge is to emphasize to funders and stakeholders the critical point that inclusion of emergency systems (and consideration of the delivery of emergency care) within developing health care systems is both feasible and desirable, even for low-income countries. The chosen package of interventions will obviously differ across countries, which illustrates why research in these settings could be vital in informing these policy decisions.

Research to address the lack of high-quality epidemiologic data on emergency care could begin with hospital chart reviews, field studies, interviews with communities and providers, and analyses of data already collected from various nongovernmental organizations such as *Medecins Sans Frontieres* that have implemented interventions in lower- and middle-income countries. Although each method will contain flaws and potential biases and may be only partially complete, these efforts can serve as an entry point into clarifying the burden of disease and costs of emergency care. There has been an increasing emphasis on establishing surveillance systems in resource-limited settings to build more infrastructure, including training of field epidemiologists, but most are targeted toward infectious diseases (eg, the Integrated Disease Surveillance and Response, first developed in Africa).[70] Yet with increased electronic data systems and Internet availability, there have been more efforts to coordinate across data systems for the purposes of obtaining better indicators and surveillance for public health, of which emergency care is a central component.

Some potential policy options may encourage research in emergency care. For example, national indicators for essential emergency care could be developed, as has been done for other public health interventions such as immunizations. These indicators could help describe effective coverage for a range of services, as has been done in Mexico, although currently not for emergency services.[71] One way to do this would be to incorporate the surveillance of emergency presentations into demographic surveys. Large-scale demographic surveys would present opportunities to further define the incidence of injuries, explore health-seeking behavior, and identify relationships between socioeconomic indices and emergency care.

Researchers from many organizations must assist in this considerable task, from the technical bodies of WHO, to private groups that aim to help direct funds appropriately, to academic institutions with an international interest or presence. It is also of critical importance that funders, who often direct research and intervention priorities, recognize the value, as well as the

ability, of emergency care to contribute positively to health systems and, ultimately, health.

CONCLUSION

This article delineates the need for increased research activities and better measurement of the role of emergency care in developing countries. A critical component of this need is for health practitioners, researchers, and policymakers globally to be aware of the large and growing societal demand for emergency care. Many communities often judge the success or failure of their government by the government's ability to provide critical infrastructure, such as security and access to critical health care services.[12] Politically and socially, emergency care contributes to the 3 basic functions of a health care system: to improve the health of a population, respond to their expectations, and protect against the financial costs of ill health.[12] The key questions for governments therefore are how to integrate emergency care within the overall health system structure and at what cost. Through initiating a comprehensive research agenda, in concert with implementing known cost-effective interventions, governments can begin to answer these difficult questions.

Our aim is to encourage research that exposes policymakers to "a wider range of validated concepts and experiences than those that can be drawn from the normal time-limited and politically constrained processes of policy deliberation."[72] Research allows policymakers to make well-informed decisions and should therefore be incorporated into policy agenda setting, policy formulation, and policy implementation.[73] Furthermore, research on the value of health in these contexts will provide evidence of the potential health gains that exist in lower- and middle-income countries.[74]

Emergency care should be a priority within global health research to improve the delivery of needed services and to influence policy. Using research to document the critical role of emergency care is an important step to confirming the importance of this component of a functional health care system. Additional considerations should then be given about how to effectively cover these health needs. These analyses can be used to emphasize the public health and clinical importance of emergency care within health systems as governments determine health priorities and make resource allocation decisions in limited-resource settings.

Supervising editor: William R. Mower, MD, PhD

Dr. Callaham recused himself from the decisionmaking about this article.

Funding and support: By *Annals* policy, all authors are required to disclose any and all commercial, financial, and other relationships in any way related to the subject of this article that might create any potential conflict of interest. The authors have stated that no such relationships exist. See the Manuscript Submission Agreement in this issue for examples of specific conflicts covered by this statement.

Publication dates: Received for publication November 19, 2008. Revisions received April 21, 2009; September 22, 2009; and November 26, 2009. Accepted for publication January 11, 2010. Available online February 6, 2010.

Reprints not available from the authors.

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