Cardiopulmonary Resuscitation in Resource-limited Health Systems–Considerations for Training and Delivery

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Abbreviations:
AED: automatic external defibrillator
BLS: Basic Life Support
CPR: cardiopulmonary resuscitation
EMS: Emergency Medical Services
IHCA: in-hospital cardiac arrest
LMIC: low- and middle-income countries
OHCA: out-of-hospital cardiac arrest
ROSC: return of spontaneous circulation

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Abstract

In the past 50 years, cardiopulmonary resuscitation (CPR) has gained widespread recognition as a life-saving skill that can be taught successfully to the general public. Cardiopulmonary resuscitation can be considered a cost-effective intervention that requires minimal classroom training and low-cost equipment and supplies; it is commonly taught throughout much of the developed world. But, the simplicity of CPR training and its access for the general public may be misleading, as outcomes for patients in cardiopulmonary arrest are poor and survival is dependent upon a comprehensive "chain-of-survival," which is something not achieved easily in resource-limited health care settings. In addition to the significant financial and physical resources needed to both train and develop basic CPR capabilities within a community, there is a range of ethical questions that should also be considered. This report describes some of the financial and ethical challenges that might result from CPR training in low- and middle-income countries (LMICs). It is determined that for many health care systems, CPR training may have financial and ethically-deleterious, unintended consequences. Evidence shows Basic Life Support (BLS) skills training in a community is an effective intervention to improve public health. But, health care systems with limited resources should include CPR training only after considering the full implications of that intervention.

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Background

The Necessity of Basic Life Support (BLS) Training in Resource-poor Settings

In the past 50 years, cardiopulmonary resuscitation (CPR) has gained widespread recognition as a life-saving skill that can be taught successfully to the general public.[1] Specifically, BLS training for the public that includes basic first aid and CPR has been advocated as a low-cost, high-impact intervention to improve outcomes for medical emergencies.[2] This training has been recommended by international health organizations and practitioners as an effective tool to mitigate preventable death and disability in low- and middle-income countries (LMICs).[3-6]

Cardiopulmonary resuscitation training for laypersons in LMICs could be an attractive public health training initiative because it is simple to perform, is of low training costs, and can be taught to a wide cross-section of a given population. The proliferation of international emergency medicine training[7,8] has provided new opportunities to begin to investigate the costs and benefits of CPR training in resource-limited health care systems.[9] This report aims to contribute to the discussion of CPR training in LMICs by considering challenges for health care educators, public health officials, policy makers, and other stakeholders.

Cardiopulmonary Resuscitation Outcomes

Taken at face value, CPR training for laypersons in LMIC health care systems may seem an effective way to mitigate preventable death and disability. Although it comprises only one component of the standard BLS curriculum, CPR involves the recognition of choking victims and cardiac arrest, the performance of basic airway management, chest compressions, and use of an automatic external defibrillator (AED), if available.

According to the American Heart Association (Dallas, Texas USA), CPR requires only four hours of instruction, and can be learned by children as young as nine-years-old.[10] With these minimal requirements, and the intervention known to literally "save lives," it can be perceived as a cost-effective intervention.

However, despite widespread CPR education and the existence of robust prehospital Emergency Medical Services (EMS) systems throughout resource-rich countries, outcomes remain poor overall.[11] A 2010 systematic review of 67 international studies places the global survival rate at around seven percent.[12] Similarly, a 2010 meta-analysis of 26 countries determined a crude rate of 6.6% (n = 1,162) for survival to discharge among patients achieving prehospital return of spontaneous circulation (ROSC) after cardiopulmonary collapse.[13] Also noted was that, "survival from [out-of-hospital cardiac arrest] has not significantly improved in almost 30 years."[13] In 2008, Nichol et al reported 7.9% (n ~ 710) survival for nontraumatic cardiac arrest to hospital discharge in ten hospitals in the US and Canada.[14] In Japan, another country with advanced prehospital cardiac care provided by nonphysicians, a 5-year retrospective study published in 2012 found that sustained ROSC was obtained in 10% of patients (n = 17,020), with 1-month survival equaling 7.6% (n = 12,861).[15]

Survival for traumatic arrest is still worse, ranging between 1.3% and three percent for blunt trauma[16,17] and between 0.8% and four percent for penetrating trauma.[16,18] Among all-cause pediatric arrests, survival to discharge ranges between 6.7% and 8.6%.[19,20]

While statistics on survival may vary slightly dependent upon etiology, in all cases, only a fraction of these survivors have favorable neurologic outcomes. If the rates cited above are demonstrative of what can be achieved in developed nations with significantly more resources available, the expectations for what can be achieved through CPR training in resource-limited health settings should be tempered. While recently reported outcomes may show incremental gains for cardiac arrest patients, these improvements increasingly involve new or emerging therapies, including therapeutic hypothermia.

The Chain-of-Survival

Effective survival with CPR in out-of-hospital cardiac arrest (OHCA) is predicated upon the "chain-of-survival" concept.[21] This chain is an integrated continuum of care that includes community-wide CPR training, public access to AEDs, a robust prehospital emergency care system, and health care facilities with the capacity to both continue resuscitative efforts and provide integrated and intensive post resuscitative care and rehabilitation. Without a complete and functioning chain-of-survival, LMIC communities will have a low chance of duplicating outcomes achieved in more affluent countries. With this in mind, the notion that OHCA could be a target for a low-cost, public health intervention is no longer straight forward. It nonetheless remains a popular, persistent recommendation for health development programs in LMICs,[22] perhaps to the detriment of other, more effective BLS skills.

Cardiopulmonary Resuscitation Training and In-hospital Cardiac Arrest (IHCA)

On the other hand, CPR training for in-hospital use may prove worthwhile. US studies have shown that IHCAs have better outcomes than OHCAs,[23,24] and that outcomes for this group are improving.[25] This is likely due to increased probability of witnessed arrest and available advanced cardiac care.[26] However, the opportunity costs might still be too high for many health care facilities because advanced resuscitative care is costly. A 2008 study from Germany found the cost per admitted patient after ROSC was €21,166 (US $26,451);[27] a 2004 study from Norway reported that the "survivors" from cardiac arrest cost €40,462 (US $50,565) per patient discharged alive;[28] and a 2009 study examining the costs of in-hospital pediatric cardiac arrest in the UK reported that the mean cost of resuscitation was £3,884 (US $6,203), the mean-cost for post resuscitative length of stay was £22,562 (US $36,033), the annual costs for CPR preparedness were £181,565 (US $289,971), and the cost per survivor to discharge was £53,289 (US $85,106).[29] Unfortunately, it would seem that few health systems in LMICs would have the health care infrastructure in place to achieve sophisticated post resuscitative care (including both physical and human resources), as well as the financial resources to maintain this infrastructure. Without a complete and functioning chain-of-survival, developing communities will have little expectation of replicating outcomes comparable to those in wealthy countries.

Ethical Considerations

While the economic realities of post resuscitative care in resource-limited health systems are clear, it is perhaps more important to examine the ethical issues surrounding CPR training in these same communities. For many, the idea of withholding CPR training and education may seem unethical, especially to those clinical providers and laypersons who recognize the utility of CPR as a life-saving intervention. Given the more favorable prognosis among select etiologies (eg, near-drowning[30] and open-heart surgery[31]) some health care systems may choose to teach or perform CPR despite a lack of adequate educational resources, necessary equipment, supplies, and personnel, as the decision to not provide CPR training potentially denies individuals and families a chance to survive a devastating event.

There is, at the same time, an expansive body of literature examining the ethics of CPR. Though the majority seems to assume the existence of a fully-operational chain-of-survival functioning within a robust health infrastructure that is capable of providing a recognized standard of care at all times, the concepts commonly used to frame discussions about the ethics of CPR (ie, patient autonomy, beneficence, and nonmaleficence) may be reasonably applied to differing societies, irrespective of socio-economic status. Given the relative paucity of existing discussion on the ethics of health training in resource-limited settings,[32] a few of the ethical considerations surrounding CPR are discussed here that may be relevant to communities and health systems with limited resources.

Patient Autonomy—Cardiopulmonary resuscitation, by its nature, makes informed consent virtually impossible. Western clinical providers are commonly trained to provide aggressive attempts at resuscitation unless presented with legally valid proof of the patient's or proxy's decision to forgo resuscitative efforts. This often results in providers acting first and asking questions only after resuscitation has begun. It also assumes that resuscitation is the correct thing to do. In LMICs where health education may be limited and literacy levels are low, the concept of "resuscitation," or even "reanimation" in some languages, may be foreign to the society's social, cultural, and religious traditions, and inadvertently create misunderstandings that may have

profound unintended consequences for health care providers, families, and the community.[32] Ardagh points out, "the process of achieving proxy consent is an unfair burden to place upon the patient's relatives or loved ones… [and] urgency in itself is coercive and it limits the time available for adequate informing and deliberation."[33] This problem is further exacerbated when nonphysician providers, including laypersons with less education and experience, have to make these decisions in the prehospital setting.[34]

The fragility of such situations is potentially greater in countries unfamiliar with common approaches to palliative and end-of-life care. Discussions with family and caregivers in these situations may be incompletely understood, or entirely alien, in communities with limited access to health care. The subsequent confusion among family members and caregivers regarding the risks and benefits of resuscitation may lead to adverse outcomes, including: (1) unnecessarily prolonging a patient's suffering through insufficient or incomplete resuscitative care; (2) delaying or confusing the administration and pronouncement of "last rites" in varied religious traditions;[35,36] or (3) complicating the coping and grieving processes in settings where the cultural and religious understandings of mind, body, and soul are not amenable to Western understandings and debates surrounding life and death.[37,38] In a 2003 article from Barbados examining the use of futility-of-care decisions in a hospital intensive care unit, Hariharan and colleagues reported, "there was no single case where the decision of futility of care was used to withhold life-support. Many physicians are hesitant to recognize futility of care because of religious beliefs, a feeling of guilt, and fear of litigation."[39] Countries may also have medical-legal definitions of life, death, and euthanasia that may or may not be clearly articulated, creating additional areas for potential problems. Such wide-ranging dilemmas are regularly encountered during the administration of CPR, and may become more pronounced in resource-limited settings where fewer advances in medical care and technology have yet been introduced.[40]

In settings with low health literacy among the indigenous populations, patient autonomy can be a far more difficult issue to define. Even in nations where resuscitation is common and widespread, the debates and legislation surrounding the definitions of life, death, and euthanasia may be contentious with the on-going arguments regularly played out in both academic and popular media venues.[41,42] The lack of a uniform approach to CPR among health systems in resource-rich countries is furthermore evidenced by the range of actual care provided.[31,43-46]

Beneficence—In resource-limited health care systems, the utilization of scarce resources can have a far greater impact on the well-being of a larger population. This is true in cases where limited medical supplies are intermittently available to a given population. Lack of health insurance may incur overwhelming debts for families who cannot cover the medical bills accrued during and after resuscitation.[37] These can be further exacerbated when the low probability of successful outcomes is not fully understood,[47] or when outcomes that include chronic disability and decreased cognitive ability are possible.[48] In resource-poor health systems, the concept of beneficence, or acting in a person's best interest, may be justifiably applied to the view point of a family or an entire community when considering the effects of using limited resources. While withholding medical care for cardiac arrest patients could be seen as rationing, the opposite may be equally true in a resource-limited health care system; as Timmermans notes "Social scientists usually suggest that the solution to the negative effects of rationing is to increase accessibility for all populations; however, resuscitative efforts are a prime example where *less* access of all groups – instead of for some – might be preferable"[49] (italics in original). Additionally, there is also the question of the emotional and psychological toll that extended, futile attempts at resuscitation can have on health care workers and families alike.[50]

Nonmaleficence—If health care providers are expected by the public to not inflict intentional harm upon their patients, proper regulatory measures need to be enacted to ensure that health care providers are providing an approved minimum standard of care. The administrative capacity also needs to exist to enforce accountability, maintain competency, and encourage continuing education for CPR skills and knowledge retention. It could be considered unethical to not expect the same standards for CPR training in LMICs as is expected in high-income countries.

The relative ease of CPR instruction should not, in itself, be a satisfactory justification for conducting CPR training courses in resource-limited health care systems. Without proper educational tools and regulatory capabilities, including, at a minimum, certification and refresher training to ensure that CPR is continuously delivered at a recognized, accredited standard, persons with limited health care knowledge and/or low literacy may inadvertently induce iatrogenic complications. Mock et al reported "a slight overreliance" on the use of mouth-to-mouth resuscitation under questionable circumstances;[51] in one author of this reports' experience (JF), an overreliance on chest compressions when not indicated was also observed. In recent years, recognized international standards for CPR training have modified the instruction to now omit mouth-to-mouth resuscitation, but this should not assume that the information has been definitively disseminated in the interim. Paradoxically, the contrasting outcomes among neonatal[19,52] and pediatric arrest[53] versus geriatric arrest, or witnessed versus unwitnessed arrest,[19,43,54] can pose other dilemmas for educators and policy makers.

Finally, it is well documented that cardiac arrest patients being transported rapidly to a medical facility put pedestrians at unnecessary risk of injury, including the patient, transporting providers, and the general public.[55] Thus, the defining principle of nonmaleficence, "first, do no harm," can be reasonably applied as well to emergency responders and other road users, particularly when resuscitative efforts are unlikely to produce successful outcomes.[56] This is further supported by a 2012 study that described 0.69% survival to discharge for OHCA patients who did not achieve ROSC prior to arrival at the hospital.[11]

Potential Guidance

The decision to provide training for, and delivery of, CPR within a resource-limited health care system should be made only after performing a thorough examination of the financial and ethical implications for the local community and including the public in an open and honest discussion regarding these issues. The following practical considerations may help stakeholders more accurately assess the logistical feasibility of starting, or continuing, a CPR training program in resource-limited health care systems; if answers cannot be provided, the probability of positive outcomes after CPR decrease:

1. Access – How do members of the community access the health care system in the event of an emergency? How

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reliable are communications and community-based care systems? Are there areas in the community that have limited or no access to emergency care?
2. Prehospital Care – What does care in the prehospital environment look like? Who are the prehospital care providers in your community and what is their training level? What resources and equipment are available to them? Are there areas in the community that are not reached by prehospital care services?
3. Definitive Care – Are clinical providers and facilities equipped to provide on-going and post resuscitative care? Are protocols in place to determine futility of care and termination of resuscitation?
4. Chronic Care – Are there resources available for potentially long-term rehabilitation? What stigmas exist among the community regarding the social status of disabled persons?
5. Health Care Finance – How is this care to be financed? Is it the patient's and their family's responsibility? Does the community share the cost? Is there an insurance market?

When determining the ethical implications of CPR training and delivery in different socio-cultural contexts, it is strongly recommended to consider existing legislation, including legal definitions and parameters for emergency care, consent, duty to act, and other "Good Samaritan" laws for both prehospital and clinical providers, as well as bystanders. Legislation may need to be updated to remain consistent with ethical consensus and newly-defined societal expectations around sudden cardiac arrest.

Conclusion

Cardiopulmonary resuscitation training has gained widespread recognition in affluent countries for being a simple and accessible life-saving skill. Owing in large part to these factors, health practitioners from these countries involved in international health development initiatives often cite CPR as a valuable skill and are increasingly encouraging its dissemination throughout LMICs. This report offers some further considerations for health care providers and policy makers who may be considering such initiatives, illustrating a few of the many financial and ethical issues that can present themselves when exporting advanced health interventions from affluent countries to resource-limited health systems. Health systems and the communities they serve must decide for themselves if CPR is an appropriate health intervention to provide, but should do so only after a concerted effort by appropriate stakeholders to examine the effects that implementing aggressive resuscitative care might have on their community.

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