Critical care in resource-poor settings: Lessons learned and future directions*

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Context: Critical care faces the same challenges as other aspects of healthcare in the developing world. However, critical care faces an additional challenge in that it has often been deemed too costly or complicated for resource-poor settings. This lack of prioritization is not justified. Hospital care for the sickest patients affects overall mortality, and public health interventions depend on community confidence in healthcare to ensure participation and adherence. Some of the most effective critical care interventions, including rapid fluid resuscitation, early antibiotics, and patient monitoring, are relatively inexpensive. Although cost-effectiveness studies on critical care in resource-poor settings have not been done, evidence from the surgical literature suggests that even resource-intensive interventions can be cost effective in comparison to immunizations and human immunodeficiency virus care. In the developing world, where many critically ill patients are younger and have fewer comorbidities, critical care presents a remarkable opportunity to provide significant incremental benefit, arguably much more so than in the developed world.

Essential Considerations: Key areas of consideration in developing critical care in resource-poor settings include: Personnel and training, equipment and support services, ethics, and research. Strategies for training and retaining skilled labor include tying education to service commitment and developing protocols for even complex processes. Equipment and support services need to focus on technologies that are affordable and sustainable. Ethical decision making must be based on data when possible and on transparent articulated policies always. Research should be performed in resource-poor settings and focus on needs assessment, prognostication, and cost effectiveness.

Future Directions: The development of critical care in resource-poor settings will rely on the stepwise introduction of service improvements, leveraging human resources through training, a focus on sustainable technology, ongoing analysis of cost effectiveness, and the sharing of context-specific best practices. Although prevention, public health, and disease-specific agendas dominate many current conversations in global health, this is nonetheless a time ripe for the development of critical care. Leaders in global health funding hope to improve quality and length of life. Critical care is an integral part of the continuum of care necessary to make that possible. (Crit Care Med 2011; 39:860–867)

KEY WORDS: critical care; developing countries; sub-Saharan Africa; cost effectiveness; technology; review

At its core, critical care is simply healthcare for very sick patients. As such, critical care in resource-poor settings must meet all the challenges of general healthcare in these settings: A lack of drugs, equipment, supporting infrastructure, and trained personnel (1, 2), as well as late and severe presentations of disease secondary to poor access to appropriate care (3).

Critical care must meet a further challenge, in that it has often been deemed inappropriate or at least of lower priority than prevention and primary care. This lack of prioritization is not justified. First, it is based on a misconception of the definition of critical care. As Watters et al (4) noted in 1991, “all hospitals have critically ill patients,” and intensive care is not defined by expensive technology. Thus, the debate about critical care in resource-poor settings should not center around whether it is appropriate, but what aspects of it are appropriate (4). If critical care encompasses all aspects of care for critically ill patients, it may include oxygen administration or frequent nurse monitoring. Although these interventions may not be considered critical care in resource-rich settings, they are nonetheless important aspects of caring for critically ill patients and are not universally available.

Second, the lack of prioritization of critical care in resource-poor settings is based on a presumed lack of effectiveness in improving population health. However, morbidity and mortality are not solely influenced by community-based public health efforts; hospital care for the sickest patients affects overall mortality (4–6). The public health and primary care systems of the developed world have not eliminated the need for hospital care, and the same is true in the developing world. Nolan et al (7) summarized the evidence for this well, in regards to pediatric patients: Using the World Health Organization’s Integrated Management of Childhood Illness strategy, still 12% to 34% of sick children need referral to a hospital, and almost 90% of these children have one of five common pediatric conditions that are amenable to successful treatment if appropriate hospital care is not delayed. Veirum et al (8) sought to assess the relative contribution of hospital vs. community care on overall mortality in the capital of Guinea-Bissau. They found that almost 15% of infants and 45% of children under 5 yrs old had been hospitalized, with 24% of all deaths for the community occurring in a hospital. They conclude that, “Even minor im-

*See also p. 916.

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The authors have not disclosed any potential conflicts of interest.

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DOI: 10.1097/CCM.0b013e318206d6d5
improvements in acute case management of sick children attending the hospital would be expected to result in substantial reduction in overall childhood mortality.” In addition to direct effects of hospital care on mortality, public health interventions depend on community confidence in healthcare to ensure participation and adherence. The self-perceived needs of communities include acute care for life-threatening illnesses, and the “failure to rescue” decreases confidence and healthcare utilization at all levels (9, 10). Quality hospital care for the sickest patients has the potential to multiply its effects through increasing community participation in prevention and primary care efforts.

Finally, poor prioritization of critical care is based on the assumption that its relative cost is too high when compared with other interventions. Much of critical care involves relatively inexpensive training in how to recognize, respond to, and monitor acute illness (4). Simple interventions that are known to be effective, such as early resuscitation with fluids and antibiotics in septic shock, can be achieved by increasing the number of trained staff. Cost-effectiveness studies on more complex critical care interventions in resource-poor settings have not been done, but studies for surgical services suggest that even resource-intensive interventions may in fact compare favorably to prevention and primary care. Studies in Bangladesh, Sierra Leone, Cambodia, Nigeria, and Haiti indicate costs of $10.93 to $223 per disability-adjusted life year (DALY) for surgical services including emergency obstetrical care, general surgical services, and trauma surgery (11–14). The World Health Organization defines “very cost-effective” interventions as those that cost less than the value of gross domestic product (GDP) per capita per DALY (15); these interventions fall well within this guideline. They also compare very favorably with other accepted interventions: National childhood immunization programs cost approximately $10 per DALY averted, and the incremental cost effectiveness of antiretroviral therapy compared with less expensive strategies for human immunodeficiency virus care was provided to 4655 patients, with 73% of these on antiretroviral therapy. In 2009, almost 11,000 patients were admitted to the 265-bed hospital, with an average length of stay of 6.3 days. The surgical team completed 9049 operations, and 1997 deliveries were performed. The hospital functions as the primary referral hospital for four additional hospitals and >50 small rural clinics.

The hospital and outpatient clinics are staffed by a total of 634 personnel, including 194 nurses, 20 fully trained foreign and national physicians with expertise in a wide range of medical and surgical subspecialties, and 21 doctors-in-training. The hospital’s infrastructure includes portable radiograph, portable ultrasound, a blood bank, pathology, biochemistry, hematology, bacteriology, and parasitology. AIC Kijabe Hospital’s medical education program includes registered nurse and registered nurse anesthesia programs, a medical officer internship, a clinical officer internship, residencies in family practice, general surgery, and orthopedic surgery, and a fellowship in pediatric surgery.

AIC Kijabe Hospital operates a five-bed ICU. Critically ill patients from general surgery, trauma, surgical subspecialties, medicine, pediatrics, obstetrics, gynecol-
ogy, and neurology are admitted to the unit. The ICU concept began 10 years ago with a small room and two beds, and officially opened in 2005. The equipment and beds are discarded items from American, Australian, and European ICUs. Internal medicine, pediatric, family medicine, and anesthesia physicians staff the unit in close consultation with other specialty services. Kenyan trainees, including medical interns, also participate in the care of patients. Nurse to patient ratios are 3:5 in the ICU, compared with 1:12 on the wards. The ICU nurses undergo training at AIC Kijabe Hospital and receive higher salaries for their specialized skills, with opportunities for further advanced training.

In its first three and a half years of full operation, from April 15, 2005 to October 31, 2008, the ICU served 1347 patients, 25% neonates and children and 75% adults. The admissions included approximately half who underwent major surgery and half who did not. Seventy-seven percent of patients who had major surgery survived to discharge, whereas patients not undergoing surgery had a survival to discharge rate of 62%. This compares with 97.6% survival for the hospital inpatients overall. The average ICU length of stay was 4.6 days, and the average hospital length of stay was 13.1 days. Approximately 12% of the patients were on mechanical ventilation, with an average ventilation time of 58.4 hrs. Of these, 36% survived to discharge.

ICUs in Resource-Poor Settings: Lessons Learned

The essential considerations for ICUs in resource-poor settings can be divided into four areas: Personnel and training, equipment and support services, ethics, and research. Table 1 outlines the key factors within each of these areas.

Personnel and Training

Although technology may appear on the surface to represent the greatest challenge,
staff skill development and retention is in fact a greater challenge and one with the potential for significant impact. Nurses with lower patient ratios who can alert physicians to changing patient status and respond appropriately with initial interventions add some of the greatest value we see in our ICU. Training represents an area with great potential for improvement, using creative solutions and incorporating protocols and checklists.

Appropriately trained physicians, midlevel providers, and nurses are vital to critical care services. However, as in all fields of skill development, the risk to institutions and potential benefit to trainees in critical care is that trainees can use new skills to move to the more desirable urban areas or to the developed world (33). At the initiation of our ICU, 30 of our Kenyan registered nurses participated in an intensive 2-month course taught by U.S.-trained ICU nurses and physicians. By the end of 1 yr, only five of the original 30 nurses remained, with most moving to Nairobi for higher paying jobs. Retention of skilled employees can be addressed in two complementary ways: First, training can be tied to a commitment of service, a method employed by Mukinge Hospital Nursing School in Zambia and AIC Kijabe Hospital. Second, adjustments can be made to training methods to decrease the burden on trainees. Currently, we are developing audio PowerPoint-based training modules to complement supervised practical training. We also ask visiting short-term medical professionals to contribute to staff development through training that meets the perceived needs of national staff, is relevant to the context, and emphasizes the empowerment and technical equipping of national nurses and physicians.

Another area of potential growth within the realm of training is the use of protocols and checklists. Protocols and checklists seek to take the variability out of treatment where best practices are known. They create processes that require adherence to systems and teamwork but depend less on highly specialized knowledge. This approach is particularly well suited to settings where providers tend to have fewer years of training and less access to specialized diagnostic tools. In fact, the use of checklists and simplified protocols is a common strategy of World Health Organization publications and others. It is the application of this strategy to services previously thought to be prohibitively complex, including surgery and critical care, which could add new value.

In surgery, a 19-item checklist to increase safety caused a significant decrease in 30-day mortality and complications at sites in both the developed and developing world (34). This lends credibility to the idea that checklists can be effective for even complex processes and in a wide range of settings. Although there is some controversy over the Surviving Sepsis campaign bundles (35, 36), nonetheless an association between protocol compliance and improvement in mortality was demonstrated (35). The authors of the 2008 Surviving Sepsis guidelines update were challenged to consider guidelines applicable to developing countries, and they note that appropriate and timely antibiotics, fluid resuscitation, and source control are both foundational in sepsis management and feasible in low-resource settings (37). Other authors in Uganda have suggested the general interventions, although without specific target outcomes, that might be most appropriate in sepsis in low-resource settings (38). The basic ventilator bundle that the Institute for Healthcare Improvement supports is cheap and feasible in low-resource settings: Elevating the head of the bed, daily sedation vacations with consideration for extubation, peptic ulcer prophylaxis, and deep venous thrombosis prophylaxis (39).

**Equipment and Support Services**

Perhaps the most daunting feature of critical care in resource-poor settings is the perceived technology need. We divide the needs into four categories: cardiopulmonary monitoring, oxygen and ventilator support services, and the development of new technologies designed for resource-poor settings.

Cardiopulmonary monitoring is essential for critically ill patients. At AIC Kijabe Hospital, we use secondhand, multifunction ICU monitors that include electrocardiograms, noninvasive blood pressure, and pulse oximetry. Ventilatory status is assessed noninvasively with end tidal carbon dioxide monitoring, using donated Microstream ETCO2 monitors (Oridion, Needham, MA). Each patient area also includes access to a stethoscope and manual blood pressure cuff for instances of equipment failure and power outages. Although electrocardiogram pads, blood pressure cuffs, and pulse oximeter probes are often very expensive in-country, these items can be donated from western countries, where they are often used once as disposable items. With all electrical equipment, the risks of power supply interruption and power surges are high, so a reliable back-up generator and high-capacity surge protectors are crucial investments.

Basic airway management and a reliable source of oxygen are the first priorities in the respiratory aspect of critical care (27). Mechanical ventilation is another important capability. Ventilators require ongoing electricity and a minimum skill set among personnel, but they need not be as technologically complex and expensive as many assume. One hospital in Uganda stresses the need for ventilators that are not dependent on compressed gases or disposable circuits and notes the potential of Glostavent (28). At AIC Kijabe Hospital, we previously used Puritan Bennett LP6 and LP10 ventilators (Covidien, Boulder, CO), both of which operated with oxygen concentrators and included only basic volume and rate settings. Currently, we use the Siemens 900C model (Siemens, Deerfield, IL) with a piped oxygen system and more choices in modes and settings. The working parts in this model are simple enough that we can maintain them locally, without the high repair costs charged by service agents for more recent models. While we have received donations for more advanced ventilators, we have actually traded these with other private hospitals to obtain additional older Siemens 900C ventilators. Equipment is only valuable to the extent that it can be maintained and repaired. This concept of investing in a consistent model, for which both the parts and biomedical technical expertise are available, applies to all technology. Prioritizing training of biomedical technicians as new pieces of equipment become available markedly improves patient care and increases the sustainability of services.

Ventilator accessories that are standard in the developed world must be contemplated and procured when deemed necessary. Simple donated humidification devices are important for decreasing the incidence of mucous plugging. Ventilator breathing circuits must be durable and multiple-use. As we increase our ability to care for sicker patients, more difficult questions arise. For example, we do not currently have the ability to monitor pressure, flow, and volume tracings, and we do not have arterial blood gas monitoring. We are considering whether the potential added value of these capabilities justifies the additional cost.
Hospital support services are as important as the equipment that is specific to the ICU. Basic laboratory capability including complete blood counts, electrolytes, and in some cases cultures are critical and will raise the level of care for the entire hospital. Radiology and ultrasound capabilities will also raise the overall level of care, although these should be available at the bedside specifically for intensive care patients. Both laboratory and radiologic studies must be used carefully, reserved for instances when clinical management will change based on results. Reliable electricity including a backup generator is important, particularly if ventilators are in use, and we always have a size-appropriate, self-inflating Ambu bag (Ambu, Ballerup, Denmark) at each bedside for periods when there is an interruption in power supply or oxygen pressure. Perhaps the most important “support service” for critical care as for the hospital as a whole, is a functioning administrative structure with systems for good governance, quality improvement, financial management, resource management, general and biomedical technology maintenance, consistent staff education, and information technology.

Another consideration in equipment and technology is the development or adaptation of technologies that are cheap, reliable, and better suited to environments with variable infrastructure capabilities. Although the concept of “appropriate technology” has been used to rationalize poor quality and preventive-only healthcare for impoverished people (40), technology specifically designed for resource-poor settings can be advantageous. Technologies marketed for the resource-rich medical environment have not been shown to be sustainable in many resource-poor settings. Low cost, easy maintenance, and longer battery life are a few criteria for device development. Examples include a $7 bag valve mask for infants (41), incubators developed from Toyota car parts (41), low-cost and low-maintenance ventilators (42), and a wound-negative pressure device that developed from Toyota car parts (41), low-cost, self-inflating Ambu bag (Ambu, Ballerup, Denmark) at each bedside for periods when there is an interruption in power supply or oxygen pressure. Perhaps the most important “support service” for critical care as for the hospital as a whole, is a functioning administrative structure with systems for good governance, quality improvement, financial management, resource management, general and biomedical technology maintenance, consistent staff education, and information technology.

The most basic ethical dilemma in critical care in resource-poor settings is that of the injustice of disparity in healthcare: “The developed world has the luxury of spending millions of dollars studying thousands of patients to detect small differences in outcomes” (1) while millions die of acute illness we have long known how to treat. This injustice requires a constant effort to advocate for patients, for increased resources, and equity of care. This includes seeking funds from the rich to provide for the poor and calling on governments to provide for the health of their citizens as a basic human right (46). The importance of the latter can be observed in the impact of Kenya’s national health insurance plan. Although the plan does not cover all costs for patients who are enrolled, it clearly decreases the burden and makes healthcare including critical care more feasible for more people.

The other essential ethical implication is that of prioritizing limited resources, a dilemma that is greatly accentuated by the disparities in resources noted above but has also been openly discussed in the context of ICUs in resource-rich settings. A 1986 JAMA article by Strauss et al (47) looked at the process of rationing ICU beds in the United States, noting that in times of ICU bed shortages, patients admitted to the ICU were sicker and had shorter stays. A review of ICU bed rationing in 2004 found that hospital mortality was increased for patients refused ICU admission during times of high occupancy; the authors concluded that patients perceived to be less likely to benefit from the ICU were refused admission in these times (48). The American Thoracic Society (49) outlines principles for the fair allocation of intensive care resources and notes that, “The duty of healthcare providers to benefit an individual patient has limits when doing so unfairly compromises the availability of resources needed by others.” The current debate in healthcare reform in the United States highlights that even in the wealthiest settings, resources are in fact limited and decisions of prioritization have to be made (50).

Practical implications of this include decisions about who gets admitted to the clearly inadequate supply of ICU beds in resource-limited settings and how to approach advanced life support. An ICU in Soweto turned away 50 admissions per month secondary to lack of resources, with decisions based on clinical judgment of who would benefit most (29). Towey and Ojara (28) made the important point that beyond decisions between patients when ICU beds are limited, the decision of how aggressive to be when continued care could result in bankruptcy for a patient’s family involves ethical choices even when beds are available. Delayed presentation, the epidemic of trauma, poor intrahospital-transfer systems, and advanced pathology also contribute to the complexity of decision making. AIC Kijabe Hospital has wrestled with the use of ICU care for patients with poor prognoses when ICU beds, patient financial resources, and overall hospital financial resources are all limited. While we continue to advocate for increased resources for all of our patients, we must nonetheless make decisions in the reality of constrained resources.

To address the daily ethical dilemmas of resource allocation, two things are essential. First, we need data, both addressing the prognosis with and without the use of the available ICU-level care and addressing the cost of this care. Although decisions will always be difficult, they should at minimum be as informed as possible. Second, procedures must be developed for addressing level-of-care decisions openly and clearly. In many African countries the ideas of advanced directives and code status have yet to be discussed at the national judicial and medical community level. In each country, the leaders will need to determine how best to address this important aspect of care for the severely ill within their healthcare system. The ethical assumptions and choices may be very different in developing-world settings, but the concepts of open discussion, documentation, and consistent adherence to stated processes are the same.

As we developed the capacity to provide more sophisticated care for critically ill patients at AIC Kijabe Hospital, we recognized the need to articulate hospital policies on the use of critical care services. We have policies regarding appropriate ICU admissions, cardiopulmonary resuscitation, and ventilator candidates. The policies include prioritization of patients for ICU services, mechanisms for instituting comfort care status for patients, reasonable time limits for cardiopulmonary resuscitation efforts, specific definitions of patients who are “high morbidity ventilation cases,” meth-
ods of determining code status including discussions with patients, family members and medical providers, and processes for appeal of decisions (51–53).

Research

The above section points to the critical need for data to practically and ethically guide decision making in critical care services in resource-poor settings. Research needs to occur in the developing world, rather than extrapolating results from the developed world. Differences in available diagnostics and therapies make many developed-world studies unusable in the developing world. In addition, variation in population characteristics and disease prevalence may be important. The difference in outcomes seen in corticosteroid use for meningitis in Europe, Malawi, and Vietnam is an important example (54–56). Even with the recent surge in interest in critical care in resource-poor settings, little research has been done. A few epidemiologic and outcomes studies have been published, although these are heavily concentrated in a few urban academic centers (19–25, 57).

The research agenda should initially focus on three main areas: Needs assessment, prognostic scoring, and cost-effectiveness evaluation. Regional needs assessments could encompass the epidemiology of critical illness, current resources, and what is known about the impact of both preventive and curative care (1). Needs assessments with evaluation of capacity could also be helpful for individual hospitals in planning a stepwise expansion of critical care services.

Prognostic scoring that is relevant to settings without extensive laboratory capacity is needed so that resource-use decisions can be based on the best data available (29, 58). It is ethically appropriate and even mandated to use the best data available to make decisions of resource utilization (59). In 1989, a group in Sri Lanka looked at mortality by diagnosis of 43 patients who had been mechanically ventilated (60). More recent studies in Tanzania and Uganda have looked at vital signs and other basic clinical signs as predictors of mortality (61, 62). Another study in Uganda found that handheld portable whole-blood lactate was highly predictive of mortality among patients admitted with severe sepsis (63). Specific prognostication in these settings is important, both because available diagnostic tests do not allow for collection of many of the variables in developed-world scoring systems and because prognostication depends on the level of care possible in different settings.

AIC Kijabe Hospital began keeping data on ICU patients in 2005, including diagnoses, surgical procedures, ventilation time, ventilator settings at 24 hrs, length of stay, and survival. The data must be viewed with caution for prognostication purposes since patients who enter the ICU have already been selected based on a clinical judgment of their likelihood to benefit from ICU care. Nonetheless, patterns of morbidity and mortality can be gleaned from this sort of data, which is currently being analyzed.

Finally, cost-effectiveness analyses need to be the other primary focus on current research efforts. These analyses provide data for resource prioritization at an even broader level than prognostication, by allowing comparison of interventions for critically ill patients with other interventions including preventive and primary care. To do this, affordable and sustainable health management information systems which integrate a health facility's operations/financial data with its clinical care/research data need to be developed; we are hopeful that this is possible as business modules are integrated with clinical systems that were initially developed for human immunodeficiency virus clinical care (64).

Cost-effectiveness analyses can and should be applied to all critical care interventions, from training of nurses to oxygen delivery and ICU care that includes multiple components. The few articles that have been published demonstrate that components of intensive care may in fact compare favorably to other interventions. Surgery, long thought to be far too expensive to compare with medical or public health interventions, has shown a range of costs, with $10.93 per DALY for hospital services that include emergency obstetrical service in Bangladesh (11), $32.78 per DALY for a largely surgical hospital in Sierra Leone (12), $77.40 per DALY for a trauma hospital in Cambodia (14), $172 per DALY for a trauma hospital in Nigeria (13), and $223 per DALY for a trauma hospital in Haiti (13). Five hospitals in New Guinea showed that implementation of an oxygen system including pulse oximetry and oxygen concentrators decreased child pneumonia mortality at a cost of $50 per DALY (27). The World Health Organization uses a cutoff of less than one times GDP per capita for “very cost-effective” interventions, between one and three times GDP per capita for “cost-effective” interventions, and more than three times GDP per capita for interventions that are “not cost effective” (15). As an example, Kenya’s GDP per capita for 2008 is estimated at $891 in current prices (65), so these estimates for cost effectiveness of surgical care and oxygen clearly meet criteria for being “very cost effective.”

Cost-effectiveness analyses, however, must be done carefully and with full consideration of benefits that may not be easily measured. Walensky and Kuritzkes (66) point out that ignoring context “may lead to important biases that too often go unrecognized.” They give examples of a 1990 Oregon cost-effectiveness exercise that resulted in dental caps being prioritized over surgery for ectopic pregnancy, and the fact that equally effective vaccination programs for adults and children will always be more cost effective for children given their longer potential lifespan. Critical care may confer a benefit beyond what is obvious by increasing confidence in the healthcare system and thereby increasing community participation in prevention and primary care programs. The failure to rescue can decrease public confidence and participation in public health programs (9, 10). In addition, critical care may make other cost-effective services possible, including surgery (28, 67), or care for HIV patients with complications of disease or medications (5). At AIC Kijabe Hospital, for example, some of the more complex surgical interventions can only be done knowing that ICU care is possible postoperatively. Surgical services at AIC Kijabe are both important for overall income generation as well as hospital reputation, making local communities more likely to access the variety of outpatient and inpatient services available. The ICU has allowed for substantial growth in surgical numbers, educational opportunities in acute care, and trauma care capability with a national reputation.

Critical Care in Resource-Poor Settings: Future Directions

The first ICU in the world opened in 1953 to combat the consequences of polio. In 1969 the first report of an African ICU was published (68). Now less than 40 yrs later, critical care in resource-poor settings remains woefully inadequate to meet the needs of patients with acute and potentially reversible illnesses. The cen-
ural ethical issue in healthcare in resource-poor settings is not how to ration constrained resources, but the fact that resources are so unequally distributed across the world. Nevertheless, as we actively seek to alter the allocation of global resources to combat the central injustice of unequal healthcare, we must also make daily decisions in using the resources that are available. We must define and begin to implement an agenda for improved care at every level of healthcare, including critical care. Providing comprehensive healthcare must include care for the sickest patients, beginning with identifying and implementing interventions with the greatest potential to impact morbidity and mortality.

In Table 2 we propose principles that should guide the ongoing development of critical care in resource-poor settings. A practical place to start is to perform individual hospital-based needs assessments looking at critically ill patients, with the development of stepwise plans for improvements that can be made in the care of these patients. Very limited settings may start with basic training in the care of acutely ill patients including vital signs assessment and resuscitation. Others may investigate the requirements of maintaining oxygen availability. Others may add more advanced training for nurses or a piece of monitoring equipment. Improvements can be made both by the development of relevant training curricula that include protocols, as well as the development of technology designed for the setting. We need to use what is immediately transferable from the developed world, including specialized training for critical care professionals and bundles of good ICU practices. We need to let go of developed-world practices that are currently hindrances, including advanced technologies that cannot be readily maintained. Cost-effectiveness research will likely be an important tool for decision making. Efforts need to be made to connect practitioners in similar settings to share ideas and resources. An example of a successful and growing network of physicians from both the developed and developing world is the Global Health Delivery Online project, an initiative through multiple schools of Harvard University, Brigham and Women’s Hospital, and Partners in Health (69).

The further development of critical care in resource-poor settings is urgent. Many lessons can be learned from the experience of those who practice in these settings, as well as experience from the developed world. While prevention, public health, and disease-specific agendas dominate many current conversations about global health, this is nonetheless a time ripe for the development of critical care. Leaders in global health funding are hoping to improve quality and length of life. Critical care is an integral part of the continuum of care necessary to make that possible.

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