Foreword

The Interface of Global Health and Pediatric Critical Care

Ndidiama Musa¹ Nicole Shilkofski²¹ Division of Pediatric Critical Care Medicine, Department of Pediatrics, Seattle Children's Hospital, University of Washington School of Medicine, Seattle, Washington, United States² Division of Pediatric Anesthesia and Critical Care, Department of Anesthesiology and Critical Care Medicine, Johns Hopkins University School of Medicine, Baltimore, Maryland, United States

J Pediatr Intensive Care 2017;6:1–5.

Engagement of the global community to address health care disparities for children worldwide is essential to promote optimal patient outcomes. The World Health Organization (WHO) estimates that more than 50 countries worldwide face critical shortages of health care workers, adding to a total global deficit of more than 2 million physicians, nurses, midwives, and allied health care workers.¹ In addition, only 24 of 138 developing countries are estimated to have achieved Millennium Development Goal (MDG) 4 defined by United Nations world leaders in 2000 to reduce under 5-year mortality rates by two-thirds by the year 2015.² Progress in sub-Saharan Africa and Southeast Asia has been insufficient to meet MDG 4 and 16,000 children younger than 5 years continue to die each day, mostly from preventable causes.² It is clear that child survival must remain at the heart of the emerging post-2015 Sustainable Development Goals and global development agenda.³ The continued reduction in under 5-year mortality will require political will, sound educational strategies in clinical care, and adequate resources.

► **Figs. 1–4** depict world maps with territory sizes altered to depict subjects of interest, in this case, health care workers (physicians and nurses) available worldwide (► **Figs. 1 and 2**), contrasted with early infant mortality, and under 5-year mortality rates worldwide (► **Figs. 3 and 4**).⁴ It is easy to see from these pictorial displays that major disparities exist regionally, with a large burden of pediatric disease, morbidity, and mortality in the regions of the world with critical shortages of health care providers. This proves even more salient in the field of critical care. However, critical and intensive care is one of the fastest growing hospital specialties worldwide; therefore, addressing these issues and disparities in the developing world, where human and material resources are often scarce, has become crucial. It is often assumed in the developing world that lack of material resources is the

dominant barrier to clinical care. But in reality, it is more commonly the lack of trained personnel to administer care that is the true limitation, as evidenced by the recent Ebola crisis.⁵

There will always be differences in intensive care unit (ICU) capacity and technology for critical care management among countries worldwide. However, it is incumbent upon the critical care community at large to promote best practices in the care of all children, despite these differences and limitations. This is particularly true because the majority of childhood deaths in low- and middle-income countries (LMICs) and limited-resource settings (LRS) result from preventable and reversible causes, including lower respiratory tract infections, malaria, diarrheal disease, meningitis, and nutritional deficiencies.^{6,7} In many pediatric patients, the potential for recovery after acute illness is high and often achievable with basic and affordable management strategies such as early antibiotic administration, rapid fluid resuscitation, patient monitoring, and supportive care. Educational efforts for both health care workers and the larger community become critical in LMICs because delay in recognition of the critically ill child and late presentation to health care facilities are very common, with one-third of patient deaths occurring in the first 24 hours of hospitalization.⁸ Quality metrics such as infection prevention, early recognition of sepsis, and strategies for mobilization of resources are important for global discussion and collaborative education. Bundles to improve pediatric patient care against ventilator-associated pneumonia and central line affiliated blood stream infections are now widespread for pediatric ICUs in the developed world, but these need to be disseminated to less developed regions and contextualized to be appropriate for country-specific resource limitations.

WHO has augmented educational efforts in the care of pediatric patients worldwide in several formats. In the

Address for correspondence
Nicole Shilkofski, MD, MEd,
Department of Anesthesiology
and Critical Care Medicine, Johns
Hopkins University School of
Medicine, Baltimore, MD 21287,
United States
(e-mail: nshilko1@jhmi.edu).

Issue Theme Global/
International Health and Critical
Care; Guest Editors: Nicole
Shilkofski, MD, MEd, and
Ndidiama L. Musa, MD

Copyright © 2017 by Georg Thieme
Verlag KG, Stuttgart · New York

DOI <http://dx.doi.org/10.1055/s-0036-1584679>.
ISSN 2146-4618.

Fig. 1 Cartogram map projection depicting unequal distribution of physicians working worldwide. The most concentrated 50% of physicians live in territories with less than a fifth of the world's population. The worst off fifth are served by only 2% of the world's physicians. (Reprinted with permission from www.worldmapper.org [© Copyright Sasi Group (University of Sheffield) and Mark Newman (University of Michigan)].)

outpatient ambulatory setting, the Integrated Management of Childhood Illness (IMCI) guidelines were designed with the assumption that sick children will be referred to a hospital for escalation of care if needed.⁹ In response to need for improved inpatient management, in 2005, the WHO developed the Emergency Triage, Assessment, and Treatment (ETAT) guidelines, designed to prioritize care for children who need urgent resuscitation and hospital admission.¹⁰ Despite some positive

results of ETAT implementation, reports indicate variability in implementation of best practices.^{11–13} WHO recently published revised ETAT guidelines in early 2016, which include new fluid guidelines for children with febrile illnesses with additional considerations in the management of shock, based on recent research in LRS.^{14,15}

Training programs such as Pediatric Advanced Life Support and the *APLS: Pediatric Emergency Medicine Resource* have been

Fig. 2 Cartogram map projection showing unequal distribution of nurses working worldwide. The highest number of nurses per person are in Western Europe, with the fewest per person in the countries of Haiti, Bangladesh, and Bhutan. (Reprinted with permission from www.worldmapper.org [© Copyright Sasi Group (University of Sheffield) and Mark Newman (University of Michigan)].)

Fig. 3 Cartogram map projection showing unequal distribution of early neonatal mortality worldwide. This is defined as death of a child within the first week of life. According to the World Health Organization data, the three main causes are asphyxia at birth, low birth weight including prematurity, and infections. (Reprinted with permission from www.worldmapper.org [© Copyright Sasi Group (University of Sheffield) and Mark Newman (University of Michigan)].)

implemented worldwide but are designed for practice of medicine primarily in resource-rich settings. Contextualization of these programs for use in limited-resource settings is essential for successful and pragmatic implementation of educational material. In addition, broad system-oriented interventions to address provider behavior are needed if educational programs of this nature are to be sustainable.¹⁶ Courses such as Pediatric

Fundamental Critical Care Support (PFCCS), which address fundamental management principles for the first 24 hours of postresuscitation stabilization and management of the critically ill pediatric patient, are now being more broadly disseminated worldwide. However, like some of the training programs outlined earlier, contextualization issues and cost of course participation can make PFCCS less feasible to implement in LRS.

Fig. 4 Cartogram map projection showing unequal distribution of mortality in the 1 to 4 years old age group worldwide. Central and Northern Africa, and Southern Asia have the highest rates worldwide, with Western Europe having the lowest. (Reprinted with permission from www.worldmapper.org [© Copyright Sasi Group (University of Sheffield) and Mark Newman (University of Michigan)].)

Collaborative educational and training strategies will remain a mainstay for dissemination of best practices and sharing of resources within pediatric critical care. With the increasing development of web-based resources for critical care education, e-learning formats such as self-directed learning modules, podcasts, interactive case studies, and webcasts can be sources to enhance learning and clinical competence for pediatric critical care practitioners worldwide.¹⁷ Simulation-based medical education (SBME) has also become a common pedagogic strategy in pediatric critical care. SBME modalities have enabled novice and experienced learners alike to acquire competency in high stakes procedural skills through deliberate practice and to improve teamwork dynamics and critical communication skills, particularly during resuscitation events for pediatric patients. Although SBME has experienced rapid growth in developed countries, the technology and educational strategies are being increasingly adapted for LRS, as exemplified by programs such as Helping Babies Breathe, which will be the feature of one of the review articles in this issue.

Contemporary critical care research in pediatrics also necessitates involvement of multiple centers, preferably from multiple countries. Most research networks to date are restricted to a small percentage of industrialized nations, making the findings of many studies difficult to implement in LMICs and LRS. However, many centers in resource-limited regions may still have the capacity to participate in clinical research. A recent study by Duke et al demonstrated the feasibility to collect large-scale data on pediatric morbidity and mortality in LRS. In addition, the study showed the ability of that data to subsequently inform a National Policy and Plan for Child Health to improve national practices, trigger quality improvement processes, and focus interventions to reduce pediatric mortality in the neediest areas, with emphasis on diseases with the highest burden.¹⁸ A 2015 survey of 73 centers in 34 countries offering pediatric critical care services (34 centers from high-income countries [HICs] and 39 from LMICs) showed that all centers had a similar overall disease burden, with infectious diseases, respiratory diseases, and congenital heart disease being common entities presenting to pediatric intensive care units (PICUs) worldwide. However, the PICUs in LMICs, when compared with those in HICs, were characterized by a lower number of critical care specialists, more difficult access to hemodialysis, and a lower number of elective postoperative patients.¹⁹ Surveys such as this one can shine light on deficits in certain areas such as staffing and medication access that should help guide policy development in critical care delivery in these regions. Efforts to create a global registry of adult ICUs are underway, but similar attempts are also needed for critically ill children.²⁰ Research in LRS should focus on needs assessment, prognostication, and cost effectiveness.²¹ If done in a systematic and effective manner, this could lead to further development of critical care in these settings through stepwise introduction of service improvements, leveraging of human resources through training, a focus on sustainable technology, and sharing of context-specific best practices.²¹

With the above tenets in mind, we have selected as authors for this special issue in pediatric global health and critical care leaders in pediatric critical care, neonatal intensive care, global health, policy development, and medical education to review individual topics within their fields of expertise. Through this series of articles, we hoped to focus on several recurrent themes in global health: (1) local capacity building in international settings with utilization of local infrastructure for program development, platform dissemination, and program sustainability in limited-resource countries; (2) barriers and challenges to clinical and educational program development for pediatric resuscitation and critical care in LRS; (3) adaptation of pediatric critical care curricula and contextualization of educational programs for country-specific issues in LRS; and (4) assessment, evaluation, and clinical management issues for critically ill neonates and children in LMICs and austere environments, including pediatric trauma victims and pediatric patients during mass casualty events/disasters. We have endeavored to provide global and multicultural perspectives by soliciting collaborative article contributions from authors in Asia, South America, Africa, and North America. We envision that, in doing so, we can create broader awareness of existing issues in the care of pediatric patients worldwide and begin to outline strategies to move the health care community toward an adequate standard of critical care for all children globally. We hope that this series of articles acts as a call to the critical care community in pediatrics to focus on international partnerships, contextualized educational initiatives, and more inclusive research strategies, all of which have the potential to ultimately decrease the mortality of children worldwide.

References

- 1 Global Health Workforce Alliance and World Health Organization. A Universal Truth: No Health Without a Workforce. Third Global Forum on Human Resources for Health Report, November 2013. Available at: http://www.who.int/workforcealliance/knowledge/resources/GHWA-a_universal_truth_report.pdf?ua=1. Accessed March 22, 2016
- 2 United Nations. The Millennium Development Goals Report 2015. New York, 2015. Available at: [http://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20\(July%2015\).pdf](http://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20(July%2015).pdf). Accessed March 22, 2016
- 3 United Nations. Transforming Our World: The 2030 Agenda for Sustainable Development, September 2015. Available at: <https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf>. Accessed March 22, 2016
- 4 World Mapper Cartograms [Internet]. Available at: www.worldmapper.org/countrycartograms. Accessed March 22, 2016
- 5 Lamontagne F, Clément C, Fletcher T, Jacob ST, Fischer WA II, Fowler RA. Doing today's work superbly well—treating Ebola with current tools. *N Engl J Med* 2014;371(17):1565–1566
- 6 Bhutta ZA, Black RE. Global maternal, newborn, and child health—so near and yet so far. *N Engl J Med* 2013;369(23):2226–2235
- 7 GBD 2013 Mortality and Causes of Death Collaborators. Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet* 2015;385(9963):117–171

- 8 Molyneux E, Ahmad S, Robertson A. Improved triage and emergency care for children reduces inpatient mortality in a resource-constrained setting. *Bull World Health Organ* 2006; 84(4):314–319
- 9 World Health Organization. Handbook IMCI: Integrated Management of Childhood Illness. Geneva: World Health Organization; 2005
- 10 World Health Organization. Emergency Triage Assessment and Treatment. Geneva: World Health Organization; 2014
- 11 Nolan T, Angos P, Cunha AJ, et al. Quality of hospital care for seriously ill children in less-developed countries. *Lancet* 2001; 357(9250):106–110
- 12 Ayieko P, Ntoburi S, Wagai J, et al. A multifaceted intervention to implement guidelines and improve admission paediatric care in Kenyan district hospitals: a cluster randomised trial. *PLoS Med* 2011;8(4):e1001018. Doi: 10.1371/journal.pmed.1001018
- 13 Reyburn H, Mwakasungula E, Chonya S, et al. Clinical assessment and treatment in paediatric wards in the north-east of the United Republic of Tanzania. *Bull World Health Organ* 2008; 86(2):132–139
- 14 World Health Organization. Updated Guideline: Paediatric Emergency Triage, Assessment and Treatment. Geneva: World Health Organization; 2016
- 15 Maitland K, Kiguli S, Opoka RO, et al; FEAST Trial Group. Mortality after fluid bolus in African children with severe infection. *N Engl J Med* 2011;364(26):2483–2495
- 16 de Savigny D, Adam T eds. Systems Thinking for Health System Strengthening. Alliance for Health Policy and Systems Research. Geneva: World Health Organization; 2009
- 17 Kleinpell R, Ely EW, Williams G, Liolios A, Ward N, Tisherman SA. Web-based resources for critical care education. *Crit Care Med* 2011;39(3):541–553
- 18 Duke T, Yano E, Hutchinson A, et al; Paediatric Society of Papua New Guinea. Large-scale data reporting of paediatric morbidity and mortality in developing countries: it can be done. *Arch Dis Child* 2016;101(4):392–397
- 19 Tripathi S, Kaur H, Kashyap R, Dong Y, Gajic O, Murthy S. A survey on the resources and practices in pediatric critical care of resource-rich and resource-limited countries. *J Intensive Care* 2015;3:40. Doi: 10.1186/s40560-015-0106-3
- 20 InFACT: International Forum for Acute Care Specialists [Internet]. Available at: <http://www.infactglobal.org/Home.aspx>. Assessed March 22, 2016
- 21 Riviello ED, Letchford S, Achieng L, Newton MW. Critical care in resource-poor settings: lessons learned and future directions. *Crit Care Med* 2011;39(4):860–867