World Pneumonia Day 2016: How locally adapted mHealth systems, pulse oximetry implementation, and risk scores may contribute to reducing childhood pneumonia mortality in the Sustainable Development era

Eric D. McCollum,1,2\* Carina King,3 Laura L. Hammitt,4,5 Amy Sarah Ginsburg,6 Tim Colbourn,3 Abdullah H. Baqui,7 Katherine L. O’Brien4

Authors’ preferred degree and email addresses:

Eric D. McCollum MD ericdmccollum@gmail.com

Carina King PhD c.king@ucl.ac.uk

Laura L. Hammitt MD lhammitt@jhu.edu

Amy Sarah Ginsburg MD, MPH aginsburg@savechildren.org

Tim Colbourn PhD t.colbourn@ucl.ac.uk

Abdullah H. Baqui DrPH abaqui@jhu.edu

Katherine L. O’Brien MD, MPH klobrien@jhu.edu

Author Affiliations:

1Eudowood Division of Pediatric Respiratory Sciences, Johns Hopkins School of Medicine,  Baltimore, USA

2Department of International Health, Johns Hopkins Bloomberg School of Public Health, Dhaka, Bangladesh

3Institute for Global Health, University College London, London, UK

4Department of International Health, International Vaccine Access Center, Johns Hopkins Bloomberg School of Public Health, Baltimore, USA

5Kenya Medical Research Institute - Wellcome Trust Research Programme, Kilifi, Kenya

6Save the Children, Seattle, USA

7Department of International Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland, USA

\*Corresponding Author:   ericdmccollum@gmail.com

Abanti Building – Suite. #5B & 5D, House 37, Road 27, Banani, Dhaka 1213, Bangladesh

Pausing to reflect on World Pneumonia Day, we celebrate numerous achievements in the fight against child pneumonia. Most notably, annual pneumonia deaths among children younger than aged five years have declined from 1.7 million in the year 2000 to 0.9 million in 2015.1 Vaccine and antibiotic use have contributed substantially to this reduction in mortality but maximum benefits will only be achieved when these interventions are implemented with high coverage and quality across diverse cultures and health systems. Much work remains. As we transition into the era of Sustainable Development, our joint task is to identify the next generation of interventions that will work synergistically with these established approaches to further reduce mortality, and even accelerate the pace of that decline.

The logical question is what other interventions will reach across increasingly complex settings to achieve a degree of success comparable to our current vaccine and antibiotic portfolio. No single solution will suffice. Vaccine development will continue to be central, especially next generation pneumococcal and new RSV vaccines. Beyond these, progress will likely require a combination of locally adapted interventions optimized to address the etiologic contribution of pathogens causing pneumonia deaths, while also reducing the prevalence and improving the management of mortality risk factors like hypoxemia, malnutrition, anemia, prematurity, human immunodeficiency virus infection/exposure, and environmental factors (hygiene, water, and air pollution). The examples of mobile Health (mHealth), pulse oximetry, and severity of illness scores offer insight into how mortality reduction may next unfold.

The World Health Organization (WHO) Integrated Management of Childhood Illness (IMCI) guidelines recommend pneumonia management that optimizes diagnostic sensitivity over specificity to ensure that possible bacterial pneumonia cases do not go untreated. Yet guideline implementation remains suboptimal across the highest burden countries in Africa and Asia, largely beset by weak, understaffed health systems unable to provide adequate supervision and uphold accountability. These systems fail to sufficiently equip and empower healthcare providers to identify and treat children with high-risk co-morbidities. Continued investment in strengthening effective district and community level training and supervision will remain the essential first step, but innovative development and expansion of locally integrated mHealth systems could be a key adjunct. mHealth systems using cellular networks to facilitate real-time data access could enable remote, efficient, responsive, and cost-effective supervision and monitoring.2 mHealth tools may also improve patient-centered, guideline-compliant decision-making (including co-morbidity identification and management) to achieve better health outcomes.3 Research in local mHealth development, integration, and impact should be a priority.

In the 2014 WHO IMCI update, pulse oximetry was added as an assessment step for frontline facility-based health workers, along with a recommendation for referral of children with cough and/or difficult breathing and hypoxemia less than 90%.4 A critical initial need is to learn about where and how oximetry best fits into the IMCI care pathways and whether it will be affordable and sustainable. Is oximetry best employed as a triage tool for all children or reserved for only those with cough and/or difficult breathing? At which system levels can oximetry be cost-effectively implemented? Although promising, unknown is whether frontline health facilities or community health workers will have major impact using oximetry in all settings. Given that a health system’s capacity and hypoxemia prevalence can vary between, and within, countries, the answer is likely to be found locally.5 For example, a rural Malawian study of outpatient oximetry found that hypoxemia was not only commonly present in pneumonia cases, but that oximetry improved the identification and referral of children with hypoxemia.6 This study also identified a concerning high proportion of cases (>60%) who were referral eligible by hypoxemia alone, but missed by IMCI clinical referral criteria. Another forthcoming study from Malawi reports the association of an oxygen saturation 90-92%, moderate hypoxemia, with higher pneumonia mortality risk, raising the question that a threshold of less than 90% may not be the most appropriate for initiating oxygen or hospital referral everywhere (McCollum ED, personal communication). Additional studies from other countries examining these areas will be informative.

Practical pneumonia severity of illness scores, using age, hypoxemia, and co-morbidities like malnutrition as cornerstones, but adapted to local disease epidemiology and health system capacity, are gaining traction as objective tools to prioritize children with an increased mortality risk for earlier hospital referral, closer home follow-up, or advanced treatments which require greater resources, such as bubble continuous positive airway pressure (bCPAP).7-10 bCPAP has exhibited potential in a Bangladeshi randomized trial at a tertiary intensive care setting, showing significantly lower pneumonia mortality compared to low-flow oxygen;11 African trials are ongoing (McCollum ED, personal communication). Work to externally validate and locally adapt the South African Respiratory Index Severity Score is also forthcoming from the multi-country Pneumonia Etiology Research for Child Health Study (O’Brien KL, personal communication) and from Malawi (King C, personal communication).7 Research to prospectively implement such scores, perhaps alongside mHealth tools, and to assess clinical impact are needed.12

Lastly, it is imperative that any advances in pneumonia prevention, triage, or treatment be accompanied by improvements in care access. This is particularly critical for children currently unable to reach care in a timely manner, who present later, with greater disease severity and preventable mortality. If we fail to access more children, then mortality reduction will inevitably plateau. Improving demand for child pneumonia care through community sensitization to disease prevention and symptom recognition must also accelerate so that no one is left behind in our collective movement to prevent child pneumonia deaths.

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