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How to Push the Limit: Developing Informed Research and Implementation Programs in Resource Limited Settings

Fiona Muttalib, MDCM and Allan Doctor, MD*

Division of Pediatric Critical Care, Washington University in St. Louis, St. Louis, Missouri

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In low- and middle-income countries (LMIC), the burden of unintentional childhood injury is high, with mortality due to injury 3.4 times higher than in high-income countries (HIC) (1). Pediatric traumatic brain injury (TBI) remains a significant global health problem with up to 3 million children affected annually worldwide and mortality rate between 1 – 7% (2). TBI represents one of the most common severe injuries, though inadequately described in the current literature and likely underestimated in LMICs (1). The largest qualitative literature review to date comprised 165,000 children with TBI, yet this population included only 127 children from LMIC (one publication from Africa and three publications from Asia)(2). In this issue of PCCM, Fink et al. partially address the dearth of epidemiologic data available with the aim of informing priorities for future research, education and quality improvement (3).

Broadly speaking, development of novel research programs should be firmly grounded by a formal, detailed assessment of the target disease and population in a fashion that is specific to context and environment. With this strategy in mind, the PANGAEA group undertook an international point prevalence study of acute neurologic disease, first publishing their results predominantly from HIC academic hospital settings (4). In this following study, Fink et al. surface important distinctions for children with TBI in resource-limited settings (RLS) that merit further attention.

In keeping with prior data, key differences in the predominant causes of TBI in RLS were identified: falls were the most common and, in the setting of road traffic accidents, pedestrian victims were more common than passenger victims (2). As an aside, injury prevention may also be informed by these data; specifically, increased prevalence of pedestrian injuries suggests an unintended consequence of road improvements that do not anticipate need to protect foot commuters attracted to these routes. Pre-hospital care was

*Corresponding author: Doctor_A@kids.wustl.edu.

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uncommon (54%) with only 3% transported by ALS-trained providers and 51% by BLS-trained providers. This population assessment is limited by selection bias as children were enrolled only at tertiary academic hospitals. In RLS, this may exclude children who were critically injured at presentation to a district hospital, for whom timely transport was unavailable or for whom seeking treatment was deemed futile. As such, the high proportion of favourable outcome (73%) and low reported mortality (9%) suggest that selection may have biased the study population to less severe TBI. Though no difference in mortality or favourable outcome was detected for patients transported by BLS- or ALS- trained providers, the true effect may not have been detected if the patients transported had mild TBI and did not require specific interventions during transfer.

Of note, the observed difference in frequency of TBI versus infectious encephalitis (IE) may have been impacted by the site of enrollment. Where possible, children with TBI would likely be referred for tertiary care, whereas children with IE would likely be brought to the nearest hospital and remain for the duration of care. This would account for the shorter time to presentation of children with IE who were brought directly to the referral center. IE seasonality would also modify the relative frequency (in comparison to TBI), specifically due to cerebral malaria. In the next phase of study, inclusion of children at district health care centers and during different seasons would be advantageous. Thereafter, these initial baseline data can serve as a sound basis for devising a public health agenda that is relevant to the specific setting, disease and population.

At the hospital level, interventions must be tailored to locally available resources with attention to equipment, personnel and expertise. Recent evidence suggests that unanticipated ill effects may be observed after applying guidelines derived in resource-rich areas to RLS (5, 6). In light of this, the Global Sepsis Initiative adapted Surviving Sepsis guidelines by level of resources available and evaluated their impact on mortality (7). Given that current guidelines for management of severe pediatric TBI were based upon evidence predominantly derived in HIC (8), caution should be exercised prior to blanket deployment of similar recommendations in RLS. Despite the intuitive likelihood of benefit, the feasibility and efficacy of core neuroprotective bundle interventions (e.g. elevating the head of the bed, maintaining normoglycemia and normothermia, providing supplemental oxygen, treating seizures with anti-epileptic drugs) must be evaluated. Thereafter, a graded approach to advanced TBI monitoring and management can be generated for use where appropriate.

Beyond the immediate management of the injured child with TBI, Fink et al highlight the limited disposition to convalescent rehabilitation. Only 12% of children with TBI were discharged for inpatient rehabilitation versus 30% in the international survey conducted by the PANGAEA group. Concurrent with an approach to improving pre-hospital and hospital care of children with TBI, development of programs for rehabilitation must be a priority. While increased hospital survival has been associated with a concurrent improvement in rate of good functional outcome, some children will survive with morbidity (9). The family impact of a child with functional sequelae may indeed be magnified in RLS. Without rehabilitation and long-term care facilities, responsibility for ongoing care at home falls exclusively upon family members and siblings. This interrupts schooling and work, increasing both current and future financial burdens (1). Thus, a complete public health

agenda cannot omit an assessment of existing rehabilitation infrastructure and a pragmatic implementation strategy.

Fink et al have taken an important first step for the global health community that is necessary prior to development of wise action plans. We must be structured in the approach to research in RLS, adapt interventions in partnership with experienced local care providers and be rigorous in the assessment of their impact on the child, family and broader society. We should be prepared push the “limit” in favour of an informed approach to this important global health problem for a feasible improvement children’s outcomes.

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