

Patient safety without borders: measuring the global burden of adverse events

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In high-income countries, prominent cases¹ and seminal epidemiologic data^{2–3} have focused attention on the importance of safe medical care for hospitalised patients. Since this initial work, reports from high-income countries have painted a remarkably consistent picture, with around 9% of hospital admissions complicated by an adverse event (ie, an injury due to medical care), of which around 44% may be preventable.⁴ In this issue of *BMJ Quality & Safety*, Jha *et al*⁵ make a substantial contribution to the patient safety literature by estimating the burden of adverse events among hospitalised patients worldwide. They incorporate a systematic search of published data and recent multi-country observational studies commissioned by WHO, construct statistical models to pool these data, and meticulously report the underlying assumptions, methods and results.

The main findings are that approximately 43 million adverse events occur each year around the globe and cause a staggering 23 million associated disability-adjusted life years (DALYs, the sum of years of life lost and years lost to disability). Importantly, two-thirds of these occur in low-income and middle-income countries (LMICs).⁵ This level of DALYs places adverse events ahead of maternal disorders (16 million) and behind cirrhosis (31 million), although as the authors point out, DALYs due to adverse events are not new but comprise some of the total global burden of 2.5 billion DALYs.⁶ The widely cited estimate from the US Institute of Medicine⁷ of 44 000–98 000 preventable deaths annually due to medical care made medical error the eighth leading cause of death in the USA. Similarly, the analysis by Jha *et al*⁵ suggests that preventable adverse events represent a leading cause of morbidity and mortality worldwide.

WHERE DO THE NUMBERS COME FROM?

Jha *et al*⁵ considered DALYs from seven in-hospital adverse events: adverse drug events, nosocomial pneumonia, catheter-related blood stream infections, catheter-related urinary tract infections, venous thromboembolism, falls, and decubitus ulcers. Although their estimates of burden are subject to biases, several would lead to underestimation of the number of adverse events. The most notable such bias is the exclusion (due to limitations of available data) of clinically important and common adverse events in LMICs related to peripartum care, counterfeit drugs, unsafe injection practices, blood use, surgery and outpatient care. Inclusion of these events would only increase the estimated global toll of adverse events. In contrast, one bias that would overestimate the number of DALYs in LMICs is the assumption of equal life expectancy as in high-income countries, but this methodology is consistent across the Global Burden of Disease research programme.⁸

Accepting the findings at face value, one limitation is that the highlighted deficiencies in inpatient medical care may be refractory to intervention. For example, preventability has not been considered. Since not all adverse events are preventable, and since case reviewers generally only agree modestly on the extent of preventability, the opportunity to eliminate adverse events and subsequent DALYs is less than implied in the summary estimates. A more fundamental issue is that of causality. For example, Jha *et al*⁵ use disability weights for endocarditis to calculate DALYs for catheter-related blood stream infection. The authors turned to analogous conditions because data on disabilities caused by in-hospital adverse events are lacking. However, disability in a patient admitted with endocarditis is much easier



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to attribute to this disease than disability due to catheter-related bloodstream infection in a critically ill patient admitted with community-acquired pneumonia, septic shock and acute respiratory distress syndrome. Even if the causality is obvious, how can one distinguish DALYs attributable to an adverse event from the DALYs that would have followed from the underlying condition? Indeed, two adverse event studies asked chart reviewers about the probability that patients would have left the hospital alive with good quality of life in the absence of adverse events, and in both studies the answer amounted to 'not often'.^{9 10} Therefore, eliminating medical error may have less impact on DALYs than anticipated, but this is a common issue in patient safety research and should not stop clinicians, investigators or policymakers from implementing and evaluating quality improvement initiatives.

HEALTHCARE QUALITY VERSUS ACCESS

While readers may quibble with estimates of disability due to adverse events and their preventability, the message that most inpatient adverse events are concentrated in LMICs is novel and important. The implication is that global resources devoted to patient safety should be concentrated in LMICs, where the burden is greatest. These data also raise a crucial point about expanding access to healthcare, an urgent priority in LMICs: it should be accompanied by activities in quality improvement. Indeed, a recent global seminar highlighted these concerns, prioritising the engagement of health workers, patients and governments in quality improvement and technical assistance to incorporate evidence-based quality improvement methods.¹¹

Improved access to healthcare underscores political commitments to the fulfilment of health-related millennium development goals, which include reductions in child mortality, HIV/AIDS, malaria and other diseases, and maternal illness.¹² Although inadequate access to healthcare is a major barrier to reducing disease burden,¹³ other non-clinical health system factors, such as access to water and sanitation and the extent of government corruption, are equally important.¹⁴ Even in a high-income setting, limitations of simply improving healthcare access were recently demonstrated in a study of US Medicaid expansion in Oregon. Clinical outcomes did not improve despite achieving the goals of more healthcare services being provided and patients experiencing less financial strain.¹⁵

THE SCOPE OF THE PROBLEM MAY BE RIGHT, BUT WHAT ABOUT THE SPECIFICS?

Notwithstanding these considerations, clinicians, researchers and residents of LMICs may have a more fundamental objection to the study's findings and implications.⁵ The barriers to patient safety in LMICs, even where hospitals are generally accessible, will strike many as palpably different from those in high-

income countries. How could problems such as catheter-related bloodstream infections represent an important patient safety problem in regions like sub-Saharan Africa where central lines are generally unavailable?¹⁶ Surely central line complications, venous thromboembolism, and other issues pale in comparison to blatant patient safety problems due to basic infrastructure gaps in hospitals (erratic electricity and water)¹⁷; expired, counterfeit or intermittently available medications¹⁸; lack of skilled birth attendants¹⁹; surgical site infections²⁰; and limited treatments for diseases predominantly affecting LMICs.²¹

Clearly, this reaction has some basis in fact. Importantly, however, Jha *et al* do not claim that patient safety problems of high-income country healthcare systems constitute the most important patient safety problems worldwide. Rather, they demonstrate that even counting only these problems, LMICs experience the preponderance of harm. If a reliable estimate of the harms uniquely associated with care in LMICs were available, it would only strengthen the authors' findings that the large majority of harm from medical care occurs in these countries.

WHO has already acknowledged that improving patient safety in LMICs will require attention to different priorities and targets than in high-income countries. LMICs need locally effective solutions for problems such as counterfeit drugs, inadequate healthcare worker competencies and training, and poor basic maternal and neonatal care.²² Given the importance of affordability for these solutions, the cost effectiveness of potential safety interventions should be determined and ranked, as was recently done for around 500 interventions for high-burden non-communicable diseases in sub-Saharan Africa and South-East Asia.²³

HIGH ACUITY CARE STILL MATTERS IN LMICs

If patient safety problems related to poor basic healthcare services and infrastructure dominate complications of hospital care, why pay attention and dedicate resources to high acuity hospital care? Traditionally, global health improvement efforts have focused on nutritional adequacy, treatment of endemic infections, and provision of basic maternal and neonatal care. However, for a young and previously healthy patient who develops sepsis, an obstetrical catastrophe or is injured, timely access to an organised system of acute care, even a modest intensive care unit, can prevent death and disability. As noted in recent reviews^{17 24 25} and descriptive epidemiologic studies^{26–28}—and confirmed by the personal experience of many^{29 30}—these patients often present late to hospital from reversible acute illnesses. While traditionally relegated to low-priority status, acute medical care is now increasingly recognised as a worthwhile component of public health.³¹ This care is not about technology, but focuses on simple, effective and affordable interventions like antibiotics, intravenous fluids, oxygen and close

monitoring by trained nurses. As counterintuitive as it may seem, a short trial of intensive care will become more feasible and cost effective in LMICs. Contributing factors include rapid urbanisation (driving the burden of infections³² but also making hospital care more accessible) and knowledge translation programs for sepsis^{33 34} and obstetrical care.³⁵

FUTURE DIRECTIONS

Regardless of the specific adverse events, the objective of reducing their global burden globally is worthy. However, the barriers are substantial. First, even with two decades of concerted effort to reduce adverse events in high-income countries, multicentre observational studies have shown no appreciable improvements.^{36 37} Progress in identification of effective patient safety interventions, dissemination of effective interventions and use of measurement tools to evaluate effectiveness in real clinical settings have all been limited.³⁸ Second, resources are lacking. Economic challenges in high-income countries are even more acute in LMICs, whose healthcare problems receive disproportionately low research and development funding.³⁹ Considering grants from global health-focused organisations like the Bill and Melinda Gates Foundation, <5% of total funding between 1998 and 2007 was directed to health services research; the largest proportion (36%) focused on basic science.⁴⁰ Third, the data collection infrastructure for adverse events in LMICs is hampered by rudimentary medical record systems and lack of trained personnel. Fourth, there is insufficient capacity for research in LMICs.

In response, WHO launched several initiatives in patient safety. One prominent example is the 'Safer Surgery Saves Lives' campaign, which has documented the global volume of surgery⁴¹ and gaps in operating room supply⁴² and pioneered a simple checklist to improve intraoperative safety.⁴³ Other efforts include tools for patient safety research and quality improvement in 'data-poor' hospitals⁴⁴ and a consensus conference to develop international core competencies for patient safety research.⁴⁵ Local patient safety research expertise is crucial because the uncritical adoption of best practices from high-income countries may lead to harm, an important lesson from clinical interventions.⁴⁶

In summary, Jha *et al*⁵ highlight inpatient adverse events as a crucial and under-recognised category contributing to the global burden of disability and premature death. The most pressing patient safety problems in LMICs may differ from those analysed in the study, but the epidemiology of adverse events will evolve over time. As countries urbanise and develop economically, access to hospital-based care will expand, societal expectations of healthcare will increase, and survival after trauma, sepsis and childbirth should improve. As hospital care becomes more available and complex, the risks of safety problems commonly recognised in high-income countries will require

measurement and quality improvement activities. The epidemiologic data in this study, which highlight the need for more attention, resources and sharing of skills to deal with patient safety problems on a global scale, are thus welcome and timely.

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