Epidemiologic Approaches to Global Health

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In this introduction to volume 32 of Epidemiologic Reviews, the authors highlight the diversity and complexity of global health concerns, and they frame the 12 articles included in this issue within the diverse topics of research in this emerging and ever-expanding field. The authors emphasize the need for ongoing research related to the methods used in global health and for comprehensive surveillance, and they offer suggestions for future directions in global health research.

Abbreviations: AIDS, acquired immunodeficiency syndrome; communicable diseases; environmental health; epidemiologic methods; HIV; maternal welfare; population surveillance; world health

This issue of Epidemiologic Reviews focuses on global health, a term that has come into use since this journal was started. Global health is a new and evolving field, and its definition has proved elusive and even contentious (1, 2). An experienced group of practitioners proposed a definition that implied a new multidisciplinary field with a focus broader than the traditional domains of public health and international health (1). In response, a recent commentary from leaders in US schools of public health finds little distinction between “global health” and “public health” (2). The scope of papers in this global-health-themed issue of Epidemiologic Reviews reflects the broad reach of those involved in global health research, regardless of the definitional debate, and the central place of long-established epidemiologic approaches in this emerging and ever-expanding field.

As with all public health topics, the problems inherent in global health need to be identified, quantified, and tracked. Several reviews in the issue are concerned with the methods used for these purposes. Castillo-Salgado (3) provides a comprehensive review of global health surveillance. The methods and principles covered are those of surveillance generally, no different from the classic description by Langmuir in 1963 (4). However, coverage has shifted to a global level, not only raising the complexity of cooperation among nations but also addressing difficult surveillance and health systems issues, as well as serious deficiencies in the infrastructure required for efficient monitoring and reporting of diseases. The review also probes the role of the new edition of the International Health Regulations (5) and the rapid development of new global public health networks for disease surveillance and bioterrorism. Examples such as severe acute respiratory syndrome (SARS) and the pandemic of H1N1 influenza are utilized to identify the various issues required to be tackled in establishing global health surveillance systems. As with many problems in global health, capacity building is urgently needed in some areas in which disease surveillance is lacking or insufficient. It is evident that these new directions of global surveillance are transforming and driving the function and form of public health in a globalized world. The World Health Organization has a critical role in coordinating the multilateral response to emerging infectious diseases and other health threats.

Methods for surveillance have become more sophisticated, reflecting advances in data systems, surveillance methodology, and analytic methods. Brookmeyer (6) reviews the methods used to track the human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome (AIDS) epidemic, now followed for nearly 30 years. Over this time period, data sources and methods for assessing incidence and prevalence have changed, and these changes have led to new figures and discontinuities of the new figures with prior figures. Brookmeyer’s analysis highlights the need to maintain continuity of tracking, even as advances enhance surveillance. The ability to differentiate between changes in HIV/AIDS surveillance data on a yearly basis due to changes in methodology versus real changes in the...
underlying epidemic will be critically important in monitoring trends in this disease as well as others. The “lessons learned” from HIV/AIDS surveillance are predictive of challenges that will inevitably come regarding other diseases with global reach.

Identifying causes of mortality and attributing disease burden based on these illnesses has always been challenging but is now a very real issue for global health investigations. Fewer than one-third of deaths worldwide are assigned a cause of death, limiting our understanding of population health and of the effectiveness of specific interventions aimed at improving health. With declining rates of postmortem autopsies in many countries, epidemiologists need to depend more on verbal autopsies in assigning cause of mortality within a country. Counting and classifying deaths by using the verbal autopsy technique is well established and has been in use for decades. Fottrell and Byass (7) provide a systematic review of verbal autopsy methods, documenting their evolution and calling for broad context- and purpose-relevant approaches. Absent a “gold standard,” they call for standardization and the tailoring of approaches to situations and purposes. In Fottrell’s and Byass’ view, the verbal autopsy is still a work in progress and in need of empirical methodological research.

The diversity of health matters inherent in global health is exemplified by the variety of topics covered in this issue. Included are unintentional injury, HIV/AIDS, malaria, sexually transmitted infections, family planning, environmental health, maternal and child health, and the effects of global health on foreign policy. These topics provide only a very small snapshot of the multidisciplinary approach to global health and the variety of issues facing us in promoting health on a global basis.

One of these issues common to all countries and all populations is unintentional injury, a rising cause of morbidity and mortality. More than 90% of such deaths and disabilities from unintentional injuries occur in low- and middle-income countries. Road traffic injuries make up the largest proportion of these premature deaths and disability-adjusted life years lost. Rising numbers of vehicles are leading to increasing accidents throughout the world. In China, the private vehicle fleet increased from about 280,000 in 1985 to about 290 million in 2007 (8); in India, the new Tata Nano vehicle will be affordable for millions of drivers at a price starting at Rs 115,000 (approximately US $2,500) (9).

The review by Chandran et al. (10) emphasizes the already substantial public health consequences of unintentional injury. These authors call for additional data targeted to have a policy impact. Cost estimation, one of their proposed approaches, may be one of the most effective translation strategies for motivating protective policies. Several decades ago, a landmark report by the National Research Council, Injury in America: A Continuing Public Health Problem (11), set out a national agenda for the United States, emphasizing the need for evidence from surveillance and from research. Chandran et al. provide a template for a global evidence-based strategy, incorporating 6 core areas that need further research investment and capacity development: surveillance, etiology and predictors of injury, costs and the burden on society, public perceptions, environment, and public policy.

Infectious diseases continue to dominate the landscape of global health. In considering the long-standing global threat of malaria, Sullivan’s (12) review is comprehensive in its coverage. Primarily because of population growth in malaria-endemic areas, malaria threatens the health of 3.4 billion people today, an increase from 800,000 a century ago. Sullivan emphasizes the spatial heterogeneity of the disease and the relevance of this heterogeneity to prevention. A strategy is proposed based on mapping malaria infections in space and time to target control efforts. The author leaves unanswered the question of integrating this strategy into the array of malaria control strategies. Evaluation of this approach, as for any other element of a multifaceted strategy, is not specified and will need further development.

Beyrer et al. (13) show the essential role of surveillance in combating the global HIV pandemic. Their systematic review considers the role of men who have sex with men in 4 different scenarios and the corresponding factors contributing to the epidemic in low- and middle-income countries. The review identified 138 studies from 54 countries, and their findings were the basis for proposing 4 categories related to the role of men who have sex with men in propagating the epidemic in the various countries. Representative countries were then selected for each category, and the “epidemic scenarios” were used to explore selective control strategies. This analysis points to the need for ongoing collection of data within each country and community so as to continuously tailor HIV prevention strategies to more effectively fit the HIV epidemiology and the social context of HIV risk.

Wetmore et al. (14) systematically review randomized controlled trials of interventions to prevent sexually transmitted infections. Worldwide, these infections contribute to significant morbidity and disproportionately impact the health of women and children. In addition, they contribute to the transmission of other infections, such as HIV, leading to more morbidity and mortality. The authors identified 93 papers from 74 randomized controlled trials, evaluating 75 interventions to prevent sexually transmitted infections, including behavioral interventions, vaccines, microbicides, male circumcision, treatment, and multicomponent efforts. Over half of these interventions demonstrated efficacy in preventing at least one sexually transmitted infection, with treatment and vaccine being the most effective and microbicides and barrier methods the least effective. The authors concluded that implementation research and scale-up of interventions known to be successful is urgently needed to control the spread of these widespread infections and to reduce their morbidity. Multicomponent interventions and new biomedical interventions using more effective drugs should also be investigated in future randomized controlled trials.

Three papers touch on global threats to child health. Pope et al. (15) address indoor air pollution from solid fuel use in developing countries and low birth weight and stillbirth. Approximately 3 billion people worldwide are exposed to smoke from indoor fuel combustion for heating and
cooking, and this exposure is causally associated with lower-respiratory illnesses, including pneumonia, chronic obstructive lung disease, and lung cancer, resulting in high morbidity and more than 1.5 million deaths annually. Pope et al. identified a small number of articles on this association with indoor air pollution: 5 for low birth weight and 3 for stillbirth. Even this limited body of evidence indicated that indoor air pollution had an adverse effect on pregnancy outcome. The authors found that the evidence is sufficient to motivate action, but they also call for more research. The evidence on lower-respiratory illness already makes a compelling case for action. Since the predominance of pregnant women live in developing countries, where indoor air pollution is greatest, this increase in relative risk translates into substantial population attributable risks for both low birth weight and stillbirth.

Abu-Saad and Fraser (16) provide a perspective on maternal nutrition during pregnancy and adverse birth outcomes. They illustrate this complex topic with a conceptual framework that emphasizes the timing of nutritional issues across gestation, delivery, and lactation. They draw on literature resources and, within their framework, conclude that “maternal nutrition is a modifiable risk factor of public health importance” (16, p. 5). Even single-nutrient interventions conducted for a limited period during a single pregnancy have shown positive effects on birth outcomes. The authors conclude that additional studies, particularly randomized controlled trials, would provide the best evidence. While highly effective, nutritional supplementation alone has met with some controversy, and some studies have suggested that more emphasis be placed on developing, implementing, and evaluating programs aimed at improving specific socioeconomic factors as a more effective means to breaking the cycle of deprivation, maternal undernutrition, and adverse birth outcomes. Clearly, more work is urgently needed to address all these needs in order to ultimately have a positive effect on child survival and maternal health overall.

Tsui et al. (17) address family planning, unintended pregnancy, and public health within a behavioral framework. They begin with the reminder that “unintended pregnancies still constitute a health burden for women and their partners” (17, p. 153). They review epidemiologic aspects of family planning and provide findings of a systematic review, spanning 2004–2009, of pregnancy intentions and birth and maternal outcomes. Notably, the 21 studies meeting their criteria for selection come largely from the United States, and the evidence generally suggests that unintended pregnancy adversely affects short-term maternal or neonatal health outcomes. Tsui et al. then turn to the literature on family planning, finding evidence of a favorable impact on pregnancy outcome. Family planning was documented to prevent mother-child HIV transmission, contribute to birth spacing, reduce infant mortality, and lower the number of unsafe abortions. They end with a call for more research on the relation between contraception and changes in pregnancy morbidity rates, and for expanded access to quality contraception.

Technology has permeated the field of global health interventions over the past decade or more. One review in this issue evaluates cell phones as a tool for intervention. Cell phone usage is expansive and global, with 4.6 billion subscribers at the end of 2009 (18). The potential for using cell phones for research purposes and for providing health messaging was quickly recognized. Cole-Lewis and Kershaw (19) report the findings of a review on the efficacy of text messaging for health promotion, so-called mHealth. While the literature is still limited, it indicates efficacy. Of the 9 countries in which adequately powered studies were carried out, only 1 is a developing country. Theoretically, this widely accessible technology could be used effectively for health behavior change because of its low cost and broad availability in the developing world. The review documents the promise of text messaging, but its efficacy in global health contexts remains to be established.

Collectively, these articles demonstrate the effectiveness of selected interventions in reducing the morbidity and mortality of people worldwide. This research, when scaled up, can result in dramatic improvements in life survival and quality of life. Linkage of health to national stability and the destructive consequences of epidemics have enmeshed global health with foreign policy. This linkage has resulted in increased funding and given priority to selected global health issues such as HIV, tuberculosis, malaria, and maternal and child health. However, the relation between global health and foreign policy can have a negative impact on global health advances in certain countries. Feldbaum et al. (20) examine this relation across 4 aspects of foreign policy including aid, trade, diplomacy, and national security. They conclude that the global health field has “never been better placed in world affairs to improve health and save lives” (20, p. 87), but they caution that success regarding global health will depend on not only new and successful interventions and scaling up of current interventions but also the “ability of public health practitioners to protect and promote global health interests in the political world of foreign policy” (20, p. 88).

The articles included in this issue of Epidemiologic Reviews cover a broad range of topics, although, notably, none address chronic diseases. They highlight the need for ongoing research related to global health methods and for comprehensive surveillance. A number of the reviews find enough evidence to motivate action on unintentional injury, contraception, HIV and men who have sex with men, and malaria. In most of the articles, the inevitable call—“more research is needed”—is obvious but correct when applied to global health. However, for some problems covered in this issue, for example, indoor air pollution, the need for further research on risk should not delay interventions.

What do these articles tell us about what global health is? Although they do not resolve the definitional debate, they highlight the breadth of global health and the complexity of the problems being addressed. The debate about definition will probably be set aside as the field is defined by the work undertaken under its penumbra. We anticipate a dynamic set of problems that will require the combination of solid methodology and high-quality research exemplified in the articles in this issue of Epidemiologic Reviews.
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