From the American College of Epidemiology

Charting a future for epidemiologic training

Ross C. Brownson PhD [a,b,*], Jonathan M. Samet MD, MS [c], Gilbert F. Chavez MD, MPH [d], Megan M. Davies MD [e,f], Sandro Galea MD, MPH, DrPH [g], Robert A. Hiatt MD, PhD [h], Carlton A. Hornung PhD, MPH [i], Muin J. Khoury MD, PhD [j,k], Denise Koo MD, MPH [l], Vickie M. Mays PhD, MSPH [m,n], Patrick Remington MD, MPH [o], Laura Yarber MPH [p]

[a] Prevention Research Center in St. Louis, Brown School, Washington University in St. Louis, St. Louis, MO
[b] Division of Public Health Sciences and Alvin J. Siteman Cancer Center, Washington University School of Medicine, Washington University in St. Louis, St. Louis, MO
[c] Department of Preventive Medicine, Keck School of Medicine of USC, University of Southern California, Los Angeles
[d] Center for Infectious Diseases, California Department of Public Health, Sacramento
[e] Division of Public Health, North Carolina Department of Health and Human Services, Raleigh
[f] Council of State and Territorial Epidemiologists, Atlanta, GA
[g] School of Public Health, Boston University, Boston, MA
[h] Department of Epidemiology and Biostatistics, School of Medicine, University of California, San Francisco
[i] Department of Medicine, School of Medicine, University of Louisville, Louisville, KY
[j] Office of Public Health Genomics, Centers for Disease Control and Prevention, Atlanta, GA
[k] Epidemiology and Genomics Research Program, Division of Cancer Control and Population Sciences, National Cancer Institute, Bethesda, MD
[l] Office of Public Health Scientific Services, Centers for Disease Control and Prevention, Atlanta, GA
[m] Department of Psychology, UCLA Fielding School of Public Health and UCLA BRITE Center for Science, Research and Policy, Los Angeles CA
[n] Department of Health Policy and Management, UCLA Fielding School of Public Health and UCLA BRITE Center for Science, Research and Policy, Los Angeles CA
[o] Department of Population Health Sciences, School of Medicine and Public Health, University of Wisconsin—Madison, Madison
[p] Prevention Research Center in St. Louis, College of Public Health and Social Justice, Saint Louis University, St. Louis, MO

ARTICLE INFO

ABSTRACT

Purpose: To identify macro-level trends that are changing the needs of epidemiologic research and practice and to develop and disseminate a set of competencies and recommendations for epidemiologic training that will be responsive to these changing needs.
Methods: There were three stages to the project: (1) assembling of a working group of senior epidemiologists from multiple sectors, (2) identifying relevant literature, and (3) conducting key informant interviews with 15 experienced epidemiologists.
Results: Twelve macro trends were identified along with associated actions for the field and educational competencies. The macro trends include the following: (1) "Big Data" or informatics, (2) the changing health communication environment, (3) the Affordable Care Act or health care system reform, (4) shifting demographics, (5) globalization, (6) emerging high-throughput technologies (omics), (7) a greater focus on accountability, (8) privacy changes, (9) a greater focus on "upstream" causes of disease, (10) the emergence of translational sciences, (11) the growing centrality of team and transdisciplinary science, and (12) the evolving funding environment.
Conclusions: Addressing these issues through curricular change is needed to allow the field of epidemiology to more fully reach and sustain its full potential to benefit population health and remain a scientific discipline that makes critical contributions toward ensuring clinical, social, and population health.

© 2015 Elsevier Inc. All rights reserved.

* Corresponding author. Prevention Research Center in St. Louis, Brown School, Washington University in St. Louis, 621 N. Skinker Blvd., St. Louis, MO 63130. Tel.: +1-314-935-0114; fax: +1-314-935-0150.
E-mail address: rbrownson@wustl.edu (R.C. Brownson).

Background

The context for epidemiologic research, training, and practice is changing rapidly, due in part to emerging "macro trends" in society (e.g., Big Data, genomics, and team science) that are affecting the profession of epidemiology, as well as public health and medicine more generally. The sweeping changes brought about by such macro trends have already greatly changed sectors outside of public

health and medicine, especially business and economics [1]. Often considered in strategic planning processes, macro trends involve some combination of changing demographics, economic factors, technological changes, and legal, political, or social conditions. In light of several important macro trends affecting epidemiology, there is concern that training in our discipline has changed very little over the past several decades, and therefore, the next generation of epidemiologists will be ill prepared to meet challenges posed by the changing landscape [2].

Training in epidemiology has roots in descriptive epidemiology, etiologic research, causal inference, and public health practice [3]. More advanced methods and their appropriate use are taught quite variably, and there are few textbooks covering material beyond the introductory level. Much of the instruction on emerging methods, for example, topics pertaining to Big Data and/or advanced analytics, is left in many programs to courses in biostatistics, bioinformatics, and computer sciences and may not be available at all in some programs.

Historically, training in epidemiology has benefitted from competency-based education, which has helped to shape educational programs [4,5]. Formally, a competency is defined as a cluster of related knowledge, attitudes, and skills that is important for the performance of a job activity and can be measured against well-accepted standards [6,7]. Employers and positions held by epidemiologists require certain competencies, and the degree to which one can define those competencies is also a determinant of the ability to hire, train, and retain the right people in a given position. For example, graduates of epidemiology training programs who have not mastered the competencies demanded by government agencies or private employers will not be competitive for employment in the current and future job markets.

Several previous efforts have defined competencies relevant to epidemiologic training in the United States. For master's level training, the Association of Schools and Programs in Public Health uses its MPH Core Competency Model to outline 10 competencies in epidemiology and additional competencies in the five traditional core areas of public health and seven interdisciplinary or cross-cutting areas [8]. In 2002, the American College of Epidemiology held a workshop to develop a set of competencies for doctoral education in epidemiology across 12 domains (e.g., descriptive epidemiology, study design, data analysis, communication) [9]. Ongoing work being led by the National Cancer Institute has developed recommendations for training in cancer epidemiology that seek to better position the science for challenges and opportunities in the 21st century [10–12]. For more applied training, the Centers for Disease Control and Prevention (CDC) and Council of State and Territorial Epidemiologists (CSTE) developed a set of competencies for individuals working in public health practice [13,14]. The CDC and CSTE competencies were designed to be comprehensive across four different skill levels and are linked to a toolkit to assess skill levels and tailor efforts.

Building on these previous efforts, this project sought to (1) identify macro-level trends that are changing the needs of epidemiologic training and (2) develop and disseminate a set of competencies and recommendation for epidemiologic training that will be responsive to these changing needs [2]. We asked senior epidemiologists from a variety of sectors to identify macro trends and related competencies.

Data collection and synthesis

The present project began with the assembly of a working group (the coauthors on this article) that had a charge to conduct a series of interviews with epidemiologists working in various capacities to develop and disseminate a set of competencies and

recommendations for epidemiologic training to address the changing landscape (macro trends). The working group consisted of leading U.S. epidemiologists who (1) teach and/or participate in research in various academic (medical schools, schools of public health), government, or industry settings; (2) represent various levels of public health practice (federal, state, local); and (3) have strong linkages to relevant professional groups (e.g., American College of Epidemiology, American Epidemiological Society, Association of Schools and Programs in Public Health, CSTE, Society for Epidemiologic Research). Although the focus of this effort was primarily on epidemiologic training in the United States, many of the issues described are likely to be applicable in other parts of the world.

Next, the initial relevant literature was gathered by the working group. The search began with a convenience sample of articles related to competencies and education in epidemiology identified by the core team (Brownson, Samet, Yarber) and then additional relevant literature was sought from the working group. An initial list of 12 articles [4,10,15–24] was identified.

At the third stage of the project, semistructured interviews with key informants were conducted. An interview guide was developed by the core team that included seven open-ended questions covering the respondent's background or experience in epidemiology, perceptions of the challenges facing epidemiologists as they enter the workforce, an assessment of the degree to which current training is addressing challenges, skills that are missing, other macro-level forces facing epidemiology, and competencies for training that the respondent has found to be useful in her or his career. The interview guide is available from the first author on request. Interviews were conducted with 15 experienced, active, future-oriented epidemiologists from both practice and research settings (including the working group). Most of the respondents worked in academic settings ($n = 10$), whereas two worked for the U.S. government (the CDC and the National Cancer Institute). Five participants either currently worked for a state or local health department or had previously worked in public health practice.

The interviews ranged in length from 15 to 45 minutes. From the interview notes, major themes were extracted and organized in a three-column spreadsheet with the following column headings: major macro trend, skills needed to address the trend, and other comments related to the trend.

The study was reviewed and approved by the Institutional Review Board at Washington University in St. Louis.

Findings

Twelve macro trends were identified and each is briefly described. In Table 1, associated actions for the field and educational competencies are listed. The actions are the broader steps to be taken by the field of epidemiology and other sectors; the competencies are those needed to begin to address many of the actions via specific types of knowledge or skills. Many of these competencies build on earlier efforts [4,8–11,13,25].

Macro trend 1: the growing availability of "Big Data" or informatics

The rapid growth in the scope and ability to link multiple large static and streamed data sets—such as electronic health care records—provides opportunities and challenges for epidemiologists. The U.S. government has invested $200 million to enhance Big Data research within and across federal agencies [26] and the U.S. National Institutes of Health has issued announcements for initiatives in this area. As data sets become increasingly larger and more complex, epidemiologists will need advanced skills to link, manage, map, analyze, interpret, display, and communicate their findings to