We live in the era of genomics and big data. Evaluating the impact on health of large-scale biological, social, and environmental data is an emerging challenge in the field of epidemiology. In the past 3 years, major discussions and plans for the future of epidemiology, including with several recommendations for actions to transform the field, have been launched by 2 institutes within the National Institutes of Health. In the present commentary, I briefly explore the themes of these recommendations and their effects on leadership, resources, cohort infrastructure, and training. Ongoing engagement within the epidemiology community is needed to determine how to shape the evolution of the field and what truly matters for changing population health. We also need to assess how to leverage existing epidemiology resources and develop new studies to improve human health. Readers are invited to examine these recommendations, consider others that might be important, and join in the conversation about the future of epidemiology.

big data; epidemiology; funding; genomics; precision medicine; training

A recent blog post (1) summarized the results of multiyear strategic efforts and discussions on planning for the future of epidemiology conducted by 2 institutes within the National Institutes of Health, the National Cancer Institute and the National Heart, Lung, and Blood Institute. Although the 2 institutes had independent processes, they both arrived at somewhat comparable and overlapping lists of broad and specific recommendations for actions that fall into thematic areas: leadership, resources, epidemiology cohorts, methods and technologies, workforce development, data and knowledge integration, and impact evaluation (Table 1). The primary impetus behind these recommendations is to transform the field and its funding strategies at a time of big data science (2) and technological developments but also resource constraints (3). Given the continued importance of epidemiology as a foundational science for public health and clinical practice, we at the American Journal of Epidemiology seek to encourage an open dialogue and sharing of ideas with our readers about the future of the field. We feel that these recommendations and related questions for discussion shown in Table 1 are worthy of further exploration by the community and are applicable beyond the subject areas of cardiovascular disease and cancer to the field of epidemiology as a whole.

The planning for the future of epidemiology by 2 institutes within the National Institutes of Health coincides with the launch of the Precision Medicine Initiative (4) in 2015. A major component of this initiative is the establishment of a large longitudinal epidemiology cohort of a million or more participants in whom genetic and environmental determinants of a wide variety of human diseases can be studied (4). In the coming years, crucial themes for moving the field of epidemiology forward will include sharing of resources, data, and metadata; evaluation of new methods and technologies to measure exposures, susceptibility, and outcomes; and identification of new ways of collecting personal (e.g., mobile health or “m-health”) and macro-level data. Shared resources such as whole genome sequencing of study participants will help in epidemiologic studies across age and disease spectra.

The use and evaluation of new methods and technologies in epidemiologic research, including new methods of data collection, require extra attention. For example, in the rapidly moving field of genomics and other “omics,” editors of this Journal have anticipated the need for education and information dissemination about various omics fields in the Practice of Epidemiology section (5). A few Primers on -Omic Technologies have been published in the past year (6–10), and more are under way.
More generally, we need to rethink workforce development and training of 21st century epidemiologists in data sciences, collaborative research, and more. This sentiment was echoed in a recent collaborative paper from the American College of Epidemiology on the need to retool epidemiologic competencies in the coming decades to ensure relevance of the field and enhance its ability to adapt to evolving global health needs (11). At the heart of the transformation of epidemiology is perhaps a revised expectation of what the field can or cannot deliver.

More generally, we need to rethink workforce development and training of 21st century epidemiologists in data sciences, collaborative research, and more. This sentiment was echoed in a recent collaborative paper from the American College of Epidemiology on the need to retool epidemiologic competencies in the coming decades to ensure relevance of the field and enhance its ability to adapt to evolving global health needs (11). At the heart of the transformation of epidemiology is perhaps a revised expectation of what the field can or cannot deliver.

Adapted from Khoury and Wei. (1).
even in the midst of a technological revolution. Undoubtedly, large-scale population studies tend to be expensive, and the integration of additional measurements will make them even more expensive. Vasan and Folsom commented on, among other things, the undue focus of the National Heart, Lung, and Blood Institute report on administrative efficiency and cost savings (12). In addition, the focus on the value of risk-factor epidemiology, which has been debated for years, is put into sharper focus in the era of precision medicine. As commented by Keyes and Galea, a focus on “precision” in risk factor analysis “could come at the expense of engagement with the broader causal architecture that produces population health” (13, p. 305). Integrating social and biological determinants in epidemiologic studies is easy in principle but difficult to achieve. Kuller et al. echoed some of the same sentiments and further criticized the development of “large mega cohorts without attention to specific hypotheses” (14, p. 1350). Clearly, epidemiologists have a vested interest in making the field more “consequentialist” (15) and “translational” (16). The epidemiology community will need to shape the evolution of the field and ultimately “what will truly matter most for changing population health” (13, p. 310). We also need to assess how to leverage existing epidemiology resources and develop new studies to improve human health. We invite readers of the Journal to take a look at some of the issues listed in Table 1, consider others that might be important, and join in the conversation about the future of epidemiology by submitting commentaries or letters for publications in the Journal.

ACKNOWLEDGMENTS

Author affiliations: Office of Public Health Genomics, Centers for Disease Control and Prevention, Atlanta, Georgia (Muin J. Khoury); and Division of Cancer Control and Population Sciences, National Cancer Institute, Rockville, Maryland (Muin J. Khoury).

The opinions expressed in this paper are those of the author and not those of the Centers for Disease Control and Prevention.

Conflict of interest: none declared.

REFERENCES