MPH Education for the 21st Century: Motivation, Rationale, and Key Principles for the New Columbia Public Health Curriculum

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Public health is at a watershed moment. The world's health needs are changing, and complex problems require interdisciplinary approaches and systems-based solutions. Our longer lives and changing environments necessitate life-course and structural approaches to prevention.

This argues strongly for public health graduate education that adequately prepares trainees to tackle emerging challenges and to lead now and in the future. Nearly a century of scholarship and scientific advances may offer a blueprint for training the next generation of public health leaders.

We articulate a case for change; discuss some of the foundational principles that should guide public health education; and discuss what such a change might look like building on prior scholarship, on the examples set by other disciplines, and on our own experience. (*Am J Public Health.* 2014;104:23–30. doi: 10.2105/AJPH.2013.301399)

WE ARE IN MANY WAYS IN a period of remarkable global change, driven by large-scale macrosocial forces that, for the first time in human history, are altering the core conditions of daily living and the health needs of populations within single generations. We briefly, by way of illustration, highlight 4 of these forces—globalization, urbanization, population aging, and health disparities—that point to the types of challenges that a new, integrated problem-based curriculum must be designed to prepare graduates to address.

First, the world is globalizing at a dramatic pace. Globalization, the increasing interconnectedness of ideas, behaviors, resources, and human capital across the globe, is increasingly shaping all aspects of human interaction and knowledge exchange.[1,2] At the most visible level, infectious disease outbreaks, fueled by transcontinental travel, are no longer confined to 1 country or continent. Less visibly, global epidemics of obesity are fueled by widespread adoption of unhealthy dietary practices and the growing availability of nutritionally poor, calorie-dense foods, coupled with less physical activity.[3,4] Conversely, a globalizing world creates opportunities for innovative, effective interventions that can promote the public's health, from the ability to develop global governance around shared threats to individual-based solutions. An example of the latter:

novel use of communications technologies have been shown to be effective means of communicating health messages.[5] For example, cellular telephones have been shown to have positive effects on sexual health, because they can be used to quickly communicate risk reduction messages.[6] Young people are the most likely age group to contract sexually transmitted infections and the largest demographic group among cellular telephone users, giving cellular telephones an important potential role in sexual health education. Young people also may be more likely to communicate and follow up with physicians through the privacy of their own cellular telephones instead of a family landline. Globalization then magnifies the scale and scope of public health's remit, presenting previously unthinkable challenges and introducing yet unforeseen opportunities, and highlighting the complex knowledge base and diverse toolkit we need to impart to public health graduates who will be working in a globalized world.

Second, increasingly, urbanization poses a unique challenge to public health research and practice. Urbanization is a sentinel human demographic shift during the past 2 centuries. For the first time in human history, more than half of the world's population is now living in urban areas, with the most rapid urbanization happening in, and most urban

residents living in, low- and middle-income countries.[7,8] By 2030, 60% of the world's population will live in cities. Urban living affects all aspects of the human experience, influencing how we behave, think, interact, eat, and live.[9] Nearly a decade ago, world leaders and mayors at the World Urban Forum in 2004 warned that "rapid urbanization was one of the greatest challenges facing humanity in the new millennium."[10] Migration in many countries results in massive movement of the world's populations into cities annually, occasioning new challenges to urban planning and strains on aging urban infrastructures. It has also resulted in the separation of family members in many regions, attracting young and middle-aged adults to urban environments and leaving the very young and very old in rural areas. However, as with globalization, urbanization presents opportunities for public health action. Effective health departments in large urban areas have been responsible for the implementation of large-scale environmental modifications that influence the health of millions living in densely populated urban areas.[11–13] The concentration of vulnerable populations in cities affords an opportunity to provide services that can meet the needs of these groups. Interconnectedness of urban populations provides opportunities for behavioral interventions at a truly large

scale, illustrating the need for public health graduates to be comfortable in competencies for developing multiple approaches to behavioral interventions and also for taking them to scale.

Third, population aging is the second sentinel demographic shift characterizing global populations over the past century and into this century. People are living longer, and the population pyramids of countries worldwide are changing dramatically. Low- and middle-income countries will age in 40 years to the degree that it took high-income countries 100 years to accomplish. Approximately 11% of the world's population is currently older than 60 years, and 26.9% is 14 years or younger. By 2030, 16.5% of the world's population will be 60 years and older, whereas 22.7% will be 14 years or younger.[14] The world's older than 60 years population will surpass the younger than 14 years population by 2050. Aging of the population will inevitably affect core aspects of public health. With increased longevity comes an increase in chronic disease burden and a shift in the population distribution of disease. This requires a redoubling of efforts to determine how we may better prevent or mitigate the effects of aging on these diseases and of these diseases on how we age. Public health must use a life-course approach to prevention so as to maintain health into the oldest ages. At the same time, an aging population creates tremendous opportunities.[15] A healthy elderly population brings with it intergenerational transfers within families and potentially huge human capital, a resource that can be deployed to improve societal well-being.[16–18] The length of a productive work life also changes, with potential attendant opportunities for global productivity and engagement in efforts that optimize health more broadly. Remaining engaged

in roles also designed to improve health is an important component of public health strategies for an aging world.[19]

Fourth, despite much effort to address them, intergroup disparities in health are increasing throughout the United States and globally. Although the challenge posed by these disparities has long been recognized,[20] disparities often have been stubbornly resistant to intervention and continue to widen.[21] In the United States, disparities are continuous, graded, and cumulative across the life course over dimensions of race/ethnicity, socioeconomic status, and gender.[20] Similar disparities exist within other countries.[22–24] More dramatically, international differences in health are striking and unconscionable. As global incomes increase, the number of marginalized persons globally is, in some countries, increasing even more rapidly.[15] Perhaps as concerning, the investment in health across countries varies dramatically, with the per-person health care expenditure gap between the richest and the poorest countries being 10 times larger than the differences in national incomes between these countries.[25] The persistence of these intergroup differences in health presents both a pressing challenge to public health and a clear call for more innovative approaches to public health problems. Public health graduates then have a particular role to play in both developing—and implementing—these innovative approaches that stand to rise to the forefront in coming decades.

Each of these phenomena will shape the health of the global public over this century. Public health will play a central role in addressing these issues. Future public health graduate education must prepare leaders who can accomplish this, scientists who understand the

issues and how to handle complexity and translate this to policy and practice, and practitioners who set standards. Many other phenomena that are exerting important influence include the emergence and effect of the global health and human rights movements, the rise of social movements worldwide, global migration, climate change and environmental degradation, the effect of environmental exposures, the global burden of disease shift to chronic disease, and the role of community social structures on each of these other processes. Each of the phenomena operates differently, but all have common characteristics that we think will centrally inform how public health practice operates and, by extension, how we must train the next generation of public health professionals.

Each of these problems suggests the need for education both on the health challenges of the 21st century and on the science of complex, large-scale solutions. Simply put, more complex problems require more complex solutions, and public health professionals must learn to work in novel, and lead in transdisciplinary, and sustained ways.[26–28] Perhaps this was best and most succinctly captured in "The NIH Roadmap," articulated nearly a decade ago by then National Institutes of Health Director Elias Zerhouni, who noted,

> The scale and complexity of today's biomedical research problems increasingly demand that scientists move beyond the confines of their own discipline and explore new organizational models for team science . . . . Solving the puzzle of complex diseases, from obesity to cancer, will require a holistic understanding of the interplay between factors such as genetics, diet, infectious agents, environment, behavior, and social structures.[26(p65)]

Furthermore, translating cutting-edge population science into

action will require new abilities to partner, communicate, and lead.

Each of these problems also requires interdisciplinary study. Our core disciplines allow for foundational study in particular areas, but interdisciplinary study is a sine qua non for tackling complex issues. Transdisciplinary work that integrates disciplines and that can create science at the interstices of disciplines and transformative knowledge is necessary.[29] William Newell, executive director of the Association for Integrative Studies, well makes the case for integrative learning, noting that

> The disciplines, which collectively follow a reductionist divide-and-conquer strategy using simplifying assumptions and "either/or" dualistic thinking, were not designed to address . . . complex situations, though the partial insights they provide are absolutely essential to understanding individual aspects of a complex situation. Each academic discipline studies a subset of the elements of a complex situation and the connections among them, producing valuable but partial insights into the complex situation as a whole. The tasks of identifying connections among subsets, creating common ground, and integrating disciplinary insights into an understanding of the complex situation as a whole, however, are left to interdisciplinary studies.[27(p9)]

At core, then, we face a challenge of preparing future public health professionals for integrative action through integrative learning. Learning approaches must maximize the potential for trainees to successfully tackle these pressing problems.

Current and future public health challenges affected by these rapidly changing global forces are problems not of independent entities but of systems. The interconnections that increasingly characterize a globalized, urbanized world create a net of influences that obviate a reductionist approach that aims

to solve small pieces of a larger puzzle. Public health increasingly faces problems that cannot be solved by a single discipline. Obesity is not a problem that can be solved by any one discipline in public health. Similarly, arsenic poisoning in Bangladeshi wells is not a problem of toxicology alone or of cultural studies alone. None of these forces shape public health independently. Rather, these systems problems require a holistic analysis and holistic approach to a solution and thus to the education of students who need to be prepared to tackle these problems in the 21st century. The more complex the phenomena, the more salient are the networks of biological, economic, social, and political forces that shape these phenomena. Unfortunately, being constrained to a "siloed" disciplinary approach (one where disciplines work in isolation) hinders the search for solutions at all levels: from limiting our lens that guides data collection, to limiting our analytic approach, to limiting our policy imagination that might identify solutions.[28] Extension beyond disciplinary boundaries goes well beyond public health disciplines, to the collaboration among public health practice, academics, government, and the private sector toward finding effective, systems-based solutions. Public health leaders therefore must be adept at thinking and partnering across disciplinary boundaries and across focused approaches that rest on single disciplinary lenses. This may have always been so in the field, but it is increasingly so as we look forward, making the challenges to public health posed by complexity and interconnectedness more salient than ever.

Ultimately, the health system of the future that produces health for the maximal number of people at the most affordable cost will need to rest on public health values and principles of health equity and to include the many levels of interventions that are essential, in combination, to produce the health of the populations. These include minimizing environmental threats to health; preventing disease at the level of global, national, regional, and community interventions; and creating the conditions that make healthy behaviors the default option. Public health leaders will most effectively define the health system of the future that achieves population health, incorporating all of these elements. Public health leaders will have a central role in the interprofessional health teams of the future.

FOUNDATIONAL WORK THAT CAN HELP POINT THE WAY FORWARD

Although rapid global change calls for a next-generation vision for public health practice and education, in many ways we can fall back on nearly a century of professional scholarship that has built the case for how public health education may fulfill its mission. A series of influential reports have, over the past 9 decades, considered how we may best educate trainees who are the future of public health. We highlight a few of the key findings from the landmark reports that have shaped the field over this time, with an eye to the recommendations that should inform our approach to public health education. We do not intend this to be a comprehensive review of these reports and refer the reader to other sources.[30,31]

The Welch-Rose Report was published in 1915 as a result of the Rockefeller Foundation's conference on the need for public health education.[15] The report's 2 primary authors, William Henry Welch and Wickliffe Rose, called for an institution that could professionally train public health workers, a vision that materialized as Welch founded the School of Hygiene and Public Health at Johns Hopkins University a year later[32] and as 2 other initial schools or institutes, at Columbia and Harvard universities, were created around the same time. The report, published nearly 100 years ago, was the first to articulate eloquently several features of public health education that would set the stage for a century of pedagogy and, we argue, provide a blueprint for public health education in this century.[33] First, *The Welch-Rose Report* clearly suggested that a public health "institute" needs to be prepared to train a broad range of experts in different aspects of public health science, including epidemiologists, statisticians, and food inspectors. Second, the report recommended that public health institutes need to provide training both in public health administration and in public health science, setting the stage for schools of public health that train both public health practitioners and researchers in the population health sciences. Third, the report is explicit in its intention to train leaders in public health. Although the report was focused on the training of physicians, the group that at the time formed the public health workforce, it noted that other groups with potential to be leaders in public health could be admitted to such institutes.[30,31]

Starting in 1972, the Commission for the Study of Higher Education for Public Health, funded by the Milbank Memorial Fund to help promote effective health services, was concerned with the relation between professional education and public health practice at a time of rapid societal change.[34] The commission's report, *Higher Education for Public Health,* published in 1976, had 3 central implications for public health education in subsequent decades that echo today. First, the report clarified some of the original thoughts articulated in *The Welch-Rose Report* about the areas of focus that might serve as the foundation of public health education, suggesting that measurement and analytic sciences, social policy and history, and management form the core foundations of a public health education.[31,35] Second, the report suggested that complementary insight from areas as diverse as medicine and sociology play a role in educating public health professionals. Third, the report, echoing *The Welch-Rose Report,* reaffirmed the imperative for schools of public health to focus on training future leaders in the field.

This was followed by the Institute of Medicine report, *The Future of Public Health,* chaired by Richard Remington and published in 1988. The preface of the report argues that in recent years, public health as a profession and a commitment to society has been neither "adequately supported, nor fully understood."[36(pv)] The report includes 3 recommendations about training that are, in our assessment, most germane to a 21st-century approach to public health education. First, the report reaffirmed the key role that public health schools play in training leaders in public health, drawing a sharp distinction between the training of leaders and that of fieldworkers who may be trained more efficiently in other institutions with input from schools of public health. Second, the report is emphatic about the importance of schools in providing cross-disciplinary training, ranging

from the epidemiological and statistical sciences, to management, to environmental sciences. Third, the report was the first among this series of reports to clearly articulate the need for public health education to be grounded in a pragmatic approach to public health. In many respects, this report set the foundation for a shift from education in an abstract public health science to education in a pragmatically rooted discipline that builds a scientific foundation on the real-world needs of defining public health problems.

The Pew Health Professions Commission, created to encourage regulatory reform in the health care workforce, published *Healthy America: Practitioners for 2005* in 1991.[37] The report further emphasized the importance of training public health professionals in the required professional competencies grounded in the pragmatics of a public health practice that is sensitive to the salient public health challenges of our time.[38] The commission in particular argued for training in community-based settings, where trainees could be exposed to a mix of professionals working on active public health challenges. The subsequent Pew Commission report, *Health Professions Education for the Future: Schools in Service to the Nation,* published in 1993,[39] further emphasized the need for a pragmatic education, suggesting the incorporation of community-based training as a means of achieving some of the desired pragmatic education in the field.

In 2003, the Institute of Medicine report, *Who Will Keep the Public Healthy? Educating Public Health Professionals for the 21st Century,*[15] recommended 8 areas of focus for graduate public health education, encouraged the use of an ecological model, and built on all prior reports to emphasize that schools of public health's primary educational mission should be to

prepare students for positions of senior responsibility in public health practice, research, and training. Centrally, the report concluded that graduate programs should develop "curricular changes that emphasize the importance and centrality of the ecological approach."[15(p17)]

Shortell et al. evaluated curricula across 33 US schools of public health and emphasized

> the importance of flexible approaches to incorporating advances in public health knowledge, curriculum design and implementation, and practice.[40(p1674)]

Several authors have focused on the training needs of the public health workforce, examining newer, less traditional modes of delivering competencies and skills,[41] as well as the specific needs of those who currently work in public health.[42] Speaking for public health practitioners, Moser encouraged educators to appreciate that public health competencies depend largely on "knowledge and skill development in areas not directly related to the student's major field" and that

> few jobs in public health practice are so narrowly focused that employee success is solely dependent on the employee's knowledge and skill in a single specialty area.[43(p1559)]

In response to these concerns, a few schools have taken steps to promote content designed to nurture interdisciplinary knowledge and skills of public health students,[44] whereas others have encouraged the development of skills for public health leadership.[45]

Most recently, a report was created by the Health Professionals for a New Century 2010 symposium "Transforming Education to Strengthen Health Systems in an Interdependent

World." The report articulates a common vision for health education at a time when "redesign of professional health education is necessary and timely," largely because of the opportunities offered by recent globalization and flow of technology.[25(p1923)] In a sweeping summary of the state of health education, the report emphasizes 3 central recommendations that can and should serve as a guide to future efforts in shaping public health education. First, echoing prior calls for a public health science grounded in the pragmatic public health challenges of the time, the report emphasizes the importance of informative and transformative learning that bridges the gap between science and practice. Second, building on prior calls for bringing public health providers into public health education, the report calls for training that prepares students for the teamwork that will be essential to solving the challenges facing public health in the coming decades. Third, the report emphasizes the role that technology can play in advancing a forward-looking education that allows trainees to "mobilise knowledge" to advance "critical reasoning" that will be essential to tackling the paramount public health challenges of our time.

In summary, a century of work in the field has well articulated the core foundational principles that should, in our assessment, guide public health education. We suggest that, at core, all these efforts argue for a public health education that focuses on training leaders in public health; that engages trainees around a range of topics that form the core of public health science; that educates trainees in a public health science that is responsive to and engaged with real-world public health challenges; and that

prepares trainees for an integrated, interdisciplinary workforce that can tackle emerging, transformative public health problems working toward what "we, as a society, do to ensure conditions for people to be healthy."[36] This work sets the stage for the directions we propose here.

SEVEN DIRECTIONS FOR THE 21ST CENTURY

Nearly 20 years ago, Fineberg et al. noted that "public health, despite enormous success, has yet to fulfill certain expectations foundational to its mission."[31(p237)] Echoing the findings of reports over the 20th century, they suggested (1) training in broad but essential competencies, (2) expanding education in public health leadership and practice, and (3) centrally creating a new paradigm of leadership.[31] Fineberg's call for the field to reconsider how to expand and lead on public health rings true and perhaps even more so today.

Informed by an appreciation of a changing world, by the previous scholarship in the area,[46] and by the experience of other disciplines that have moved more ambitiously toward a future-looking education,[47,48] and a strategic plan developed in 2009 and implemented, in design, in 2010, we suggest that public health education of the future needs to be characterized by 7 central features, summarized in Figure 1. We note that these features mean to complement, not supplant, extant strengths of our graduate public health educational system, including, for example, its emphasis on lifelong learning.

First, public health must educate students who have a firm understanding of evolving 21st-century health challenges and who can be leaders in domestic and global public health research, policy, and
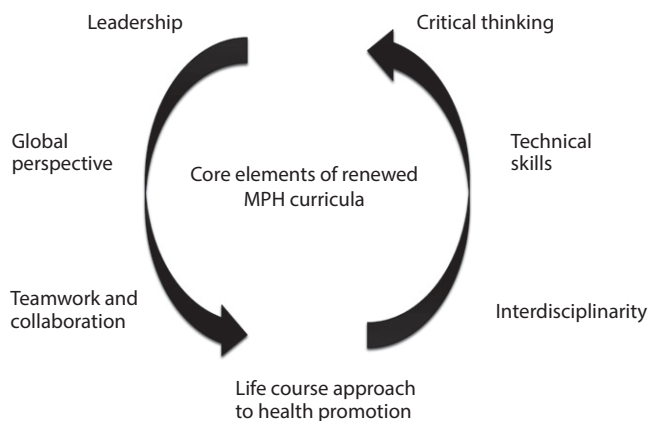
Note. MPH = master of public health.

FIGURE 1—Seven core elements of renewed curricula for future graduate public health education.

practice at both the systems and the delivery levels that are responsive to changing needs. This must include the scientific and practice foundations for a life-course approach to prevention, addressing the major health challenges and critical points of each age and stage of life and informed by an understanding of the multiple levels of influence on the health of populations.

Second, although leadership has been a focus of much of the literature on public health, as far back as *The Welch-Rose Report,*[32] it has not been fully realized or broadly implemented in concrete ways in the educational goals of schools of public health. The necessity of a focus on training leaders is the single most common feature of the many reports that have been published on the topic of public health education over the past 100 years. However, little attention has been given in these reports to how we might train leaders. In 1988, the Institute of Medicine report, *The Future of Public Health,* noted for the first time that

> Schools should provide training in the full scope of subjects relevant to public health practice, including . . . the political and management skills needed for leadership in public health.[36(p16)]

This was followed by the incorporation of leadership in the 2006 Association of Schools of Public Health Master of Public Health (MPH) competencies.[49] More recently, the 2010 report *Transforming Education to Strengthen Health Systems in an Interdependent World* recommended education moving toward the level of transformative learning where public health graduates can become agents of social change and can be leaders on transforming health systems to meet 21st-century needs. The report's sixth recommendation for instructional reform is a focus on professionalism in education. This growing chorus recognizing the need for leadership training is then at odds with the paucity of such training in schools of public health. We believe that the time is ripe to turn the history of research and recommendations into action, by creating and developing leadership curricula and courses for students at schools of public health. Ultimately, leadership requires an ability to inspire and motivate with vision, to communicate effectively, to work successfully in teams, to

organize, to listen, to realize personal limits and biases, to find consensus, and to bring the best work forward from all constituents, understanding each disciplinary contribution, to solve a complex problem. These skills can be taught, learning from management programs at many schools of public health and from schools of business where leadership training has traditionally been a priority. Schools of public health must clearly lay out desired leadership competencies and provide leadership training throughout a student's program as an integrated concept. Thus, the recommendations of many experts would be implemented into practical action for students.

Third, in an increasingly globalized world, public health students need to be conversant in and comfortable with the health challenges that confront us, the scientific methods, and the research and practice that span global and local forces. The tide of interest in global health has been growing inexorably during the past decade. The 2003 Institute of Medicine report *Who Will Keep the Public Healthy?* listed global health as 1 of 8 areas critical to public health education in the 21st century,[15] and the US Department of Health and Human Services declared global health as a key area of focus for 2020 in its *Healthy People* framework.[50] In many respects, this focus on global health is long overdue. The World Health Organization (WHO) noted in 2006[51] that there is a crisis in the global health workforce and a growing need for public health professionals who understand the challenges in global health concepts; they characterized a "major mismatch" between population needs and the available public health workforce.[52,53]

Although global health has been emerging as a force to be reckoned with in schools of public health in the United States, we must shift from global health as a discrete focus of a subset of our trainees to a core, integrated element of our approach to the global forces that shape health, locally and globally. The persistent intergroup differences in health, nationally and globally,[20] strongly suggest the need for a concerted approach that draws lessons through both local and global lenses.

Fourth, many of the problems public health must tackle are no longer (and perhaps have never been) isolated, discipline-specific problems. Similarly, our education needs to move well beyond the individual disciplinary perspective to an integrated, interdisciplinary approach. We suggest that training students in the transdisciplinary approaches that are necessary for their long-term success in the field requires the implementation of integrated, interdisciplinary, schoolwide curricula that ensure that all public health graduates are aware of, conversant in, and adept at the breadth of expertise that constitutes public health and the range of tools at our disposal to address complex public health challenges. Even more than interdisciplinarity, we would argue that schoolwide integrated curricula must, to a large extent, be transdisciplinary. Echoing prior calls for breadth in public health education,[36] a decade ago, the Institute of Medicine report *Who Will Keep the Public Healthy? Educating Public Health Professionals for the 21st Century* noted that

> The range of future research in public health will also be radically different from what we see today. To a far degree, public health research will be transdisciplinary in nature, involving applications of basic biology and social sciences, and direct

participation of the community. . . . Transdisciplinary research involves broadly constituted teams of researchers that work across disciplines in the development of the research questions to be addressed.[15(pII)]

Complementing this view, others have suggested that the Association of Schools of Public Health competencies[49] should not serve as targets for trainees within particular disciplines but rather need to serve as common ground for all public health trainees.[43] We now argue that a new, integrative, transdisciplinary public health education must not be implemented in the abstract but rather provide dynamic training that allows students to learn about and attain skill sets from different disciplines and apply them in problem-solving. This is a new focus for public health education. Echoing this, the Health Professionals for a New Century report suggests the

> Promotion of interprofessional and transprofessional education that breaks down professional silos while enhancing collaborative and non-hierarchical relationships in effective teams. Alongside specific technical skills, interprofessional education should focus on cross-cutting generic competencies, such as analytical abilities (for effective use of both evidence and ethical deliberation in decision making), leadership and management capabilities (for efficient handling of scarce resources in conditions of uncertainty), and communication skills (for mobilisation of all stakeholders, including patients and populations).[25(p1951)]

Fifth, although a forward-looking vision for public health practice and education must be integrative and transdisciplinary, this cannot forsake training in the advanced technical skills and the excellence in foundational disciplinary methods that are the key armamentarium of public health research and practice. Although, in and of itself,

disciplinary training appears to be insufficient for future public health professionals, disciplinary training is an essential foundation in graduate public health programs.[43] This needs to be maintained and even strengthened. This echoes much of the literature on public health education that has long emphasized the need for schools of public health to focus on training practitioners in core skills, because they also prepare trainees to lead in the field.[33,37] Note that the most recent health education report, the Health Professionals for a New Century report, barely mentions disciplinary training as a necessary area of focus for schools, assuming perhaps that public health education does not need improvement in disciplinary training. In the context of agitating for change in graduate public health education, however, we think it critical not to take these core strengths of our current public health education for granted but rather to highlight the need to redouble our efforts on strengthening disciplinary public health education as the necessary complement to the broader-based integrative training that will move the field forward.

Sixth, public health education must better educate students in critical thinking skills and the ability to apply them to improve population health. In a complex and interconnected world, students must learn how to critically navigate their way through resources, data, and disparate forms of information that together contribute to a full picture that can help address pressing public health issues. It is incumbent on schools of public health to build a culture of critical inquiry, guiding students to the skills they need for critical synthesis and integration of data from different sources. This necessitates a shift in how we conceive of some of our training,

a shift away from teaching trainees how to collect and analyze single source data toward teaching trainees the skills to search for relevant, cross-disciplinary data and to synthesize them as a means of understanding the systems that produce public health. We must teach students how to constructively but critically challenge long-held assumptions in the field to identify new solutions. In some ways, this brings together our 2 earlier recommendations, preparing trainees with the tools to bring together integrative transdisciplinary training and skills-based training rooted in foundational disciplines. This will build a comprehensive training that allows the development of innovative approaches toward seemingly intractable and emerging public health problems. Integration of both aspects of the proposed training is an important step in helping students to understand the depth and breadth of a field as diverse as public health, while making sure students do not lose sight of core, fundamental knowledge. Much literature advocates this integration in medical curricula, highlighting the balance between integrative transdisciplinary and skills-based education as critical to the education of physicians.[54–57] Public health must follow suit and enact the changes that many have long promoted.

Seventh, recognizing the centrality of collaborative work as a key ingredient in the solution to complex problems, it is vital that a public health education of the future incorporate a strong element of learning that prepares students for team-based research and practice. Although, increasingly, large teams are most effective at competing for research grants and tackling high-level research questions, educational initiatives have been slow

to teach students both the value and the skills to be effective team members. Knowing how to effectively work in a team is a pivotal part of becoming a successful public health professional, and it falls to public health schools to train students in the skills needed for effective teamwork. Team-based learning is an instructional approach that has been suggested and implemented in limited venues.[25] Although team-based learning provides trainees with an experiential base for future team-based engagements, formal skills also can be taught that can improve students' likelihood of success in future group work. Much as we suggest formal education in leadership for trainees, we argue for training in the skills needed for a lifetime of effective collaborative work.

In addition to these points, we note the lack of public health evaluation of its own education. This article and our companion article in this issue of the journal serve to open dialogue on the future of public health education.[58] The curriculum we launched in fall 2012, as described in the companion article, must include ongoing evaluation and publication of results, as well as ongoing evolution based on findings.

CONCLUSIONS

As the world changes, the world's health needs are also changing. We are faced increasingly with complex systems that produce population health, requiring of public health professionals transdisciplinary research and action. Public health leaders of the future must be prepared to understand the role of public health in a successful society, have the intellectual base to analyze complex problems, and have the ability to create and implement effective and sustained solutions. They must be prepared to lead now

and in the future, based on the education that gives them the knowledge and skills to adapt to changing realities. A careful read of prior scholarship about public health education in many ways points the way toward potential effective strategies used to prepare trainees for leadership in the field in this century. To that end, we describe 7 core educational strategies that can be adopted by schools of public health to renew our MPH curricula. These strategies include

1. a focus on evolving 21st-century health challenges, with a central concern for life-course approaches to health promotion or disease prevention;
2. a focus on training leaders;
3. bringing together global and local health;
4. an integrative interdisciplinary training;
5. deepening technical skills;
6. fostering critical thinking; and
7. training in teamwork and collaborative practice.

The challenge, of course, lies in how we can implement these directions. In a companion article to this one, we present a model that we are applying in Columbia University that attempts to bring these elements to MPH education.[58] We look forward to continued discussion in the field that moves us forward, collectively, toward better graduate public health education. ∎

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MPH Education for the 21st Century: Design of Columbia University's New Public Health Curriculum

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Because public health challenges are changing rapidly, over the past 3 years, we have turned a critical eye to the master of public health program at the Columbia University Mailman School of Public Health.

Under a process dubbed "curriculum renewal," we engaged more than 170 faculty, staff, and students (and hundreds of alumni and employers of our graduates) in an initiative to develop a completely new design for master of public health education that launched in fall 2012.

We have described its design and structure and presented some preliminary evaluation data. (*Am J Public Health.* 2014;104:30–36. doi: 10.2105/AJPH.2013.301518)

CURRENT AND EMERGING challenges to the public's health in the 21st century are vastly different from those in previous centuries. As we articulated in a companion article,[1] the changes in the challenges demand corresponding changes in public health education. Key elements of a reenvisioned educational program include knowledge of the role of public health in a successful society, familiarity with evolving global and local health challenges and methods for research and practice, facility with a life course approach to prevention, disciplinary strength, interdisciplinary strategies for solving complex problems, the ability to think critically, and the capacity for leadership, innovation, and teamwork.[1–12]

The Association of Schools of Public Health recognized these challenges several years ago. Under its auspices, faculty working groups were assembled to take a fresh look at master of public health (MPH) competencies; they deliberately distanced themselves from tradition and from current practices to develop curricula that promote interdisciplinary thinking, recognize the value of community partnerships to promote health, and incorporate broad definitions of health that span its physical, mental, and social dimensions.[13] The working groups developed a new set of core public health competencies; these are presented on the Association of Schools of Public Health Web site.[14] The Association of Schools

of Public Health concluded its initiative by determining to continue its support of the development of competencies in the 5 traditional areas of public health specialization (biostatistics, environmental health sciences, epidemiology, health policy and management, and social and behavioral health), but it extended these domains with interdisciplinary or crosscutting competencies, for example those in the areas of communication, leadership, and systems thinking.

With the 2006 Association of Schools of Public Health recommendations, an extensive and growing literature, and our own responsibility for ensuring cutting-edge public health education for 21st-century leaders as motivating