



The Educated Citizen and Public Health:

A Consensus Report on Public Health and Undergraduate Education

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Executive Summary

The Institute of Medicine recommends that “all undergraduates have access to education in public health” (Gebbie K, Rosenstock L, Hernandez LM, eds. *Who will keep the public healthy? Educating public health professionals for the 21st century*. Washington, DC: National Academy Press; 2003: 144). To implement this recommendation, the Consensus Conference on Undergraduate Public Health Education, funded by the Josiah Macy, Jr. Foundation, was convened on November 7–8, 2006, in Boston, Massachusetts. The conference for the first time assembled leaders in public health, arts and sciences, and health professions education and was sponsored by the Association for Prevention Teaching and Research, the Association of Schools of Public Health, and the Council of Colleges of Arts and Sciences. The Centers for Disease Control and Prevention, the Association of American Colleges and Universities, as well as the seven clinical professions that comprise the Healthy People Curriculum Task Force, participated in the conference. Conferees agreed that undergraduate public health education should result in an educated citizenry, prepared to address public health challenges ranging from acquired immunodeficiency syndrome to aging, avian influenza, and health-care costs. Undergraduate public health education can prepare students to pursue professional education in public health and other health professions, and students who pursue education in disciplines from law to business to international affairs will have a broader population health perspective. Recommendations from three conference working groups included curricular frameworks and learning outcomes for Public Health 101 and Epidemiology 101, plus minors and administrative concerns. Public Health 101 and Epidemiology 101 should be offered by all colleges and universities and be designed to fulfill general education distribution requirements. High-quality minors in public health should be encouraged and should include core courses and experiential learning. Minors should include such focus areas as global health. Public health practitioners should participate in service-learning and other educational efforts that expose students to the world of public health practice. Implementation should include Internet or intranet sites for providing information on undergraduate public health and sharing curriculum materials and faculty development programs. Health professions education and graduate public health programs should encourage applicants to enroll in undergraduate public health courses.

Introduction

In 2003, the Institute of Medicine (IOM) of the National Academy of Sciences concluded that keeping the public healthy required not only a well-educated public health workforce but also an educated citizenry. Therefore, IOM recommends that “all undergraduates should have access to education in public health” (1). In response, the Association of Schools of Public Health (ASPH) established a Task Force on Undergraduate Public Health Education (the Task Force) with broad representation from schools and programs in public health. The Task Force has established an ongoing process for data collection, issued a statement on principles for development of an introductory public health course (Appendix A), and examined the options for articulation of undergraduate and graduate curricula. An explicit goal of the Task Force is to introduce public health studies within undergraduate general education, thus addressing the education of all students with the aim of developing an educated citizenry.

Public health has both ancient and modern roots in explaining and controlling disease. However, the academic discipline of public health dates only from the late 19th century scientific institutes of Europe and the early 20th century Progressive Era in America. The initial impetus for development of formal public health education in the United States came from the Rockefeller Foundation in 1916 with its support for schools of public health as distinct institutions to provide graduate-level education for public health practitioners. These practitioners were expected to already hold clinical or basic science degrees (2).

The modern era of undergraduate public health education began at Johns Hopkins University in the mid-1970s, when a public health major was approved through its School of Arts and Sciences in collaboration with what was then the School of Hygiene and Public Health. After slow growth in the 1980s, interest in undergraduate public health education grew rapidly in the 1990s. By the end of the 20th century, a substantial number of schools of public health were experimenting with undergraduate courses, minors, and majors. Programs in public health also were revising professionally focused curricula and developing broader approaches to undergraduate public health education (3,4).

Recent surveys of public health schools and programs indicate that the majority of the approximately 40 accredited schools (ASPH, unpublished data, 2006) and >60 accredited programs (Association for Prevention Teaching and Research [APTR], unpublished data, 2006) offer undergraduate public health course work. Introductory public health course work has been exceptionally well-received, with courses often oversubscribed or turning away students. For example, a recent article reported that international studies and public health studies are the two largest majors in the Krieger School of Arts and Sciences (5). However, despite the popularity of public health studies at Johns Hopkins and other universities,

such studies still are rarely represented in the degree or minor program offerings of the approximately 1,900 four-year colleges and universities without schools or programs in public health. Colleges and universities lacking such programs have untapped potential to teach public health within the arts and sciences.

To operationalize the IOM's recommendation that all undergraduates have access to public health education (1), a Consensus Conference on Undergraduate Public Health Education was held on November 7–8, 2006, in Boston, Massachusetts. The Consensus Conference was sponsored by APTR, ASPH, and the Council of Colleges of Arts and Sciences (CCAS). The conference was supported by the Josiah Macy, Jr. Foundation through a grant to the Healthy People Curriculum Task Force (HPCTF), a coalition of seven health professions educational associations, including allopathic and osteopathic medicine, dentistry, nursing and nurse practitioners, pharmacy, and physician assistants.

Recent developments in arts and science education have opened opportunities for integrating public health and epidemiology into all undergraduates' course work. In 2000, the Association of American Colleges and Universities (AAC&U) began their Greater Expectations initiative for liberal education, a campaign designed to identify principles and to promote strategies for undergraduate learning for the new century (6). By *liberal education*, AAC&U refers to an overall undergraduate experience, combining general education and in-depth study in at least one major field (7). Liberal education is by definition integrative. AAC&U intended this campaign to model new approaches to undergraduate learning that will prepare students for life and careers in a rapidly changing, globalizing world.

Building on the Greater Expectations initiative, and specifically on goals and objectives that emerged from national discussions, AAC&U designed an integrated framework of learning outcomes. This framework, Liberal Education and America's Promise (LEAP), "challenges the convention that liberal education is, by definition, 'nonvocational.'" LEAP recommends "an education that intentionally fosters, across multiple fields of study, wide-ranging knowledge of science, cultures, and society; high-level intellectual and practical skills; an active commitment to personal and social responsibility; and the demonstrated ability to apply learning to complex problems and challenges" (8) (Box 1).

The LEAP design is an ideal framework for integrating public health course work into arts and science education and is appropriate for all undergraduate schools, colleges, and universities.

Undergraduate public health education, as with LEAP, is intended to produce an educated citizenry who can be expected to examine the evidence and to evaluate critically public health goals and methods. An educated citizenry can also be expected to make political and financial commitments to support successful public health interventions. This *MMWR* describes approaches to Public Health 101 and Epidemiology 101, two courses designed to fulfill selected LEAP outcomes and to fit within the broadest possible array of arts and science

Box 1.**Liberal Education and America's Promise (LEAP) — essential learning outcomes*****Knowledge of Human Cultures and the Physical and Natural World**

- ♦ Through study in science and mathematics, social sciences, humanities, histories, languages, and the arts.

Personal and Social Responsibility

- ♦ Civic knowledge and engagement, locally and globally.
- ♦ Intercultural knowledge and competence.
- ♦ Ethical reasoning and action.
- ♦ Foundations and skills of lifelong learning.

Intellectual and Practical Skills

- ♦ Inquiry and analysis.
- ♦ Critical and creative thinking.
- ♦ Written and oral communications.
- ♦ Quantitative literacy.
- ♦ Information literacy.
- ♦ Teamwork and problem solving.

Integrative Learning

- ♦ Synthesis and advanced accomplishment related to general and specialized learning.

* Adapted from Association of American Colleges and Universities (AAC&U). College learning for the new global century. Washington, DC: AAC&U; 2007: 5.

education programs and institutional types. This report also examines how undergraduate institutions can expand selectively upon these curricula to develop well-designed public health minors that accomplish the LEAP objectives.

The Consensus Conference participants recognized that public health education at the undergraduate level is likely to enhance student interest in public health careers. It can also prepare students to pursue graduate education in the health professions and other disciplines from law to business to international affairs as well as graduate degrees in public health. Each working group included members from CCAS, ASPH, APTR, and HPCTF. Draft sections of this report were circulated to all participants before the Consensus Conference, and each section was presented and discussed at the conference. Feedback from participants and feedback received during an online public comment period was incorporated into this final report.

Part I

PUBLIC HEALTH 101 AND EPIDEMIOLOGY 101

Rationale for Public Health 101 as Part of General Education

IOM's recommendation that all undergraduates have access to public health education is justified from a policy perspective. From an education perspective, studying public health has enormous intellectual value in that

- ♦ the study of public health involves critical thinking and decision making;
- ♦ it gives students a methodology for understanding populations;
- ♦ population-scale thinking relies on multiple disciplines, thus exposing students to ongoing health-care and policy matters while the student gains an understanding of the depth and breadth of public health; and
- ♦ it exposes students to potential career paths at the graduate level.

During recent years, institutions have developed an introductory public health undergraduate course to expose students to core topics in that area. Although the course content varies by campus, the majority of the courses introduce students to all or selected core public health topics (e.g., biostatistics, epidemiology, environmental and occupational health, behavioral health, health policy and administration, maternal and child health, and ethics). Not every survey course touches on all the topics, but a survey course can give students an overview of public health and put public health topics within a context of population-based concerns. Through Public Health 101, students learn the vocabulary and gain an appreciation by focusing on the multidisciplinary or ecologic foundations of public health.

Recommendations from the Public Health 101 Working Group

The framework of an introductory survey course should be expansive because the goal is to introduce public health topics, not to study them in depth, to excite students about this area of expertise, and to give them tools to which they otherwise would not be exposed on the undergraduate level. As a survey course, Public Health 101 (or Introduction to Public Health) should be team-taught or at least taught with multiple guest speakers who can handle the breadth of topics. The lead professor has a critical role in teaching, coordination, and linking different public health disciplines with everyday life as an educated citizen. Public Health 101 should provide an overview with an emphasis on the population perspective and the cross-cutting, systems thinking or ecologic nature of public health, including the population effects of health-care systems.

Multiple methods can be used to teach Public Health 101. For example, using public health current events, available every day in the mass media, as a discussion tool and employing the classroom as a discussion forum is one of the major techniques employed by professors to illustrate the real-world nature of the material and its pervasiveness in our lives. Teachers can also use the case-study method to address public health topics after basic didactic teaching. Encouraging critical thinking, group discussions, team projects (both in and out of the classroom), and promoting oral and written communication are all techniques used in these introductory courses.

Each school can integrate local dimensions into their courses through case studies and community projects. This is a powerful pedagogic approach to studying population health. Exposing students to guest speakers from local and state public health departments and other community agencies helps the student gain an understanding of the public health paradigm and roles and functions of the basic public health sciences. Whatever the methods used, the majority of courses attempt to increase core public health knowledge and vocabulary while fostering liberal education outcomes as proposed by the AAC&U through LEAP.

In colleges that do not have public health schools or programs, the structure and content of the course will depend on the structure in which it is housed. For example, if the course is in the history department, it might have a different curriculum than if it is in the anthropology department or within an interdisciplinary unit. Even within a public health school or program, introductory public health courses might be directed by the departments of epidemiology, health administration and policy, or public health practice, each reflecting a different character that influences the course content and structure.

The Public Health 101 Working Group endorsed the statement from ASPH on undergraduate education (Appendix A) and the sample Public Health 101 curriculum framework (Box 2).

Regarding the relation between graduate and undergraduate education, the Public Health 101 Working Group recommends the following:

- ♦ Recognizing that institutions vary substantially in terms of their major, minor, and curricular requirements, the working group does not recommend trying to dictate where Public Health 101 should fit; however, all undergraduate students should have access to an introductory course that fulfills a social science or other general education requirement.
- ♦ Public Health 101 is clearly on the undergraduate level and is not intended to have the depth of a graduate course or be substituted for any graduate-level course.

Articulation of undergraduate and graduate public health education can be difficult. Each graduate program and school has different requirements and policies that dictate waivers

Box 2. Public Health 101 curriculum framework

I. Overview and Basic Principles

- ♦ Context and scope of public health, including history, philosophy, literature, essential services, ethics, and applications to current events — Public health placed in historical and modern perspective.
- ♦ Public health as cross-cutting and systematic — Interdisciplinary concepts introduced early and integrated throughout the course (e.g., examining the options for interventions to address public health concerns).
- ♦ Epidemiologic principles and population perspective — Rates, risk factors, and health status indicators of morbidity and mortality; disease determinants, causation, and types of epidemiologic research; and public health surveillance and vital statistics.*

II. Population Health Tools

- ♦ Health communication and informatics — Accessing and evaluating the quality of health information and data in the mass media, including the Internet.
- ♦ Health and social and behavioral sciences — Impact on health and methods for altering behaviors at the individual and population levels.
- ♦ Health policy, law, and ethics — Tools for implementing health decisions and potential tensions between individual rights and social responsibilities.

III. Disease and Disability: Determinants, Burdens, and Interventions

- ♦ Environmental health and safety — Impact, control.
- ♦ Communicable diseases — Prevention, detection, and control from a population perspective.
- ♦ Noncommunicable diseases — Effects on longevity and quality of life including demographic and epidemiology transitions and methods to prevent, detect, cure, and minimize impacts

IV. Health-Care and Public Health Systems

- ♦ Health workforce — Professionals' roles and options within the health-care and public health workforce.
- ♦ Organization of health-care and public health systems — Institutions and structures of health-care and public health systems, both national and international; the distinct roles and complementary responsibilities of health care and public health systems; and the mechanisms, including insurance systems, for paying for health services.
- ♦ Costs, quality, and access to health-care and public health services — Reasons for health-care costs, criteria for quality, and effects of inadequate access.

V. Special Public Health Education Focus Areas

- ♦ Health disparities and vulnerable populations — Overview of public health's commitment to vulnerable populations, including maternal and child care, aging, persons with disabilities, and socioeconomically disadvantaged populations.
- ♦ Public health preparedness and disaster management — Essential roles of public health in preparedness for and response to natural or terrorism-related disasters.
- ♦ Global health — The burden and distribution of disease, effects of globalization, and potential for collaborative solutions.†

* These basic concepts are needed for reading and understanding public health subject matter. The approach should be compatible with Epidemiology 101.

† Global health also might be taught as a separate introductory course.

or substitution of courses. However, ultimately, a range of graduate schools and programs should recommend an undergraduate introductory public health course as a prerequisite for admission.

Public Health 101 Learning Outcomes

Taken in parallel with Epidemiology 101, the student should gain a broad-based knowledge of public health concepts and techniques. In addition to fulfilling a social science requirement, Public Health 101 can be the first course in a public health minor. The Public Health 101 Working Group recommends that students who successfully complete a course that includes the sample curriculum framework (Box 2) should be able to

- ♦ identify eras in the historical development of public health and ways that public health affects literature and the arts, current events, and everyone's daily life;
- ♦ illustrate public health's interdisciplinary, cross-cutting character and the contributions of different disciplines and professions to improving health;
- ♦ explain how practitioners assess interventions for improving population health;
- ♦ explain the basic principles of epidemiology, including rates, risk factors, disease determinants, causation, and public health surveillance;
- ♦ explain how health information and communications can be used to improve population health;
- ♦ identify how social and behavioral interventions affect population health;
- ♦ explain how policy and law affect population health;
- ♦ identify the impact of the environment and describe how communicable diseases affect health;
- ♦ explain the burden of infectious and chronic diseases and injuries on morbidity and mortality and approaches to early detection and prevention;
- ♦ describe the basic organization of health care and public health systems and the contributions of health professionals;
- ♦ identify basic payment mechanisms, including insurance, for providing health services;
- ♦ describe criteria for evaluating health systems, including matters of access, quality, and cost;
- ♦ identify the roles of public health in addressing health disparities and the needs of vulnerable populations; and
- ♦ identify the roles of public health in natural or terrorism-related disaster prevention and management.

Rationale for Epidemiology 101 as Part of General Education

The discipline of epidemiology originated during the era of widespread infectious diseases and epidemics in Europe and North America. Epidemiologic methods for describing the

frequency, course, and risk factors for infectious disease developed even before the germ theory of infectious disease was established. Interventions to establish causal associations and to intervene to reduce disease frequency have been a part of epidemiology from its earliest days. With the advent of the biologic revolution of the late 19th and early 20th centuries, epidemiologic methods became an intrinsic part of the investigation of disease among populations (9).

Modern epidemiology, as a science applicable to investigations of disease and other outcomes, policy assessment, and population sciences, evolved during the last half of the 20th century. Epidemiologic methods focused on application of statistical theory, use of survey methods, and information technology implementation. Epidemiology also broadened its scope to include concepts of causation applicable to noncommunicable disease and other health determinants, including social and behavior factors. Applications to intervention efficacy, effectiveness, and safety, testing and decision-making methods, and policy analysis applicable to social concerns recently have been integrated into epidemiology teaching and research (10).

Already during this century, the emergence and reemergence of infectious diseases, escalating options for and cost of interventions, and emergence of new threats to health and security resulting from climate change or terrorism are broadening epidemiology's scope and applications. Having a clear understanding of epidemiologic principles and applications provides a structure for thinking about underlying causes and potential interventions for addressing the health and well-being of individual persons as well as populations. Epidemiology has evolved into a discipline that can and should be viewed as an integral part of a general and liberal education.

Epidemiology has traditionally been taught as a core public health course for graduate study since the advent of formal public health education in the early 1900s. Epidemiology, as with public health education, was initially viewed as a graduate discipline for health professionals who had previous clinical training and experience (11). Curricula in epidemiology have also been integrated, often informally, into the teaching of clinical health professionals and often as part of their basic science education. However, epidemiology has not traditionally been taught as part of general education at the undergraduate level. Justifications for doing so are not new. In 1978, Abraham M. Lilienfeld, former Chairman, Department of Epidemiology at Johns Hopkins University, published his recommendation that epidemiology be introduced into the undergraduate curriculum consistent with arts and science education goals (12). In 1987, David Fraser, then president of Swarthmore College, recommended that epidemiology be taught as a liberal art because it "illustrates the approaches to problems and the kinds of thinking that liberal education should cultivate . . ." (13).

Despite these early recognitions of the usefulness of epidemiology as part of the general education for certain undergraduates, attention was rarely paid to the teaching of epidemiology as a part of general or liberal education until recently. In the early 21st century, a rapid

expansion in undergraduate public health education and epidemiology in particular has occurred in schools and programs in public health. Recent surveys by graduate schools and programs indicate that the majority of colleges and universities with schools or programs in public health now offer such undergraduate course work, including epidemiology (ASPH and APTR, unpublished data, 2006). Despite this growing experience, undergraduate institutions without schools or programs in public health rarely offer course work in epidemiology.

Recommendations of the Epidemiology 101 Working Group

Epidemiology can play a key role in general education if it is taught broadly as a way of thinking. In developing epidemiology as part of general education, LEAP outcomes can form the basis for a sample curriculum framework (Box 3). Epidemiology 101 should

- ♦ teach critical thinking and quantitative and information literacy by using readily accessible approaches with broad applicability;
- ♦ teach the methods, ethics, and applications of the scientific method; and
- ♦ provide a vehicle for rigorously linking the concerns of the natural and social sciences, thus enriching understanding of public policy and other population-based disciplines.

The thinking process of epidemiology can be used as a prototype of the scientific method by using examples accessible to students and relevant to the students' everyday experiences (14). The measurement and balancing of benefits, harms, and costs should be taught as enduring understandings and form the starting point for curriculum design (15). The scientific method forms the basis for skill development that is key to accomplishing the LEAP goal of lifelong learning. Development of these skills requires hands-on, participatory learning that provides students an appreciation of practical applications of the theoretical constructs upon which epidemiology is built. Analytic skills can be developed in multiple ways, providing opportunities for considerable resourcefulness in teaching and curricular development. Epidemiologic skills can be taught through actively participating in exercises, reading research literature, examining contemporary subjects in the mass media, and other approaches. The common element is examination of evidence-based arguments and application of these frameworks to specific problems. In this sense, epidemiologic study parallels that of other sciences through reasoning and analytic methods and hands-on laboratory-type illustrations of problem solving. As with other sciences, epidemiologic thinking uses the scientific method in which hypotheses are generated and tested and reliable explanations are sought regarding the causes of disease and injury among populations.

Epidemiology 101 can be taught in varying structures and formats, and in the context of general education, it should

- ♦ be taught without prerequisites, which will allow inclusion of students with wide-ranging interests;

Box 3. Epidemiology 101 curriculum framework

I. History, Philosophy, and Uses of Epidemiology

- ♦ Historical contributions and modern uses of epidemiology — Development of epidemiologic thinking and placement of epidemiology in historical and modern perspective.
- ♦ Ethics and philosophy of epidemiology — Appreciation of the links between epidemiology and broader ethical and philosophic traditions and concerns.

II. Descriptive Epidemiology

- ♦ Condition, frequency, and severity — The basic tools of epidemiologic analysis, including case definitions and populations, incidence, prevalence, and case-fatality rates.
- ♦ Data regarding disease or injuries — Vital statistics, public health surveillance, and measures of health status, including methods for describing quantitatively the natural history, frequency, and changes in infectious and chronic diseases and injuries.
- ♦ Patterns of disease and injuries — Application of the basic tools of epidemiology to generate hypotheses regarding person, place, and time; changes and differences in rates; exposures; incubation periods; and disease spread.

III. Association and Causation

- ♦ Estimation — Measures of strengths of association, graphical display of data, risk, relative risk/risk ratios, attributable risk, and population attributable risk.
- ♦ Inference — Concepts of statistical significance and confidence intervals.
- ♦ Bias, confounding, and adjustment — Identification of bias, confounding, and effect modification/interaction and methods to prevent and take into account their impact.
- ♦ Causation — Risk factors and other determinants of diseases and conditions.

IV. Analytic Epidemiology

- ♦ Basic epidemiologic study designs and their application to population health, including ecologic or population comparison, cross-sectional, case-control, and retrospective and prospective cohort studies.
- ♦ Experimental studies — Randomized clinical trials and community trials and their applications to the efficacy and effectiveness of disease or injury etiology and the efficacy and effectiveness of interventions.

V. Evidence-Based Public Health and Evidence-Based Recommendations

- ♦ Harm, benefit, and cost analyses — Evidence-based decision analysis regarding risks, benefits, and cost-effectiveness of interventions.
- ♦ Intervention efficacy and effectiveness — Evidence-based analyses of interventions' capacity for producing desired results and measurement of the accuracy or success of prevention and control efforts for diseases or injuries.

VI. Applications to Policy and Basic and Clinical Sciences

- ♦ Outbreak investigation, testing, and screening — Application of epidemiologic methods and basic and clinical science.
- ♦ Public health policy — Application of results from investigations and analyses to influence policymaking.
- ♦ Special epidemiologic applications — Molecular and genetic epidemiology, environmental and occupational health and safety, unintentional injury and violence prevention, and behavioral sciences.

- ♦ include use of relevant examples and exercises from multiple disciplines and applications; and
- ♦ be taught as the basic science of disease and injury prevention (16);
- ♦ employ group interactive learning, including teamwork for problem solving (a key LEAP goal) and exploration of epidemiologic problems; and
- ♦ use proven effective approaches from online collaboration to in-class exercises and laboratory-style problems.

Although different structures are compatible with these recommendations, the following attributes should be considered for any institution's chosen structure:

- ♦ In institutions that require a formal or separate laboratory experience to qualify for fulfilling a science requirement, epidemiology can be taught as a laboratory science by using formal laboratory exercises.
- ♦ Epidemiology can be integrated into varying majors as an elective or selective. Potential major areas of study that can benefit from incorporating epidemiology include but are not limited to biology, environmental science and engineering, psychology, economics, statistics, sociology, urban planning, and public policy. Teaching epidemiology to satisfy a science distribution requirement and as a component of a major are not mutually exclusive, and using both approaches can be useful.

Regarding the association between graduate and undergraduate education, the Epidemiology 101 Working Group arrived at specific recommendations.

- ♦ Undergraduate courses in epidemiology should not be taught as simplified versions of graduate courses, and the goals are appropriately different from those of an epidemiology course that is taught as a core course toward a public health graduate degree or as part of basic clinical science.
- ♦ Epidemiology 101 should be conceptual rather than technical. For example, it might employ stratification rather than regression methods to illustrate adjustment for confounding, because the emphasis is on active engagement and ensuring an intuitive and transparent understanding of key principles.
- ♦ Epidemiology 101 should stress learning outcomes that are part of the broader LEAP goals of general education, including ethical reasoning, teamwork for problem solving, integration of learning, and skills for lifelong learning. These goals are compatible with and additional to the LEAP outcomes of understanding scientific methods, critical thinking, and quantitative and information literacy.
- ♦ Epidemiology 101 should use examples not limited to health and medicine. Cause and effect might be illustrated by examples from biology or economics, and quantitative decision making might use examples ranging from forensics to environmental monitoring. The specific examples are less important than the

emphasis on illustrations reinforcing the broad applicability of epidemiology from basic science to public policy.

Epidemiology 101 Learning Outcomes

The following learning outcomes were developed by using Bloom's Taxonomy (17) and relate directly to the sample curriculum framework (Box 3). Recommended outcomes are classified as Category 1 — Knowledge/Describe, Category 2 — Understanding/Explain, Category 3 — Application/Use, Category 4 — Analysis, Category 5 — Synthesis, and Category 6 — Evaluation.

Category 1 should not be viewed as a free-standing goal of Epidemiology 101 but rather as key information to build upon for higher levels of the taxonomy. Sets of basic (Categories 1–3) and advanced (Categories 4–6) outcomes are defined in the following discussion. Institutions might elect to focus on basic or basic plus advanced outcomes.

Basic Learning Outcomes

- ✦ Describe the historical roots of epidemiologic thinking and their contribution to the evolution of the scientific method.
- ✦ Explain how ethical principles affect epidemiologic research.
- ✦ Use rates and proportions to express numerically the amount and distribution of health- and nonhealth-related outcomes.
- ✦ Use the distribution of a health-related outcome to generate hypotheses that might provide an explanation.
- ✦ Explain basic statistical and epidemiologic concepts of estimation, inference, and adjustment to establish association.
- ✦ Explain how to use evidence of an association to make a judgment about whether an association is causal.
- ✦ Describe the basic epidemiologic study designs that are used to test hypotheses, identify associations, and establish causation.
- ✦ Describe the concepts of measurement of test performance and be able to apply the concepts of testing and screening in different settings.
- ✦ Apply the concepts of benefits, harms, and cost to public health decision making.
- ✦ Describe the broad applicability of epidemiologic methods to clinical and basic science as well as public policy.

Advanced Learning Outcomes

- ✦ Analyze the evidence for or against a recommended intervention.
- ✦ Analyze a public health problem (e.g., investigation of a disease outbreak) by using basic epidemiologic methods.

- ♦ Synthesize epidemiologic methods to assess the strengths and weaknesses of assertions in scientific literature or mass media, including the Internet.
- ♦ Evaluate the design of an epidemiologic investigation, demonstrating the ability to reconcile scientific validity and ethical sensitivity.

Curriculum Resources for Public Health 101 and Epidemiology 101

The working groups do not recommend specific textbooks, nor do they want to imply that use of textbooks is essential for teaching undergraduate public health or epidemiology courses. However, the sample curriculum frameworks (Boxes 2 and 3) and specific learning outcomes should assist textbook authors who intend to write or revise texts to address Public Health 101 or Epidemiology 101 needs. However, the working groups recommend that faculty be provided with easily accessible materials (e.g., posted at Internet or intranet sites) to assist them in designing both courses. Such resources might include syllabi, case studies, methodology for case studies, recommended reading lists, toolkits, modules, and best practices for certain aspects of the course or for particular assignments. In addition, the working groups recommend that syllabi and teaching aids be peer-reviewed and that an editorial board comprising representatives from public health and the arts and sciences be consulted regarding the peer-review process.

The working groups note that although the courses should be interdisciplinary, efforts are needed to provide central coherency; hence, the course should be anchored in a specific department or administrative unit. The working groups also recommend that students be exposed to real-world public health topics by using guest lecturers from local and state health departments and health agencies. Case studies, field projects, service-learning, and other approaches to experiential learning also should be encouraged.

A unique resource for developing introductory skills through interactive practice is the YES materials developed with the support of The Robert Wood Johnson Foundation and the College Board (available at <http://www.collegeboard.com/yes/ft/iu/home.html>). YES materials were designed originally to engage high school students as a component of course work in mathematics, natural science, and social science (18), but are also appropriate for college students. CDC's EXCITE Internet site (available at <http://www.cdc.gov/excite>) also provides useful exercises to introduce students to public health and epidemiology principles (19).

Implementation of the sample curriculum frameworks can be accomplished by using multiple types of materials, but all course materials should include the following approaches:

- ♦ An Internet- or intranet-based resource center should be developed for faculty, especially those teaching either course for the first time or those who are seeking to expand or improve their teaching skills.
 - Such a center should provide the opportunity for individual faculty to contribute their materials.

- A well-considered process for peer review of submitted materials, including a screening element designed to ensure that the materials are appropriate in terms of the learning outcomes should be part of the online resource center.
- ♦ YES and EXCITE materials might be included, along with other more advanced materials that can assist faculty in using the sample curriculum frameworks.
- ♦ A mechanism for identifying and communicating with others who are teaching similar courses should be included.
- ♦ Additional user review, with revisions based on feedback, should be a key component of the resource center.

Public Health 101 and Epidemiology 101 implementation as part of general education should be based on each institution's unique expectations and structure. The best administrative structure, course structure, and choice of faculty will differ from institution to institution. However, generic principles can assist institutions in thinking through the available options.

- ♦ The courses should be taught from a broad perspective by faculty who appreciate the range of applications to different disciplines.
- ♦ Prerequisite courses (e.g., statistics) should not be required. Required statistical or other principles should be integrated into the course.
- ♦ Epidemiology 101 should be compatible with enrollment in Public Health 101 as recommended by the Public Health 101 Working Group. Thus, the basic introduction to epidemiology recommended for Public Health 101 requires coordination between the courses.
- ♦ Colleges and universities without schools or programs in public health rarely have had experience teaching these introductory courses. Therefore, successful widespread introduction will require faculty development and support efforts, which requires national efforts coupled with local support. Development of the courses provides unique opportunities to develop, evaluate, and coordinate approaches to such teaching on an ongoing basis.

Part II

ACADEMIC MINORS AND ADMINISTRATIVE ISSUES

Background

Although accredited schools and programs of public health total approximately 100, participants in the Consensus Conference identified multiple signs of promise in program development (e.g., in unexpected places in the nation's approximately 2,000 institutions that offer bachelor's degrees). New courses and programs in public health and related interdisciplinary fields are capturing attention among the most innovative undergraduate curricula, and academic public health minor programs are under development in institutions across the country (4). Information regarding related programs in societal health and applied ethics is being posted on college and university Internet and intranet sites. These programs signal the emergence of a new category of interdisciplinary initiatives, including both a minor and a major in arts or sciences. Public health minor programs are overwhelmed by demand, with students packed into any available seats or in certain cases, unable to get a seat (ASPH and APTR, unpublished data, 2006). Although counting the programs is challenging, Internet searches (using such terms as "undergraduate public health," "introduction to public health," "public health minor," "Public Health 101," "introduction to epidemiology," and "Epidemiology 101") indicate both activity and potential for future development.

These new minors are of two basic types: minors sponsored by public health units (i.e., schools, colleges, departments, or programs) and minors developed as interdisciplinary ventures within, primarily, schools of arts and sciences. Nursing schools might have expertise sufficient not only to participate but also to lead such initiatives. Other health science or allied health schools might participate in both types of programs and provide leadership.

Although the two models differ, as discussed in the following, participants at the Consensus Conference from current programs and those in the planning stages unite in enthusiasm and agreement with these objectives. Both professional schools and arts and science leaders perceive value in real-world experience gained through public health minors. They agree in emphasizing the benefits that should be accessible to all undergraduates. They seek opportunities for local and global application of knowledge and analytic skills, experiential learning linked to civic engagement, practice of applied ethics, problem solving, and team work from a population perspective. They want to instill public health knowledge, understanding, skills, and attitudes into general and liberal education, with the goal of having an educated citizenry. Students should, in this sense, understand public health as a way of thinking and of knowing the world. Knowledgeable leaders want students to grapple with ecologic or systemic

understandings of human rights and health care in diverse global societies. Meanwhile, the Minors and Administrative Issues Working Group recommends that public health professionals embrace the LEAP learning outcomes (8) as central to undergraduate education.

Across the spectrum, leaders understand that public health minors have currency. These programs interest undergraduates who are paying attention to the world. Health topics introduce a new and highly relevant approach to global understanding within undergraduate majors. Public Health 101 and Epidemiology 101 can serve as options or electives in selected majors or as general education courses. More importantly, such courses have potential for reshaping a student's outlook on his or her own discipline, even those as apparently unrelated as the humanities. A major in Spanish geared to the health professions or a major in philosophy with an emphasis on human rights opens multiple other possibilities for future careers. Ongoing world challenges can intensify that interest. Environmental degradation and disasters, biologic and chemical terrorism, pandemic disease, and population dynamics (e.g., immigration, depopulation, effects of prolonged warfare) are all topics of concern to undergraduates. They often seek avenues to socially and globally responsible work within vulnerable populations and communities, and they understand the need for an educated citizenry.

Undergraduate students, those in arts and sciences in particular, also seek career options related to their majors, and they want to explore programs that might lead to graduate and professional school. The public health minor educates citizens and opens both pathways and alternatives to medical school, among other health-related professional fields. Undergraduates often enter arts and science majors unaware of the array of health professions that might be right for them later; they frequently enter the life sciences with unrealistic plans of becoming physicians. In health professional undergraduate schools, students across the spectrum find public health knowledge and practice essential to their success in these rapidly changing fields. All participants in the working group shared this awareness, and it emerged as a point of agreement as well at the Consensus Conference. The challenge, all agreed, is to find models that work for the majority of institutions that have not experienced public health's importance and potential within undergraduate education.

Defining a Minor Program

Although no national model exists for minor programs, discussion at the Consensus Conference identified certain widely recognized features. Minor programs are typically half the size of major programs in arts and sciences. In a school that counts course units, a typical major requires 10–12 courses. The typical minor requires four or five courses, perhaps including a partial-unit practicum. In a school that counts student credit hours, the minor might require approximately 21 semester credit hours or seven courses. Minor programs often require two to four foundational courses (depending on how credits are counted) and then offer choices among approved electives. Certain minor programs culminate in a capstone course or practicum, and others require applied or experiential learning.

Minor programs are usually designed to do something other than provide a truncated version of a major. College or university departments sometimes rely on minors to boost course enrollments by introducing students from outside the department to a new field or to provide foundational work in fields where a major might be too costly or enroll too few degree students. When minors are related to the student's major field or discipline, they deepen arts and science education and open a subfield or specialization, which can lead toward a profession. Minor programs not related directly to the major will enhance liberal arts and science education through breadth and contrast. Exploration of an unrelated field can likewise contribute to lifelong learning and career planning.

Program Models

Public Health Model for Universities with Public Health Schools or Programs

Consensus Conference participants discovered that the majority of minor program development has occurred at universities having public health schools or programs. As graduate schools and programs in public health extend degrees to undergraduates, faculty probably will realize quickly that undergraduate minor programs are potentially fruitful recruiting grounds for masters in public health students and other health professional programs. Consensus Conference participants affirmed the goals of educating the future citizenry through such programs, beyond opening a pathway to the health professions and public health. The conference identified multiple programs that are opening new avenues to undergraduates from a base in public health. For example, Boston University (20), Temple University (21), and the University of Virginia (22) — all with schools or programs in public health — have developed successful minors open to undergraduates that are especially attractive to arts and science students. As noted previously, the interdisciplinary degree in public health at Johns Hopkins University has in recent years become among the largest undergraduate majors in arts and sciences (5).

A public health minor might begin by situating all courses in the public health unit. It might employ unit faculty exclusively and recruit students majoring in arts and sciences. Course content might emphasize health care from a population perspective. Public health's population perspective shapes the minor in this model. However, variations exist on the model, as exemplified by recent interschool collaborations. Certain programs bridge public health and arts and sciences, offering courses through both units. For example, Boston University's School of Public Health has launched a successful College of Arts and Sciences public health minor, enrolling undergraduates side by side with public health students in graduate courses. To facilitate enrollment, the university provides a shuttle bus to bring undergraduates to the School of Public Health campus.

A new minor in global public health at the University of Virginia is anchored in public health in their medical school and is dedicated to undergraduate education in arts and sciences with

an emphasis on global knowledge and experience integral to the university's education program. A central goal of the program is to prepare and send undergraduates abroad for experiential or service learning. Programs of this design, with the public health unit located in a school of medicine or as a separate unit, for example, might develop a minor first and consider a major second or decide not to pursue a major at all. Interdisciplinary course designs might require that the minor program share administrative responsibility, course content, and joint faculty appointments between arts and sciences and the public health unit. These bridge designs might emphasize public health theory and concepts within an array of disciplines more than they direct learning toward health-care practice. That is, collaborative or joint programs might tend more toward the theoretical and didactic than the clinical or health-care professional. They might become more inter- or multidisciplinary, according to the orientation of the arts or sciences.

Arts and Science-Based Model for Colleges and Universities Without Public Health Schools or Programs

This model is in the creative stage rather than being fully implemented as yet. However, the Consensus Conference identified encouraging signs of growth in both bachelor's degree and comprehensive institutions (i.e., those that offer bachelor's plus master's degrees). An interest in health-related programs is growing along with the increased interdisciplinary emphasis in arts and sciences. Experiential and applied learning activities now attract broad support in the liberal arts. Innovative programs in such fields as health communication are beginning to find homes in the social sciences (e.g., the concentration in health communication at the College of New Jersey [23]). Interdisciplinary projects (e.g., health and society, health studies, and medical or biomedical ethics) are appearing as concentrations, specializations, minors, and occasionally as majors within arts and sciences. New health sciences or health studies programs are discovering champions within the sciences.

Among comprehensive institutions, California State University, Fresno, and the State University of New York at Fredonia, for example, offer public health minors. San Francisco State University (SFSU), College of Health and Human Services, which offers a master's of public health degree, is breaking new ground that will be useful for comprehensive institutions without schools or programs (24). SFSU's Department of Health Education offers two minors based in public health (health education and women's health) and multiple population-based general education courses, including epidemiology and environmental health, to fulfill integrative science requirements and multiple social science courses in public health. A new public health minor program at Muhlenberg College, a liberal arts college in Pennsylvania, might be the first of its kind (25). Although certain liberal arts institutions have created a limited number of specialized courses or concentrations, that interest is beginning to coalesce.

In the arts and science model, the liberal arts and departmental perspectives shape the minor. That is, the program might seek to strengthen global perspectives by enabling students to use the lens of public health and population study within and across disciplines. This objective differs somewhat from the goals of the public health unit model, which tends toward

professionalism and might focus on health-care applications. Unlike public health unit models, arts and science-based programs might also integrate the humanities and social sciences into the program by introducing an international or global perspective.

Collaborative Efforts in Creating a Public Health Minor Program

Innovative public health work in liberal arts and comprehensive institutions will require contributions across the institution and within the regional community. Structures or administrative homes for minor programs can vary, provided that essential expertise in the field of public health is available. A department of philosophy with expertise in applied ethics and a willing faculty leader might host an interdisciplinary minor program, for example, by providing essential administrative support and program stewardship. In that model, a collaboration among departments will ensure that core or foundational courses are staffed and listed as appropriate within different departments (e.g., Public Health 101 in a social science department and Epidemiology 101 as a biologic science). A faculty advisory committee can provide oversight and be organized by the lead faculty member from the philosophy department.

Alternatively, new programs might be housed in an interdisciplinary center (e.g., in the Center for Healthy Living at Western Washington University [26]). If a nursing school or another health science unit is available, a partnership might follow, drawing on the expertise of community or public health nursing faculty and community-based public health practice professionals with an adjunct faculty appointment. Faculty with public health expertise are often available in the local community through municipal, county, or regional public health departments, health systems, and hospitals. The key to program development, all conference participants agreed, is public health expertise. If no faculty member holds a master's of public health degree, the institution should invest in consultation and team-teaching, along with faculty professional development, to bring that expertise from the outside and develop it from within. An institution might engage public health practitioners as adjunct faculty, which can be an optimal opportunity for the institution to acquire the expertise it needs and practitioners to gain status and benefit from joining the faculty.

Collaboration with Arts and Sciences

Whichever the model, the new minor will require collaboration with faculty in arts and sciences. As discussed previously, an interest in interdisciplinary health programs is evolving naturally. Any social science department observing events in the community might hire faculty from a public health-related arena. Foundational work across the social sciences is often based on population studies, and bridges between the social sciences and public health are readily available. For example, faculty interested in narratives or ethnography are located throughout the humanities, anthropology, journalism, cultural studies, women's and gender studies, disability studies, film, communication, media or digital studies, and the arts. Studies of humans' health and behavior relate easily to studies of humans' stories expressed in fiction and

nonfiction in English literature and other modern languages. Expressions of public health in literature provide an optimal opportunity for better understanding the roles that public health challenges played in the past and still play today. Finding a member of an English or Spanish department who is interested in developing a course or joining a team-taught course related to public health should not be difficult in the majority of institutions.

Other opportunities for collaboration abound. Environmental studies draw faculty throughout arts and sciences, and public health is poised to do the same. Indeed, environmental studies programs encourage studying public health. Ecocriticism or green literary studies, postcolonial and cultural studies, and world or global studies throughout the humanities similarly prompt inquiry into public health. As philosophy and religion departments devote energy to applied ethics and law, public health is an attractive field for practice.

Collaboration with Nursing Schools

The present and projected workforce shortage of nurses has prompted growth in the nation's 672 bachelor's degree schools and programs of nursing (27). Regional universities and comprehensive colleges often prepare professional nurses. Potential for collaboration between nursing schools and arts and sciences is considerable at varying types of institutions. Bachelor's degree nurses are required to study and practice public health toward community application; therefore, nursing faculty can provide expertise essential to program development for the minor that would be open to both nursing and nonnursing majors. Nursing faculty often hold community health nursing graduate degrees.

Community nursing education, required for bachelor's degrees in nursing, is founded on population-based public health. All accredited undergraduate bachelor's degree nursing programs require training in community health, including public health principles and structure, health promotion and disease prevention, epidemiology, population-based health assessment and care delivery, health disparities, and morbidity and mortality. Although nursing students might be unable to fit a public health minor into the undergraduate degree program, they might increase the number of students who enroll in the foundational courses of Public Health 101 and Epidemiology 101. Creative programming, using general education or arts and science courses — where Public Health 101 fulfills a social science requirement and Epidemiology 101 a life science requirement — might enable nursing students to complete the minor.

Collaboration with Health Science Schools

Consensus Conference participants agreed that the array of health science schools and programs, the majority of which are located within comprehensive institutions, offer both faculty expertise for minor program development and potential demand from students. No health science bachelor's degree program exists that cannot be enhanced by a public health minor. Likewise, no health science curriculum exists that cannot enrich an interdisciplinary public health minor through shared or cross-listed courses and faculty expertise. As noted

previously, environmental health degree programs are an excellent case in point. These programs study the complex interplay of environment and human health and take a systemic approach to health interventions through environmental modification and control (28).

In addition, a public health minor can be attractive to pharmacy students. The doctorate of pharmacy degree requires no separate bachelor's degree and thus combines undergraduate arts and science education with professional study. A public health minor can be a valuable complement and enable students to meet general education requirements. Other undergraduate health science majors (e.g., occupational therapy, kinesiology or exercise science, speech or language pathology, and audiology) are also likely to take interest in a public health minor.

Collaboration with 2-Year Colleges

Two-year institutions or community colleges have tremendous potential to cultivate student interest in public health and to provide foundation courses as requirements for the associate's degree and for dual-admission and transfer to 4-year (i.e., bachelor's degree) institutions. A comprehensive strategy to support development of public health minor programs can extend opportunities and provide models for partnership between 2- and 4-year schools that serve a substantial population of U.S. students. Especially promising is a shared curricular development for Public Health 101 and Epidemiology 101 between 2-year colleges and the 4-year universities in which associate's degree holders are likely to complete their bachelor's degrees. Innovative public health teaching fellowships for graduate students can be created at nearby community colleges. A population-based approach to public health program development supports an emphasis on community colleges and the regional comprehensive universities that receive the majority of their 2-year graduates.

Learning Outcomes of Public Health Minors Linked to LEAP Outcomes

Foundational or Core Learning

Participants at the Consensus Conference reached broad agreement on the foundation or core, regardless of the institutional model. A minor program might require two to four foundation courses. Public Health 101 and Epidemiology 101 should be included in the core, without exception. Different approaches might be taken in locating these two courses within the curriculum. Institutions might combine Public Health 101 and Epidemiology 101 for first- or second-year students and require an upper-division epidemiology course for the minor, which should also require a biostatistics prerequisite. An introductory global health course should also be included in the core. The number and titles of courses will matter less than the integrity of the learning goals of public health for an educated citizenry, which institutions can address in their own distinctive ways.

Minor programs should extend and develop foundational learning beyond Public Health 101 and Epidemiology 101, building on institutional strengths, and the programs should include

experiential learning (e.g., service learning and a capstone experience). A sample structure for a minor that incorporates this approach includes required core courses, a selection of specialized courses, and experiential learning (Box 4).

Box 4.

Generic structure for a minor in public health

I. Required Interdisciplinary Core

- ♦ Public Health 101
- ♦ Epidemiology 101
- ♦ Global Health 101

III. Experiential Learning

- ♦ service-learning;
- ♦ capstone or synthesis projects; and
- ♦ structured research or study abroad.

II. Electives/Selectives*

— Discipline-specific or interdisciplinary courses as determined by the institution and the student. Departmental or interdepartmental public health-related courses based on the focus and strengths of each institution.

* Examples of elective/selective courses include the following:

- Health behavior — psychology;
- Biostatistics — mathematics, statistics;
- Health policy and law — political science, sociology;
- Environmental health — environmental sciences, environmental studies, biology; Biology for public health or infectious disease — biology, biochemistry, microbiology, other biologic sciences;
- Health economics — economics;
- Organizational theory and public health practice — sociology and management;
- Women's health — women's and gender studies;
- Spanish for health professions — modern languages and biology;
- Addiction studies — biopsychology or neuroscience;
- Environmental policy and environmental justice — political science and other social sciences;
- Health communication — communication studies, journalism;
- Health and development — economics, geography, anthropology;
- Health and international human rights — philosophy, sociology, political science;
- Sexuality studies — psychology, anthropology, woman's and gender studies.

On the core foundation and toward the capstone experience, minor programs can build different structures or be shaped by different interdisciplinary emphases. Designs will depend on institutional mission and strengths. Assuming Public Health 101 and Epidemiology 101

are required, the working group understands that advanced courses might share selected learning objectives (e.g., to use public health concepts to examine a local health problem or to understand disease determinants and causation) but seek performance at a higher level. Elective courses might accomplish such varying objectives as

- ♦ encouraging work in applied science;
- ♦ opening health career avenues for arts and science students in public health, environmental health, health communication, and different professional programs;
- ♦ inviting new and diverse student populations into the sciences;
- ♦ fostering study, community-based work, and methods for achieving change in health policy, politics, and legislation (“The community is a living laboratory,” a conference participant commented);
- ♦ fostering understanding of cultural differences, in both a U.S. and world context (“Cultivate cultural understanding and humility,” one program leader observed);
- ♦ teaching behavior change strategies (individual and community-based);
- ♦ requiring both qualitative and quantitative analysis;
- ♦ opening study of small- and large-group communication;
- ♦ opening connections to diverse fields by using a population or societal approach (e.g., nutrition, sociology, psychology, anthropology, economics, political science, organizational studies, or human physiology);
- ♦ bringing study of law, ethics, human rights, public policy, and social responsibility into action;
- ♦ connecting theology, ethics, and medicine;
- ♦ promoting advanced language study;
- ♦ opening the field of health communication within communication, media, or digital studies;
- ♦ connecting the study of drugs and alcohol, nutrition and health, and sexuality to population-based study; and
- ♦ teaching information management and analysis (e.g., learning to use such tools as statistical software and to work with human-subject and confidentiality concerns).

The overall design of a minor should be distinctive and shaped by a mission-based commitment, as in the case of the University of Virginia’s minor in global public health (22). An institution with advanced community-outreach programs might choose to build service and community-based research into the options or electives. A minor intended to serve premedical and preallied health students might emphasize preprofessional education. Schools with strong communication programs might emphasize health communication. Planners should consider the academic culture of the institution as they begin discussing structure. Recommended strategies for developing a sustainable integrative public health minor (Box 5) and specific administrative concerns that need to be addressed in developing a public health minor (Appendix B) are discussed in this report.

Box 5.**Strategies for developing a sustainable integrative public health minor**

Participants at the Consensus Conference on Undergraduate Public Health Education (November 7–8, 2006), recommend the following strategies for all institutions, but particularly for liberal arts colleges and comprehensive institutions:

- ♦ Find a champion; this person will probably come from the social sciences but might hold a position in philosophy and ethics, biology, or environmental studies or environmental science.
- ♦ Seek faculty and administrative support for the program.
- ♦ Draft mission and vision statements that are related to the institution's mission and vision.
- ♦ Start or promote development with a lead department that will become the administrative host or home; this probably will be the social sciences department but be open to any willing department.
- ♦ Prepare a plan for faculty development and a timeline; develop foundation or core courses (Public Health 101, Epidemiology 101, and global health); seek general education approval of foundation courses.
- ♦ Prepare for advising and service-learning to be centered in the host department or an affiliated center.
- ♦ Organize a network of affiliated faculty who will help with advising; consider organizing an advisory committee or board.
- ♦ Connect the program to the sciences through development of Epidemiology 101, which might meet general education requirements in the sciences, including laboratory science.
- ♦ Encourage statistics faculty to incorporate public health problems and examples into regular statistics instruction with the understanding that arts and sciences majors outside the sciences might take statistics to fulfill general education requirements in quantitative reasoning.
- ♦ Organize events that attract interest in public health study. One institution sponsored a well-attended interdisciplinary panel on the topic of DNA testing and risk, bringing together a public health professional, a philosophy professor, a psychologist in behavioral medicine, a medical sociologist, and a biologist.
- ♦ Apply for start-up funding (internal or external) after making progress on all of the previous strategies

Conclusion

The promise of Public Health 101, Epidemiology 101, and academic public health minor programs is extraordinary. Such programs integrate well with arts and sciences and other major programs, bringing critical global matters into multiple disciplines. Collaboration among institutional units, especially bridging arts and sciences and professional schools, can substantially enrich the opportunities for that institution's students. Professional school faculty might find the experience of teaching engaged undergraduates to be refreshing and inspiring. Arts and science faculty might discover a new perspective on their research and scholarship when they observe the world through a population perspective, and conversely, public health's population perspective supports new approaches through which to observe both liberal arts and professional school majors.

The emphasis on application and real-world problem solving enhances arts and science education, both general education and major areas of study. Public health and epidemiology courses and minors invite students to take socially responsible steps and to provide valuable direction for career choices. Considering the magnitude of world health problems and the diversity of societies and cultures, public health minors help students to focus on solutions, to be sensitive to differences and aware of vulnerable populations, and to be optimistic about world affairs. Through such programs, colleges and universities address critical needs for an educated citizenry and foster leadership development.

Although administrative challenges are substantial, as in any interdisciplinary or interschool project, committed stakeholders will find solutions, and the outcomes will fully reward the effort. For undergraduates who will live through much of the 21st century, these are engaging and relevant programs that will conduce to the good of the world.

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Appendix A

Statement on Recommended Content for an Introductory Undergraduate Public Health Course

In 2003, the Institute of Medicine recommended that “all undergraduates should have access to education in public health” (A-1). To implement this recommendation, the Task Force on Undergraduate Public Health Education (the Task Force) of the Association of Schools of Public Health* concluded that the content of public health undergraduate courses should adhere to the following:

- ✦ A public health course should be built upon a population perspective and provide a multidisciplinary and ecologic understanding of disease causation and prevention. It should emphasize health concerns that affect society as a whole as well as those that affect vulnerable populations.
- ✦ An introductory public health undergraduate course should include
 - an historical perspective on the contributions and roles of public health, including the structure and functions of public health institutions;
 - an introduction to epidemiologic and biostatistics principles, including concepts of rates, causation, and public health surveillance;
 - determinants of health and access to health services from a global perspective, including environmental, social, and behavioral, as well as biologic.
 - an introduction to selected tools of disease control and health promotion, including such interventions as vaccinations, screening, counseling and education, environmental and occupational, legal, and policy approaches, as well as the roles of health communication; and
 - problems related to health-care delivery systems, addressed from a population perspective, including quality, cost, and access, as well as organizational structure, and the association between these concerns and public health services.
- ✦ An introductory course designed by using this approach should be available for all undergraduates and be part of undergraduates’ general education.
- ✦ This course is strongly recommended for those students considering a health profession.
- ✦ Health-related professions should consider this type of undergraduate course as a requirement for those seeking graduate education.

* The Task Force includes representatives from multiple schools of public health with undergraduate majors or minors as well as Council on Education for Public Health-accredited programs affiliated with the Association for Prevention Teaching and Research.

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Appendix B

Administrative Considerations and Requirements

Because institutions differ so widely in structure and mission, participants of the Consensus Conference on Undergraduate Public Health Education (November 7–8, 2006) decided that no one set of answers were feasible for all administrative problems. However, the meeting produced a comprehensive set of questions that should be answered during the planning and implementation phases of a new program for offering an undergraduate public health minor.

All Institutions

- ♦ Successful programs require investment and commitment from the administration and grassroots interest of faculty because they share an understanding of the institutional mission, the vision for the public health minor program, and in particular, the goal of an educated citizenry. Not only is this goal socially valuable, but it also helps to refocus and recenter discussion if disputes arise regarding program or course oversight.
- ♦ Effective programs negotiate across boundaries of departments and schools. An administrative entrepreneur at the center of the institution (in the office of academic affairs) can help.
- ♦ Successful programs need a champion who invests in sustained leadership.
- ♦ Certain administrative planning concerns are predictable and will vary with institutional type. Effective planning begins with mission and vision and then calculates the costs of program development and implementation, as well as the regular operating budget of a sustainable program. Answering the following questions is essential:
 - Who is releasing faculty to plan and operate the new minor program?
 - How much can and should planners achieve before negotiating for additional resources?
 - Who leads the program?
 - What is the faculty director's line of authority?
 - Interdisciplinary or interschool programs cost time and money. In institutions without formula funding, how do planners find or negotiate for start-up costs?
 - Under formula funding, who pays?
 - Where does tuition flow within the institution?
 - Does the institution permit or encourage leadership to be shared or rotated among departments, especially in the case of interdisciplinary programs?
 - How does the institution handle the costs of team-teaching? Will it permit t

- eam-teaching at full faculty credit or weighting during a set period of program development (e.g., during two semesters)?
- ✦ Common program management concerns include the following:
 - Who advises students? How does the institution assign, credit, and share advising for other interdisciplinary or interschool programs?
 - Who pays attention to course sequencing in interdisciplinary programs?
 - How does the institution list interdisciplinary courses in program material and in student records?
 - What models for interdisciplinary programs (e.g., women's and gender studies) exist at the institution? How does the institution support departments that host other programs?
 - Is having a departmental base or a hosting department necessary for an interdisciplinary program or can the program survive by floating?
 - ✦ Successful programs, according to conferees, will require full integration with and within the arts and science unit. A thriving public health minor will be built on respect for differences in perspective between professional schools and arts and sciences, and between the sciences, social sciences, and humanities. Stakeholders involved in planning should consider the preferred level of preparation they want to seek for students and the long-term goals of the minor within the institutional context.
 - How do planners achieve full immersion in arts and sciences, with the goal of an educated citizenry firmly before all stakeholders?
 - Do the goals of the minor serve a population beyond the premedical and other health professions students?
 - Do the goals of the minor invite students in the humanities to enroll and faculty in the humanities to address public health in disciplinary context?
 - Do the goals of the minor address the institutional commitment to general and liberal education?

Schools and Colleges with Health Science Units

- ✦ Minors might be easier to develop if the arts and science unit has access to a health science unit. Deliberate crossover between schools can be productive. Questions to anticipate include the following:
 - How to handle calendar and scheduling differences between schools, especially in universities with separate health science campuses?
 - Should undergraduates enroll in graduate epidemiology or public health courses?
 - How will students enrolled in a minor program be granted access to upper-division and graduate courses?
 - If undergraduates take graduate public health epidemiology, should the course be less heavily quantitative for the undergraduates (e.g., a separate set of assignments)? One program might determine that undergraduates perform well

in graduate courses. Another program might worry that the rigor of the courses will decline if undergraduates enroll.

- Should epidemiology and public health courses be located or administratively housed in the arts and science unit?
- ♦ Oversight concerns might arise if the arts and science unit creates a major that competes with other degree programs. Minors are typically more easily implemented and managed so as not to compete with other degree programs.
- ♦ Public health minors should at least have an anchor in arts and sciences, especially social sciences. Institutions should consider the advantages of a 5-year bachelor's or a combined bachelor's and masters of public health degree design.

Schools and Colleges Without Health Science Units

- ♦ Arts and science units and liberal arts colleges without access to a health science unit should seek external resources, including the following:
 - Internet- or intranet-based courses;
 - community-based health professionals, using the business school model (e.g., adjunct faculty epidemiologists from a local, state, or regional public health department);
 - consortia with local health-care institutions; and
 - support from and collaboration with health-related nonprofit organizations or foundations.
- ♦ Planners need to answer the question, Does the success of a minor program depend on the participation of faculty who have public health degrees? Differences of opinion exist. Nurses often have masters or doctorate of public health degrees and can work as team members with arts and science faculty. Certain social science and science faculty have or are willing to earn master's degrees in public health, especially because online programs are available. Certain institutions might need to hire adjunct faculty with public health degrees for team-teaching, program advisory, and curricular development. Concerns about the role of adjunct faculty are more readily addressed if the adjunct faculty take assignments that require and reward their professional expertise and that allow them to work in full partnership and standing with full-time faculty.

Consensus Conference

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