Training in Interdisciplinary Health Science:
Current Successes and Future Needs

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A Vision for the Future

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I. The Need for Interdisciplinary Population Health Science

US investments in health and health research traditionally have been shaped by a widespread tendency in US culture to conflate health with health care. Investments in preventing disease or disability have been small relative to the whopping 17% of the US GNP that goes to health care. Investments in biomedical research to find cures for disease greatly outpace those in research that addresses the social/environmental and behavioral causes of poor health outcomes. Americans regard the health care system as the major defense against poor health; our health policy focuses mainly on making that system work better for us.

Today, however, there is growing recognition that factors outside the medical sphere also powerfully affect health. This increasing awareness is reflected in reports from the World Health Organization’s Commission on the Social Determinants of Health (e.g., Closing the Gap in a Generation), the Robert Wood Johnson Foundation (RWJF) Commission to Build a Healthier America, the National Research Council and Institute of Medicine,¹ and many other organizations. Evidence documenting the importance of upstream determinants of health has motivated key institutions to adopt multi-sectoral approaches to improving population health; examples include RWJF programs on obesity and its new initiative on “Culture of Health”, The California Endowment’s “Building Healthy Communities” commitment, the Federal Reserve Bank’s initiative on healthy communities, the Centers for Disease Control and Prevention’s Health Community Design Initiative, and the Obama administration’s place-based initiatives. Another key effort, the Health in All Policies initiative of the National Association of County and City Health Officials, draws attention to the potential consequences of all policies, not just health care system policies, for improving or diminishing health.

These efforts imply a focus on population health: “the health outcomes of a group of individuals, including the distribution of such outcomes within the group” (Kindig and Stoddart 2003). Population health moves beyond the individual focus of the traditional medical model to consider the large disparities in morbidity and mortality among population groups in the U.S., to consider why the U.S. population’s health lags behind health in other advanced economies despite much larger investments in health care (NRC & IOM, 2013), and to consider how a range of social, economic, environmental or other policy interventions and investments that operate at local, regional, and national levels can improve population health.

“Population health” has entered the lexicon of medical care organizations in recent years, in part, thanks to the “Triple Aim” that emerged from the Affordable Care Act: improving the experience of care, improving the health of populations, and reducing per capita costs of health care (Berwick, et al, 2008). The term’s usage in this setting has differed somewhat from that intended here, in that the populations targeted have, with some exceptions, tended to be enrolled participants and the focus, improved management of clinical populations. By contrast, we define populations broadly to include geographic and/or political entities, as well as population subgroups such as those sharing a particular economic, racial, or ethnic status. Our

¹ Recent examples include IOM (2012a,b); IOM and NRC (2013); and NRC (2009).
focus is also broad in the range of health outcomes considered, including for example life expectancy, disability, and “physical, mental and social well-being” (WHO, 1948). These two meanings of population health are complementary, but their co-existence has led to some confusion and calls for modifying terminology to clarify the distinctions.²

An interdisciplinary evidence base for population health

As the momentum for addressing the multiple determinants of health grows, it is important to take stock of the evidence base that informs these efforts and the pool of scientists who can move the science forward. One of the most striking things about the evidence base is that it can’t be ascribed to any one field or discipline. Scientists trained in traditional schools of public health have contributed significantly to our knowledge of upstream determinants and health behaviors, but so have scientists from economics, sociology, psychology, anthropology, demography, geography and other social science disciplines. Medicine, genetics, neuroscience, endocrinology, and other biologically-oriented fields have also contributed the science needed to understand how and why upstream determinants and behaviors produce health outcomes.

The field of population health science has grown over recent decades to embrace the multi-disciplinary sources of science relevant to health and to emphasize the need for a focus on health at the population, rather than individual, level. Population health science:

- focuses on the levels of health within populations and disparities in health within and across different population groups;
- conceptualizes health as the product of multiple determinants at the biologic, behavioral, contextual levels and their interactions among individuals, communities, time, and place;
- often requires scientists to examine common health determinants across different diseases and conditions, and may offer solutions that operate at the population level to improve outcomes across disease categories as well as disease-specific outcomes; and
- produces knowledge about the contextual, behavioral, and biological causes of health and disease, the mechanisms through which overall levels of health and health disparities are produced, and the evidence base for policies and practices that improve population health and ameliorate health disparities.

While acknowledging a close relationship to public health, population health proponents seek to extend traditional scholarship and training in public health to better incorporate the full range of disciplines that contribute to population health knowledge. This implies a deep commitment to inter- and/or trans-disciplinary science, defined as science that combines

² See Kindig (2012) for the suggested term “population medicine” to refer to the meaning common in the health care community.
discipline-based theories, methods, and knowledge to solve scientific questions. In interdisciplinary work, researchers work jointly, each drawing from his or her own discipline-specific perspective, to address a common research problem. Transdisciplinary work involves an integrative process in which researchers work jointly to develop and use a shared conceptual framework that synthesizes and extends discipline-specific theories, concepts, and/or methods to create new models and language (Stokols et al. 2008a). In this paper we use interdisciplinary to refer to both concepts.

Population health science seeks to integrate knowledge, theory, and tools from multiple disciplines to develop a broad understanding of the multi-factor pathways that produce health and health disparities so that more effective solutions can be found. Disciplinary science provides a foundation for this interdisciplinary undertaking and many critical insights in population health trace back to individual disciplines. No one discipline, however, has all the answers. The attempt to develop an integrated interdisciplinary field can draw on: the experience of other interdisciplinary fields that have developed in science and technology, the support and encouragement of funders in the public and private sectors, as well as a growing body of knowledge about the factors that make interdisciplinary teams fail or succeed. This research suggests that a broad range of intrapersonal, interpersonal and contextual factors contribute to success in interdisciplinary science. Population health science may face particular challenges to the extent that it engages disciplines that are widely separated by institutional structures and scientific approaches.

The integration of the basic social sciences alongside the basic biological, clinical, and behavioral sciences is essential to population health science. Many health-focused sciences treat social contextual determinants as “exposures.” The problem with this approach can be illustrated with an extreme example: one might say that a death was caused by exposure to a bullet, neglecting a larger and more useful explanation that took into account the relationship of social and economic conditions, environmental stressors and stress response pathways, patterns of social interaction, and public policies to the firing of the bullet. By addressing the processes that drive social systems and produce “social exposures;” that is, by addressing processes of stratification, economic cycles, political movements, migration, diffusion, and institutional change, the social sciences can greatly enrich and deepen the understanding of social determinants and the avenues for addressing their effects on health. Currently, schools of public health vary in the depth of social science expertise and the extent to which they engage with disciplinary social science departments on other campuses. Linkages with

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3 This integration both reflects and reinforces the prioritization of interdisciplinary research by the National Academy of Sciences (2004), the National Institutes of Health (2007), and the European Science Foundation (2012), as well as many colleges and universities (Klein 1996; Latucca 2001).
4 For example, the contributions of cognitive science to designs for menu and package labeling that enable consumers to more readily understand the health risks and benefits of products (Roberto & Kawachi 2014).
5 For example, the Science of Team Science is a new field of inquiry that applies rigorous methods to investigate what makes interdisciplinary teams successful (Stokols et al 2008a,b).
disciplinary scientists and departments can both enrich the application of social science to population health issues and improve disciplinary social science research on health.

Moving ahead: workforce and challenges

The adoption of population health strategies within public health, medical, business, government, and educational institutions signals a growing demand for a trained workforce that can develop and apply the evidence from population health science. This workforce will include a diverse set of people with skills ranging from basic scientific discovery to translation and implementation, and occupational titles from scientist to policy analyst to social worker, doctor or business owner. Not all workforce members need to be highly skilled interdisciplinary scientists. Training that provides a basic understanding of population health may suffice for most people involved in carrying out relevant programs. Many members of this workforce, however, will need the skills to create the evidence base for population health and the skills to critically evaluate the products of population health science and its potential application to policy and practice. These needs imply interdisciplinary training programs at the pre- and/or post-doctoral levels, as well as other mechanisms for mid-career learning. This paper focuses on the training pipeline necessary to produce such interdisciplinary population health scientists.

Three challenges lay ahead as this growing field moves forward. First, despite the emphasis on interdisciplinary science, most universities retain disciplinary structures that tend to silo the diverse contributors to population health science. Scientists in schools of medicine and public health tend to be divided from social scientists not only by scientific approach and discipline-based incentive structures but also by institutional boundaries, geography, and weak network connections. While some social scientists hold positions in schools of public health, soft money environments often make such positions disadvantageous compared to those in traditional disciplinary departments. Widespread cultural views that devalue the social sciences as “soft” also function to discourage effective integration of their contributions. Finally, although most health scientists recognize the importance of interdisciplinarity, it is less clear how far this has influenced training. In a recent study of public health programs in Canada, over three quarters endorsed the value of interdisciplinary, multidisciplinary or cross-disciplinary training opportunities, but only one-third (32%) provided them (Mishra, et al., 2011).

Second, the success of population health science will depend on letting problems, not familiar toolkits, drive approaches to understanding and improving health. The complexity of pathways that operate at the contextual, behavioral and biological levels to produce health outcomes means reaching out to a wide ranges of sciences to identify relevant theory and methods and finding innovative ways to improve and adapt methods deriving from different disciplines to fit the problems of population health. The field will need to reach out to systems and computational scientists for powerful ways of distilling and integrating knowledge. It will need to simultaneously retain the strengths of the disciplinary roots of population health science while transcending disciplinary silos.
A third challenge is to ensure that the scientific contributions of population health science lead to innovative ways to improve health. The field must embrace not only science on basic mechanisms producing health, but also research that can guide choices about the most effective levers for improving population health, demonstrate the return on investment for manipulating them, and specify the conditions under which they are most effective. Existing research provides appealing ideas for improving population health in many areas, but too often these are based on narrow disciplinary assumptions and do not produce results. Adler et al (2013) argue that agile institutional mechanisms that link population health science and practice are needed to build bridges between basic and applied research and among researchers, policy makers, and practitioners. We need a “two-way street” in which the application of population health concepts to practice, programs, and policies is guided by the best possible scientific evidence and scientific agendas are responsive to the need for evidence to guide programs and policies. This type of interdependent relationship, if done well, can create an innovative learning environment that produces both new knowledge about population health and improved strategies for improving it.

How to structure training programs to optimally address these challenges remains unclear. It is the rare scientist who both advances knowledge on the basic social, behavioral and/or biological mechanisms that drive population health and develops and implements effective programs or policies for population health improvement. More commonly, scientists may learn to effectively communicate their research or partner with scientists skilled in translation to assure that their science makes a difference. It may take a range of training activities to produce both individuals and teams who will produce outstanding population health science and effective translation and implementation of that science.

### Goals of the meeting

The upcoming meeting on June 1-2, 2015, “Training in Interdisciplinary Population Health Science: A Vision for the Future,” will develop a vision for training the next generations of scientists in this nascent field. While population health science holds great promise for advancing new approaches to improving health and reducing health disparities, the future of training in this area is uncertain. The only national post-doctoral training program specifically focused on training in population health science will be ending as of August 2016. As we discuss below, many other related programs exist, but most focus on a subset of the sciences embraced by population health science, a subset of health outcomes, or on the leadership and translational aspects of improving population health.

*The overarching goal of the meeting is to develop a vision for the production of outstanding scientists who can integrate knowledge, theory, and methods from diverse disciplines and...

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6 This meeting is hosted by the IOM Roundtable on Population Health Improvement and supported by the Roundtable, the NIH Office of Behavioral and Social Sciences Research, the National Institute for Minority Health and Health Disparities, and Robert Wood Johnson Health & Society Scholars.
Most participants in the meeting are scientists who have experience with academic training in population health science and/or interdisciplinary training in related areas. Meeting participants will review goals and principles, existing models, and best practices in population health science training from the undergrad to mid-career levels and develop a set of feasible strategies for developing a robust pipeline of interdisciplinary population health scientists. Participants will also consider how best to incorporate knowledge translation and exchange in training.

This document is intended to provide a common starting point for discussion at the meeting. In the next section we provide an overview of programs and funding streams that have supported training in population health science. In the following section, we advance a preliminary assessment of critical competencies, training strategies, and institutional factors that contribute to successful training programs. The next section describes the ways in which programs at different levels, from the undergraduate to the postdoctoral, can contribute to an effective training pipeline, and provide examples of programs at each level. The final section of the document highlights key issues for exploration and debate at the meeting.

Following the meeting, this paper will be revised to reflect discussion at the meeting and recommendations developed by meeting participants. The final document will be published on the website of the IOM Roundtable for Population Health Improvement and widely disseminated. It will provide an accessible review of the needs, lessons learned, and challenges for training in interdisciplinary population health science along with priorities and action steps for ensuring a sustainable future supply of scientists prepared to address critical issues in population health and population health improvement.

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7 This is not to discount the importance of training nonscientists in population health concepts. As discussed elsewhere, training in undergraduate and graduate settings can also set the stage for people who will contribute to population health through nonscientific activities.
II. An Overview of Training in Population Health Science

Although the development of training programs in population health science is a relatively recent phenomenon, training in related fields is well established and many scientists trained in other fields have made major contributions to advancing research on population health and health disparities. In this section, we acknowledge some of the major disciplines and fields that have offered training relevant to population health and health disparities.8 We also discuss the various funding streams that have supported this training. Finally, we focus in on training in interdisciplinary population health science, noting the key features that may distinguish it from other training experiences.

Not surprisingly, schools of public health have played a major role in fostering pioneering work on population health. The health of populations is central to the mission of public health, and many traditional departments within schools of public health explicitly address issues in population health science, including environmental health, health policy, community health, and epidemiology. Outstanding training programs in these areas are long-established. Despite concerns, expressed by some scientists, that public health has become too narrowly focused on health care, biological determinants of disease, and individual-level approaches (Krieger, 1994:892), the movement towards population health science has been embraced by many schools of public health. Indeed, several such schools have adopted names including “Population Health.” Social epidemiology has grown as a subfield within epidemiology, although only recently gaining broader legitimacy. Many of the leaders in population health science are housed in schools of public health.

Other university programs outside public health have also contributed to the development of population health scientists. Programs in demography have trained many scientists in the study of population mortality trends and differentials, the contributions of social factors in mortality and health, and methods of population analysis. Schools of public policy have trained experts in analyzing the effects of policy on well-being as well as the process of policy-making and implementation. Medical and other health professional schools are increasingly providing attention to social and behavioral as well as biological factors in health and many medical schools are now establishing departments of population health. Training programs in traditional disciplines located within schools of arts and sciences have also generated leaders in the field.

Past training has relied on a variety of funding sources. Central among these, of course, are the traditional sources of funding for universities: tuition, endowments, contributions from state and local governments, and increasingly gifts from donors. “Soft money” grants and contracts from public and private sources tend to dominate funding for schools of public health and other specialized schools. While most of this funding goes to research, training grants from the NIH have played a major role in supporting interdisciplinary training relevant to population health.

8 Because so many fields contribute to population health science, our review is necessarily partial.
A search of NIH training grants active in 2013 identified 70 pre- and/or postdoctoral programs that were related to population health.9 (See Appendix 1 for a detailed account of the methods and results of the search). Most of these were focused on specific disease outcomes and some on population science broadly (without a specific focus on health). A few addressed health disparities. While many provided exposure to a variety of relevant disciplines, relatively few integrated social science deeply in the training. Very few explicitly provided training in the skills needed for interdisciplinary science.

Private foundations have also been important contributors to training activities in population health. The Robert Wood Johnson Foundation has funded the Health & Society Scholars program (HSS), a postdoctoral program explicitly directed toward the development of scientists who can advance the science of population health and develop innovative approaches to improving health. However, this program will close in August 2016 as a result of the Foundation’s decision to discontinue all site-based human capital programs. The RWJF has also been funding other relevant programs, such as the Clinical Scholars Program and the Scholars in Health Policy Research program, and these will also close in 2016. A new program focused on leadership training in four domains related to the Foundation’s new “Culture of Health” initiative will take their place (see Appendix 1 for a summary).

Other organizations and foundations have also supported training relevant to population health. Kaiser Permanente provides support for several important training programs relevant to population health issues, including the Burch Minority Leadership Development Program, support for the Satcher Health Leadership Institute at the Morehouse School of Medicine, training activities within the UCLA Kaiser Permanente Center for Health Equity, and the UC Berkeley Kaiser Permanente Public Health Scholars program. The W. K. Kellogg Foundation’s Kellogg Health Scholars Program provided training on the social determinants of health, academic-community partnering, community-based participatory research, and application of research to strengthen advocacy and achieve policy change. This two-year post-doctoral program closed in 2012. The Aetna Foundation and the Kresge Foundation offer programs focused on policy, leadership, and community engagement activities related to population health, but not training in science. Appendix 1 provides a description of methods and results of a search of foundation funding in this area.

In the next section, we advance a set of “essentials” for training in interdisciplinary population health science. While many of the programs we have discussed here share some of the characteristics we will present, few if any provide the full range of competencies needed to create outstanding population health scientists.

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9 This search, conducted by Yonette Thomas and Christine Bachrach, included grants as population health-related if (1) a substantial goal of training was acquiring and/or learning to produce knowledge of the determinants of health within and across populations and (2) the program either explicitly or implicitly acknowledged a multi-level conception of health determinants ranging from the biological to the social/environmental. Programs focused entirely on health services research were not classified as population health.
III. Defining the Essentials of Training in Interdisciplinary Population Health Science

What does it take to produce outstanding scientists who can integrate knowledge, theory, and methods from diverse disciplines and participate effectively in interdisciplinary research to address complex population health issues? Certainly there are multiple approaches -- diverse and innovative approaches to training are encouraged. In this section, we first outline specific competencies that one might consider emphasizing in designing and evaluating training programs that aim to contribute to creating an outstanding cadre of population health scientists. Second, we describe practices that are commonly used to develop these competencies. Third, we discuss features of the institutional environment that are essential for successful training programs.

Competencies
We suggest a preliminary list of competencies below in the categories of knowledge acquisition, interdisciplinary collaboration skills, and knowledge translation and exchange. This list is not meant to be exhaustive, but is intended to highlight specific competencies that may be critical in developing outstanding interdisciplinary population health scientists. Clearly there are many additional competencies related to creating strong scientists in general (e.g., research ethics, research design, general leadership skills), and we do not list those here.

The competencies discussed in this section are those needed by population health scientists by the end of their training. In the section that follows, we address the potential for developing these competencies across different levels of educational experience, from undergraduate to post-doctoral.

Knowledge Acquisition

Goal: Population health scientists should have broad knowledge of the fundamentals of population health science. The approach to defining this knowledge base should remain open and flexible. While there may be a core set of knowledge in population health that people need to learn, openness to diverse disciplinary contributions, both in theory, substance and methods, should remain a guiding principle.

Rationale: A strong population health scientist will have both depth and breadth in knowledge. At some point in one’s training, developing depth and expertise in knowledge about a particular discipline, approach, or population health problem is necessary to conduct both independent and collaborative work in population health sciences. While some population health scientists will have knowledge, skills, and experience rooted primarily in a particular discipline/approach, interdisciplinary population health training should ensure that such scientists develop a number of other competencies, particularly knowledge of other disciplines/approaches that challenge or complement one’s own training. Training in broad population health knowledge has the aim of increasing the creativity and scope of the population health scientist, improving the
scientist’s ability to contribute effectively in an interdisciplinary team, and transforming a scientist to produce rigorous population health research alone or in teams.

**Examples of competencies:**

- Demonstrates knowledge of concepts of health as a product of factors operating at multiple levels (e.g., molecular, cellular, organ, individual, family, community, region, nation, global) in dynamic ways over time.
- Achieves broad familiarity with literatures on the contributions of biological, behavioral and contextual factors to population health.
- Demonstrates familiarity with foundational concepts in population health (e.g., population, disparities, selection into and out of populations, ecological fallacy).
- Demonstrates introductory knowledge about the range of disciplines and theories that contribute to understanding and addressing population health.
- Analyzes the strengths and weakness of the methods that contribute to population health science and multi-method approaches.
- Demonstrates in-depth expertise in the theory, methods, and knowledge base of at least one discipline or approach that contributes to understanding population health
- Critically analyzes and integrates knowledge, theory and methods from multiple disciplines in designing and carrying out research on population health.
- Maintains a current knowledge base in population health science and monitors emerging methodologies and technologies (for example, “big data” mining, systems models), assessing how they may or may not be relevant to understanding and addressing population health.

**Interdisciplinary Collaboration Skills**

**Goal:** Population health scientists should develop the ability to effectively lead and/or work with others who have different approaches to or expertise in population health topics in order to understand and address the complex causes of population health problems.

**Rationale:** When working with people from other disciplines and sectors (e.g., business, government, the public), population health scientists must learn to communicate their knowledge in ways that others can understand and to develop an appreciation and understanding of the language and approaches of others. Developing this mutual understanding and respect is difficult without also acquiring particular collaborative skills in fostering and maintaining relationships, group dynamics, conflict resolution, and communication. These skills are sometimes developed in disciplinary approaches to scientific training, but are rarely explicitly attended to. Yet these skills are imperative for future population health scientists to work effectively with people from other disciplines and sectors. Moreover, for population health scientists who expect to work outside of academia (which is a

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10 We intend this list as a starting point for discussion.

11 See also Canadian Academy of Health Sciences, 2005 for a similar call for training in interdisciplinary skills.
growing proportion of the population health science workforce), these interdisciplinary and team skills are often crucial. In fact, academia is chastised by non-academic employers who sometimes find new scientists unprepared to work in team environments with people from different disciplines and sectors.

**Examples of competencies:**

- Builds and maintains working relationships among people with different approaches to population health science and practice.
- Assesses when an interdisciplinary approach may be necessary or unnecessary and which other disciplines/approaches could contribute significantly to a particular research project.
- Develops research questions and selects appropriate study designs to understand a population health problem from an interdisciplinary perspective.
- Navigates and negotiates roles and responsibilities within an interdisciplinary and/or cross-sectoral team project where there are likely no clear, shared norms at the start.
- Leads and/or functions effectively within an interdisciplinary and/or cross-sectoral team.
- Demonstrates problem-solving and conflict management skills.
- Fosters group cohesion.
- Mentors trainees from one’s own and other disciplines, either one-on-one or in team mentorship.

**Knowledge translation and exchange**

**Goal:** Population health scientists should not only produce rigorous science, but they should know how to communicate that knowledge to appropriate audiences and understand a range of methods of knowledge translation and exchange that may improve population health policy and practice.¹²

**Rationale:** There is growing consensus that population health scientists should be concerned with not only producing rigorous science, but also with taking an active role in communicating that science to appropriate audiences and stakeholders. Training on the dissemination of research in various formats (e.g., clinical guidelines, policy briefs) and media training and engagement provides trainees familiarity with a “push” approach to knowledge translation in which the scientist pushes or disseminates knowledge out to users (Grimshaw et al., 2012; Lavis et al., 2003; CHSR, 1999; Lomas 2007). However, training in other forms of knowledge translation may also prove critical for population health researchers. As Lavis and colleagues (2003) suggest, effective knowledge translation may need to go beyond a unidirectional “push” approach to also incorporate “pull” and “exchange” approaches. “Pull” refers to how the users...

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¹² There is another side to this. Those who will be applying knowledge of population health science should be cognizant of the underlying limits and strengths of the evidence they are working from.
of knowledge pull information from knowledge producers, develop capacity for digesting new knowledge, and apply knowledge effectively in decision-making. An understanding of these processes helps scientists better understand when and how to disseminate their research. "Exchange" approaches refer to the development of bidirectional collaborative relationships between the producers and users of knowledge that promote the exchange of ideas over time. Exchange relationships can improve the relevance of the research produced, and the efficiency of take-up of the new research by the users of evidence. Integrating these ideas, we refer to "knowledge translation and exchange" as the domain of inquiry and skill in which new population health scientists must be trained.

While recognition of the need for this training has grown, the extent to which it should be emphasized in scientific training remains controversial. For example, the RWJF Health & Society Scholars program was designed to provide postdoctoral training in both science and knowledge translation, but the six sites responded to this latter mandate differently. This lack of consensus in the HSS program reflects ongoing debates within and across disciplines. Concerns about the idea of training in knowledge translation center around a few key issues. Some suggest that when conducting basic science rather than applied science, there is no need for training in knowledge translation. Others believe that requiring training in knowledge translation implies that all scientists should be involved in advocacy; many are concerned that when scientists are viewed as advocates, the credibility of their science is undermined. Some worry that including training in knowledge translation raises issues of opportunity cost – that trainees’ time is much better spent learning to produce good science, and/or that a mentor doesn’t have enough experience or time to help trainees with knowledge translation.

We acknowledge all of these concerns, but suggest that there are new ways of training scientists in knowledge translation and exchange that do not require scientists to conduct applied work or become advocates, and that the training does not need to be time consuming. At a basic level, training in knowledge translation can help all scientists better communicate their science to other scientists; this is particularly important in conducting interdisciplinary work. Training in knowledge translation also helps scientists better communicate their science to the media—universities and journals are increasingly encouraging scientists to discuss their research in the media, and few are prepared to do this well. We argue that new cohorts of population health scientists could receive better knowledge translation training than in the past -- improving communication of science to relevant audiences, no matter who those audiences are deemed to be.

The exact type of knowledge translation and exchange approach and depth of training that is appropriate for a given scientist, group, or project will vary. For scientists whose work has implications for practice or policy, training that moves beyond “push” approaches to knowledge translation can be useful. We argue that even if a given scientist does not want to engage him/herself in translating research to policy and practice, it is important to understand the various ways that this translation does or could happen. For researchers who want their research to be as relevant as possible for practice or policy, understanding the newest
approaches, options, and dilemmas regarding knowledge translation and exchange seems crucial. In sum, we believe all population health scientists can benefit from knowledge translation training -- how to develop knowledge translation goals and training to fit the needs of a variety of scholars requires additional attention.

Examples of competencies:

- Understands different theories of or approaches to knowledge translation and exchange.
- Communicates with practitioners, policymakers, the media, and/or other relevant audiences about the findings and population health significance of one’s research.
- Summarizes and communicates the importance of a body of research (synthesis of research in a particular area, rather than just one study) for relevant audiences.
- Understands how to engage networks, knowledge brokers, social media, and other avenues to disseminate research.
- Understands the basics of the policymaking process.
- Frames, speaks, and writes about one’s research using a variety of approaches to communicate with different audiences.
- Able to evaluate how potential end-users of one’s research (e.g., scientists, practitioners, and/or policymakers) prefer to access and use those research findings (e.g., their preferred formats and venues).
- Understands the barriers and incentives experienced by potential research users in accessing and applying population health science.
- As relevant, develops and maintains relationships with practitioners/policy makers in one’s area to enhance the efficient exchange of information over time between scientists and end users of the science.
- Able to engage policy/practice stakeholders in the design of a study to ensure the results will be useful, as appropriate.

Training Practices

The competencies discussed above can be achieved over time through a combination of mechanisms. What is most appropriate and feasible will depend on the level of training, the level and kinds of resources available to a program (e.g., funds to support research and other activities, breadth, experience and skills of faculty able and willing to participate, number of trainees that can be supported, applicant pool).

Coursework is a traditional educational tool for imparting basic knowledge and skills, and it is likely to play a role in most approaches to population health training. Through coursework, trainees can acquire basic knowledge of the concepts, methods and research that diverse disciplines contribute to understanding population health. Curricula in population health may take the form of “weak” interdisciplinary programs, in which students take courses from a menu of options that span disciplines, or “strong” interdisciplinary programs, which also include integrative courses (Augsburg and Henry 2009; Klein 2010). Integrative courses (for example,
an interdisciplinary introductory and/or capstone course) can ensure that students are exposed to a range of relevant disciplinary science and may facilitate the development of skill in analyzing and integrating across disciplinary contributions. The integration of problem-based learning approaches and case studies may be especially effective in developing such skills. Coursework can also help to build a foundation in knowledge translation and exchange, including an understanding of theories and approaches, the basics of the policymaking process, and concepts, theories, and skills relating to communication to different audiences.

Alternatives to traditional coursework include mentored study and interactive seminars. By necessity, many of the early pioneers of population health science developed interdisciplinary knowledge by studying diverse literatures on their own. Individuals who enter population health at an advanced stage of training may do the same. However, such an approach is more likely to be successful if guided and/or advised by an experienced interdisciplinary mentor who can help to expose the trainee to a broad range of relevant literatures and methods.

Interactive seminars are groups of students and at least one faculty member who meet together on a regular, sustained basis to discuss a designated topic. These seminars have much in common with coursework conducted in a small-class setting, but are less likely to follow a pre-structured curriculum. If participants in the seminar are drawn from multiple disciplines, this can be a vehicle not only for substantive learning but also for modeling and developing skills in interdisciplinary communication and integration. Moreover, seminars that include multiple faculty from various disciplines along with trainees may be a particularly rich approach to co-learning and modeling interdisciplinary discourse.

Mentored research experience is an integral part of scientific training at the graduate and postdoctoral levels and, to a lesser extent, at the undergraduate level. Involvement in research complements didactic training by allowing trainees to apply their growing knowledge and skills to real research problems. This experience hones skills in research design: for example, in the interdisciplinary context, skill in analyzing concepts and methodologies from multiple disciplines in formulating questions and approach. It also develops competence in navigating the many decision points involved in research, from fieldwork problems to questions about publication and translation. If the trainee joins (or forms) an interdisciplinary team, the experience can provide on-the-job training in interdisciplinary skills. Many faculty members are motivated to engage trainees in their own research because they provide an accessible and relatively inexpensive source of skilled labor. However, advanced trainees who are developing their own research careers often benefit more from mentoring that is not tightly tied to faculty research projects, often requiring multiple mentors or a team of mentors. As such, consideration of how to incentivize or reward faculty for such non-traditional mentoring roles needs attention.

Other forms of experience-based learning can also play an important role in preparing trainees for a successful career in interdisciplinary population health science. Through team-based activities such as organizing conferences, community-based projects, or even completing group course assignments, individuals can develop leadership and teamwork skills needed for
interdisciplinary research. Experiential learning can also play an important role in knowledge translation and exchange training. For example, some programs have trainees write op-ed columns that use science to speak to public issues or ask trainees to summarize and communicate research for a lay audience. At advanced stages of training, hands-on experience in engaging potential end-users of one’s research (e.g., scientists, practitioners, and/or policymakers) in research design or translation efforts can help trainees learn about opportunities and challenges inherent in the process of translation. The success of these activities is likely to depend on the availability of faculty mentors with the experience, skills, and networks to guide trainees towards productive experiences, or mentors/programs with the commitment to finding additional trainers or mentors to help with this aspect of training.

Trainees’ engagement with individuals with different disciplinary backgrounds is an important element of many of the mechanisms discussed above. This suggests that population health training may be best served by programs that provide for the immersion of trainees in an interdisciplinary environment. This means designing projects, seminars, and classes to include trainees from diverse disciplinary backgrounds and to require participants to manage and transcend disciplinary boundaries in problem-solving. It means providing ongoing opportunities for building scholarly networks across interdisciplinary boundaries and mentoring in interdisciplinary values and skills. This requires several kinds of resources – the ability to create small-group settings that are large enough to provide disciplinary variability13 but small enough to force cross-disciplinary exchange;14 time for sustained interactions that can produce interdisciplinary understanding and commitment; and the ability to provide an environment rich in faculty engaged in and committed interdisciplinary research. Such environments also tend to be rich in opportunities for modeling, which depends on interaction with faculty who demonstrate interdisciplinary and leadership skills as well as successful strategies for career success as an interdisciplinary scientist.

Finally, there is increasing attention to the role of mentorship in helping scholars achieve successful academic trajectories (Bland, et al. 2009; Pfund, et al. 2014), particularly in the STEM sciences. Mentorship is especially important in interdisciplinary population health training because the field encompasses such a broad range of content, disciplinary approaches, and career pathways. As a result, individual training trajectories may (and perhaps should) be highly individualized, and experienced mentorship is required to help trainees stay on course.15 Mentorship is needed in all three of the competency areas discussed above: knowledge

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13 In the RWJF Health & Society Scholars program, sites found that having six trainees in place at a given site was an optimal number, allowing for both rich interdisciplinary interaction and strong mentoring.
14 In the RWJF Health & Society Scholars program, the trainee selection process was critical to achieving these conditions. Final applicants were evaluated by a multi-disciplinary team of interviewers, and trainees were selected to create both disciplinary diversity and intellectual synergies among cohort members. Sites also tended to select applicants with interpersonal styles that lent themselves to the challenges of interdisciplinary collaboration.
15 As discussed in Section V, effective mentorship requires compensated time for faculty. The lack of compensation in NIH T32 grants represents a major challenge for training in population health science.
acquisition, interdisciplinary skills, and knowledge translation and exchange, as well as in career
challenges such as choosing disciplinary or interdisciplinary publication venues, negotiating
authorship expectations, securing academic or other positions, and promotion. Ideally,
mentors should be experienced interdisciplinary scientists who have mastered these
competencies themselves (Nash 2008). However, the relative youth of the field means that
such faculty may be in short supply. As a result, new training programs in interdisciplinary
population health science need to consider a range of methods of mentoring trainees, including
team mentoring, having team research opportunities that gather multiple mentees and
mentors in an interdisciplinary research endeavor for co-learning and training, and having
training directors who themselves are interdisciplinary or transdisciplinary and are able to
advise and support around the challenges of such work. New programs should also consider
mentor training for mentors and mentees in order to improve both mentor and mentee skills
around mentoring interdisciplinary scholars.

Institutional Contexts and Resources
For even the best designed program with carefully specified goals, a diverse and supportive
institutional context is essential for success. Population health science draws on disciplines
typically distributed across many segments of a university. Ideally, trainees need to have access
to top-notch social science, public health, and medical school departments, and often schools
of business, education, social work, and more. Access to government, public health, and clinical
settings can also benefit training by providing hands-on experience with knowledge translation
and exchange. Even at universities where all of these resources are available, however,
linkages between different campuses and schools are often weak or nonexistent. Institutional
leaders can play an important role in creating incentives for strengthening these linkages. As
shown by the experience of the RWJF HSS, population health science training programs can
often contribute dramatically to this goal, because trainees draw faculty from different schools
into common networks of research and mentoring.

Conceptualizing population health as the subject matter of interdisciplinary research rather
than a discipline in and of itself implies a need for institutions that value interdisciplinarity and
support the development of innovative programs that may not resemble traditional
departmental training programs. Some interdepartmental programs tend to rely on affiliated
and adjunct faculty, resulting in less continuity and consistency in the curriculum for students
and greater administrative burdens for program chairs. Joint appointments offer young
scholars the opportunity to do innovative work across disciplines, but may also double their
service commitments and thereby impede their progress to tenure. At the same time,
department chairs express concern that interdisciplinary programs and centers siphon away

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16 As discussed in the final section, this may create a quandary, for these resources may be present only at the
most elite schools, reducing diversity in the pipeline of population health scientists.
scarce resources, making it more difficult for departments to fulfill their missions (Handler 2013).

University leaders and external funders can play a crucial role in countering these difficulties by establishing incentives for and reducing barriers to interdisciplinary training. For many new faculty in particular, there is a lack of resources and reward at the departmental and university level for developing interdisciplinary coursework. Structural barriers, such as physical distance, departmental philosophical silos, and lack of financial incentives for team teaching make it difficult for faculty members from different departments to join forces to create integrated course material (Canadian Academy of Health Sciences, 2005). While some academic institutions are able to prioritize such interdisciplinary initiatives, often it is infusion of outside funds that is more efficient at stimulating and supporting such endeavors.¹⁷

There is also a need for a variety of incentives (both instrumental, e.g., funding, and institutional, e.g., “credit” for promotion and tenure) for faculty to offer mentoring and interdisciplinary research opportunities to undergraduate, graduate, and postdoctoral trainees interested in population health sciences. In the past, mentors in training programs have often not been reimbursed for their mentorship and training, or reimbursed little, because they directly benefited from having trainees work on their projects and publish with them. In new interdisciplinary training models, mentors may benefit less directly from their mentorship roles because mentees may work with multiple collaborators and mentors and may work less directly on the goals of one primary mentor. Increased funds for effective multi- and team mentoring models will be crucial moving forward. It needs to be recognized that taking the role of mentorship seriously in future training in interdisciplinary population health science will make new training programs more expensive.

“If you build it, they will come.” Institutions and funders must also consider incentives that draw students into population health training programs. Excellent, well-resourced programs attract strong trainees. Arguably, at the pre-doctoral level, programs that fund trainees well and attract strong faculty as mentors are able to attract good trainees. At the postdoctoral level, there are additional challenges. It is a norm in the biological sciences for recent PhDs to take postdoctoral positions, but this is not the norm in the social sciences. In the current economic climate, many of the strongest candidates for faculty jobs often take a good faculty position right away rather than extending their training in postdoctoral positions that pay very little. The RWJF human capital programs have had great success in recruiting top candidates because they have paid higher stipends. Other resources for trainees such as travel and research funds are also important. Traditional predoctoral and postdoctoral fellowships often

¹⁷ For example, the RWJF Health & Society Scholars program at the University of Wisconsin-Madison has offered annual course development grants for faculty developing new courses or course modules related to population health.
provide inadequate funding for trainees to attend multiple conferences – attendance that can be important to maintaining a presence in one’s discipline and expanding into new areas of interdisciplinary inquiry.

In the next section of this paper, we discuss the pipeline of training, highlighting considerations for undergraduate, graduate, and postdoctoral interdisciplinary training related to population health sciences. We do so with the recognition that the competencies listed earlier may not be equally appropriate at each stage of the pipeline. Applying a scaffolding model to training, one can envision introductory exposure to knowledge and skills at earlier stages, and more advanced exposure, immersion, and independence at later stages of training.
IV. The Training Pipeline

There is no single path to becoming a population health scientist. Some individuals don’t discover the concepts and approaches of population health until they are already in graduate school; increasingly, some may do so during their undergraduate years. Many eminent contributors to the field never received any formal training in population health, instead piecing together the needed expertise through their own efforts and interaction with other scientists. In this section, we discuss opportunities specifically designed for training in population health at the undergraduate, graduate, and postdoctoral levels.

We highlight these three levels as crucial stages of the interdisciplinary training pipeline in population health sciences. However, there are also opportunities to start the pipeline earlier, such as in high school programs that introduce students to complex thinking about the determinants of and solutions to health issues. Similarly, there are opportunities to train strong mid-career scholars in new ways that will facilitate interdisciplinary population health scholarship and its translation into policy and practice. Further consideration should be given to these training stages, but they are not the central focus of this paper.

In addressing programs at each level of training, we consider opportunities for population health training in the light of typical educational experience at each level: what skills entering students have, what they learn, and how they expect to use what they learn. Based on searches of available programs in population health (see Appendix 1), we then summarize population health-focused programs at that level and describe a few programs selected to represent variations among available programs. Although we preview some of the issues and challenges facing training at each level here, we defer detailed discussion of these issues, and of issues that apply across levels (e.g., diversity), to Section V.

Undergraduate Training

Undergraduate education offers students the opportunity to broaden their understanding of the world and their own interests, develop skills (e.g., critical thinking, communication, independence) that are valued on the job market (Handler 2013), and develop knowledge of one or more major subjects. Although training at this stage is not intended to produce independent scientists, there are both structural and temporal characteristics of undergraduate education that provide opportunities to build interest in and capacities for population health science.

Undergraduate education is well poised to impart substantive knowledge relevant to population health. New requirements that applicants to medical school demonstrate competence in the social, cultural, and behavioral aspects of health, as ascertained by a new section of the MCAT, provide colleges a powerful incentive for offering courses that cover the broad determinants of population health. In addition, many of the skills needed as a population health scientist are also important to success in many careers. Thus, colleges that provide students opportunities to develop skills in research design and data analysis and/or in
team building, leadership development, communication, and knowledge translation prepare students for a diversity of future paths, including population health science.

Undergraduate education also offers a unique opportunity to orient students towards interdisciplinarity. College students are expected to explore multiple disciplines, so college can be a time when students learn to think and work across them. Students interested in health may find courses reflecting the contributions of many different disciplines and this may naturally promote an interdisciplinary orientation. Interdisciplinary majors for undergraduates are growing rapidly: from 1970-2000, the total number of interdisciplinary majors at U.S. colleges and universities grew by nearly 250%, outstripping an 18% increase in college and university enrollments (Brint, et al., 2009).18

Exposure to interdisciplinary population health topics and approaches at the undergraduate level may help to motivate continued training in population health sciences at the graduate and postdoctoral levels. Even for undergraduates who do not continue along the population health pipeline, exposure to population health topics at the undergraduate level may help create a more informed public who can engage in discourse around health in productive ways and contribute to multi-sectoral approaches to improving health. Moreover, introducing basic competencies that can support later interdisciplinary work at the undergraduate level can uniquely position students to both pursue and succeed in interdisciplinary careers.

Approaches to Undergraduate Training

In a review of undergraduate programs relevant to health, Sara Shostak and colleagues at Brandeis University19 identified three types of programs of potential relevance to the undergraduate pipeline for population health science. Interdepartmental majors, undergraduate public health majors, and interdisciplinary health and society majors20 each take a different approach to organizing a program at the undergraduate level. All of the programs provide coursework on the multi-level (e.g., social, behavioral and biological) determinants of health and include faculty with a broad range of disciplinary backgrounds. Appendix 2 provides descriptions of three example programs selected to elucidate the variety of curricular and organizational features among these programs.

One of these programs, the Health: Science, Society, and Policy Program at Brandeis University, not only “help[s] students understand the biological underpinnings of health, illness and disability, as well as their social, political, legal and economic dimensions” but also introduces students to translation, evaluation, and communication. Students who major in the program

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18 This study used a very expansive definition of such programs: “We define undergraduate interdisciplinary programs as ‘degree-granting programs that draw on faculty from more than one academic department.’” (Brint et al. 2009: 160).
19 We thank Kathryn Howell for her assistance with this review.
20 The review also identified a fourth type of program, biology and society majors. We include an example of this in Appendix 2. We omit discussion of this type here because it focuses on the social and ethical dimensions of biological knowledge rather than the determinants of health.
complete a capstone project that provides experience in the integration of knowledge from different disciplines. As an interdepartmental major, this program is not located in a specific department but rather draws faculty from a variety of schools and departments.

A similar program, the Major in Medicine, Health, and Society at Vanderbilt University, is located in an interdisciplinary center. This program provides similar coverage of health determinants at the biological, behavioral and social levels. Although it may not explicitly teach interdisciplinary skills, the program’s location in an active interdisciplinary research environment provides students with exposure to these skills.

A final example, the Undergraduate Program in Public Health at the University of Colorado, is a collaboration between the Department of Social and Behavioral Sciences, College of Liberal Arts and Sciences (where the program is located) and the Colorado School of Public Health (CSPH). Substantively, the curriculum mirrors many other undergraduate programs in public health. Unlike other undergraduate majors in public health, however, all core courses are team-taught by one faculty member from each school. In addition to internship and service learning opportunities, students complete the major with a Capstone project wherein they select and analyze a health-related topic from a perspective that integrates social science and public health perspectives. While students are exposed to many different disciplines in the program, interdisciplinary skills are not explicitly taught. Neither of the latter two programs appears to include a focus on knowledge translation or exchange.

By exposing undergraduate students to multiple disciplinary contributions to understanding and improving health, all of these programs have the potential for preparing students for careers in population health science. However, as discussed later in Section V, access to these programs tends to be concentrated at elite colleges and resources constraints often limit what programs can offer. Thus, leveling the playing field for undergraduate education in population health will require strategic investment.

For those undergraduates who wish to continue on the path to becoming an interdisciplinary population health scientist, no single consensus exists on the ideal next step in training. In the next section, we discuss alternative approaches to training in population health science at the master’s and doctoral levels.

Predoctoral Training

Graduate school is arguably the educational stage requiring the most intense knowledge development. In doctoral work, the individual develops deep knowledge of a field and the research skills needed to advance knowledge in that field.21 Graduate education is also the

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21 We focus here on scientific training, and not professional training, recognizing that individuals trained in medicine, nursing, and other clinical fields may also obtain research training that enables them to become population health scientists.
stage at which most individuals form professional identities (Walker et al., 2008). As such, it is a crucial aspect of the pipeline for enticing, producing, and forming population health scholars.

A typical graduate program includes both didactic and experiential learning. Students take coursework and engage in at least one major research project. They may also participate in small seminars that encourage critical engagement with the theories and methods of one or more disciplines, or that introduce students to interdisciplinary exchange and skills.

Coursework provides the opportunity to introduce students to the fundamental principles and knowledge that support population health science as well as the spectrum of methodological approaches used in research. Graduate students can be exposed to the multi-level determinants of health and to some of the social, behavioral, biological, and clinical sciences that contribute to the field of population health. They can learn about quantitative and qualitative methods, about the process through which research can be moved into practical applications, and knowledge “exchange” between scientists and the various users of science. Although it is impossible for students to achieve in-depth training on all theoretical and methodological approaches from each discipline, they can receive exposure to many, and achieve basic knowledge in several that are most relevant to their area of study. Graduate education may also include training in a variety of professional development skills, though there is great variation in the range and quality of this training.

Research projects provide hands-on experience that may include theory development, research design, data analysis, and also the methods used to engage communities in research and translate research findings. Participation in research involving an interdisciplinary team provides opportunities for a student to observe, learn, and practice the range of interdisciplinary skills we listed above under competencies. Research projects necessarily focus the student on a particular problem, but participating in a variety of research projects involving different problems, tools, and disciplinary perspectives can lay a rich foundation for an interdisciplinary career. Some graduate programs have begun to teach interdisciplinary skills in classroom settings as well.

22 Training in knowledge translation and exchange often receives only minor emphasis in graduate training. When it is addressed, it is typically at the end of a project. This mode of training has perpetuated the lack of integration of knowledge translation and exchange ideas throughout the research process. If graduate students learn about knowledge translation and exchange hand in hand with the other research skills and knowledge they develop, it is more likely that it will always be a part of their research process considerations in the future.

23 For example, Johns Hopkins University has recently begun offering “Interdisciplinary Research Practice in Sustainability and Health”. The course, which is open to all doctoral students, provides students with the skills to build and manage interdisciplinary teams and promotes the synthesis and integration of existing sciences as they relate to environmental sustainability and public health. The course includes teaching faculty from various areas of the university and also requires that students work in interdisciplinary groups to complete a capstone research proposal.
Some future population health scientists may use their graduate training to become masters of a single discipline, whereas others may undertake interdisciplinary programs of study. Both options can contribute to the pipeline of population health scientists. In the next section, we describe graduate programs that focus explicitly on population health, some of which may be pursued alongside a disciplinary degree.

Approaches to Predoctoral Training

Our discussion of population health predoctoral programs focuses on interdisciplinary M.A.-and PhD-level graduate programs that explicitly label themselves as population health programs in some manner. In an online search, Tiffany Green and colleagues at Virginia Commonwealth University identified 25 U.S. and 1 Canadian University that offered such programs (see Appendix 1 for methodology and a complete listing of results; see Appendix 2 for three examples discussed below). The majority of program descriptions explicitly use the terms “interdisciplinary” and “population health” in program descriptions, and some use the term “transdisciplinary.” Many programs also provide similar training in population health without labeling it as such; for example, Appendix 1 also reports on a large number of NIH-supported programs that provide related training, but often focused on specific disease outcomes or population studies.

Many of the programs we identified lead to an interdisciplinary degree in population health. For example, the PhD program in Population Health at Northeastern University is a unified interdisciplinary training program that focuses on the multiple determinants of health. The focus of these programs differs depending on where the program is housed at each institution. Some programs based in medical institutions are more clinically focused; these represent an opportunity for developing the pipeline of clinician-scientists in population health. Other programs integrate population health approaches within a more traditional public health model. Still others are housed within a School of Medicine and Public Health but have faculty members with diverse disciplinary backgrounds from the social sciences, public health, and clinical sciences. While all of these programs explicitly aim to produce interdisciplinary scientists, the extent to which they emphasize interdisciplinary and transdisciplinary, as contrasted with multidisciplinary, population health education and research remains unclear.

An alternative approach to population health training at the graduate level is to offer opportunities to students enrolled in traditional disciplinary doctoral programs coursework and

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24 See Appendix 1 for a discussion of implications for errors of omission and commission.
25 Search conducted by Yonette Thomas and Christine Bachrach – see Appendix 1 for details.
26 For example, those at the School of Nursing at the University of Massachusetts and the Jefferson School of Population Health at Thomas Jefferson University (See Appendix 1 for details).
27 Examples include those housed in the Columbia University Mailman School of Public Health and the Division of Epidemiology, Department of Family Medicine and Population Health, VCU School of Medicine (See Appendix 1 for details).
28 E.g. the Department of Population Health Sciences at UW-Madison.
research opportunities that provide knowledge and skills relevant to interdisciplinary population health. These opportunities may take a variety of forms.

First, minors and certificate programs in population health provide opportunities for a disciplinary scholar to acquire basic knowledge about population health by taking courses outside of his/her field. Some minors and certificates may also provide additional interdisciplinary research opportunities. Most, but not all, minor and certificate programs in population health are housed in schools of public health. For example, Johns Hopkins University offers a Certificate in Population and Health, which allows masters, doctoral, and professional trainees the opportunity to expand their knowledge of population dynamics and its linkages with public health issues.

Second, disciplinary trainees may be able to enroll in an interdisciplinary population health training program supported by an NIH T32 or foundation funding. The strongest examples of such programs recruit scholars from a range of disciplines and provide them classroom training, mentoring, and research experiences. For example, the University of Michigan’s Interdisciplinary Research Training in Public Health and Aging, funded by an NIH T32 award, recruits students (usually at the dissertation stage) who are pursuing degrees in a variety of fields and provides funding support and additional training and mentoring in the social, behavioral and biological influences on healthy aging. In our review of programs, we found many such programs with relevance to population health, but none with an explicit population health focus. Training programs have several advantages over minors and certificate programs. They assemble a cohort of scholars who learn from each other over time, gather faculty from different disciplines, and provide opportunities for interdisciplinary research projects. They are also more likely to directly address the professional challenges of conducting interdisciplinary research, although few program descriptions explicitly mention this.

Third, some students in disciplinary doctoral programs may have the opportunity to participate in interdisciplinary research teams. If the research team is strong, this exposure may be enough to turn the disciplinary scholar into one who can conduct interdisciplinary work alone or in teams. However, such experiences are not necessarily structured to provide training in interdisciplinary skills.

A central issue facing population health training at the predoctoral level is the extent to which mastery of a discipline (as contrasted with exposure to multiple disciplines) is necessary for creating outstanding interdisciplinary scientists. This has important implications for the objectives, design, and targeted audiences of programs offered at the predoctoral level. Other issues include the extent to which programs should focus on knowledge translation and exchange, how broadly interdisciplinary they must be, and how programs can develop and sustain the commitment of faculty from diverse disciplines. These and other issues receive

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29 Examples include epidemiology, biostatistics, environmental health sciences, health behavior and health education, sociology and social work.
further attention in Section V. In the next section, we turn our attention to postdoctoral training.

Postdoctoral training
Postdoctoral training (hereafter, postdoc) is “a temporary period of mentored research and/or scholarly training for the purpose of acquiring the professional skills needed to pursue a career path” (National Postdoctoral Association, 2015). Postdoctoral training can be used to meet a variety of goals. In some cases, postdocs provide opportunities for further specialization in a field already mastered; in others, they allow a trainee to acquire new skills and methods that extend or broaden prior research; and in fields such as population health, it can provide both new knowledge and skills needed to conduct interdisciplinary science. In the postdoc, didactic coursework generally is de-emphasized and research takes center stage.

A population health postdoc may be useful regardless of whether a trainee is coming from a disciplinary or interdisciplinary predoctoral program or one that combines elements of both. Trainees with disciplinary backgrounds may have “discovered” health as an interest during their doctoral programs and chosen a health topic for their dissertation work. These trainees can use the postdoc to develop the interdisciplinary knowledge and skills needed for population health science. Other trainees may have come from interdisciplinary programs and need further time to develop interdisciplinary skills, or the depth or breadth of disciplinary knowledge and methods needed for their work.

Many population health scientists view postdoctoral fellowships as the ideal setting in which to bring skilled researchers together with researchers from other fields to train them to conduct inter- or trans-disciplinary research. By the time of the postdoc, trainees have established themselves as experienced researchers with strong research skills. Most have developed an understanding of disciplinary cultures and have the maturity and breadth of perspective that allows them to engage across fields. A period of protected time for mentored post-doctoral research and training can enable trainees to acquire or extend knowledge of population health science, develop the skills needed for interdisciplinary science, and develop knowledge and expertise in knowledge translation and exchange. The optimal duration of a postdoctoral training program depends on program goals and the skills and experience of incoming trainees. Trainees making a larger interdisciplinary stretch (e.g., from biology to social science) may need more time to complete training. In training programs that provide immersion in an interdisciplinary environment, two-three years may be ideal.

Approaches to post-doctoral training
The Robert Wood Johnson Foundation Health & Society Scholars program is currently the only postdoctoral program explicitly devoted to training in population health. In this section we review this model in detail and subsequently comment on other programs that have a somewhat narrower focus.
HSS provides two years of post-doctoral training at a number of university sites for scholars at the post-doctoral or early-career level. The program seeks to produce outstanding scientists who can contribute to understanding multiple determinants of health and their integrative effects on health as well as their implications for interventions to improve population health. Because population health training was in its infancy when the program was launched in 2001, faculty from the six chosen sites collaborated in designing the program. They developed a training model that incorporated lessons learned from existing interdisciplinary health programs and also provided flexibility for sites to experiment with different approaches. All programs included a core set of elements deemed essential for effective interdisciplinary training in population health science. Elements included:

- Immersion in an interdisciplinary environment and culture: each site has six post-doctoral trainees in residence, drawn from diverse disciplinary backgrounds. These trainees interact continuously with each other, with a set of interdisciplinary core faculty, and with faculty from departments across the university. The program explicitly fosters cross-disciplinary thinking and dialogue among individuals with different backgrounds and skill sets around problems in population health.
- An explicit expectation that scholars will move beyond their own disciplinary backgrounds, learn from other disciplines, and engage with other disciplines to conduct population health research. Trainees are provided travel allowances at levels that permit attendance at conferences in addition to their own disciplinary meetings.
- Curricula that expose scholars to multi-, inter- and transdisciplinary approaches to research on the broad range of factors that influence health, with special focus on the interactions among context, behavior and biology. At some sites, scholars participate in a structured course or seminar on population health research; at others weekly seminars provide broad exposure to this material.
- Scholar-directed research projects, usually involving both individual and team efforts, supported by seed funding and faculty mentoring.
- Intensive group-level and individual mentoring on skills needed to conduct interdisciplinary research and navigate future career challenges as an interdisciplinary scientist. Trainees work with mentors from multiple disciplines. The program provides salary support for mentoring and other faculty training activities.
- Modeling, mentoring, experience-based learning, and/or direct instruction on leadership skills and the translation of knowledge to policy and practice.
- Mechanisms that facilitate networking with other interdisciplinary population health scientists who are former or current trainees and faculty at other sites, as well as with a nationally prominent group of health leaders who serve as an advisory committee to the overall program.

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30 Columbia University; Harvard University; University of California, San Francisco/Berkeley; University of Michigan; University of Pennsylvania; and University of Wisconsin-Madison. As of 2013, budgetary reductions required that sites at the University of Michigan and the University of Pennsylvania discontinue accepting scholars.
Through these mechanisms, the program not only provides trainees with an integrated knowledge base in population health science that transcends disciplines, but also equips them to become leaders in interdisciplinary population health science. Through immersion in an interdisciplinary environment, trainees become comfortable with and skilled at team science and learn how to practice it effectively within disciplinary institutions.

The HSS program also sought to strengthen interdisciplinary cultures and the concept of population health at participating universities. To address this goal, each site was provided a pool of funds that could be used flexibly to support not only scholar research but also projects that would engage non-program faculty in interdisciplinary population health research. For example, many programs used these funds for supporting new interdisciplinary research projects or working groups on population health topics, drawing faculty, students, and postdocs from different corners of the university. Other programs used some of the funds to support the development of new population health courses or course modules in departments not traditionally tasked with population health training. Funds were also used to support cross-sectoral efforts – bringing researchers and knowledge users together to create projects that both examined and addressed population health problems.

A key element of the program’s success has been its carefully designed process for selecting scholars. Demand for the program has been high, allowing sites to recruit highly talented scientists from diverse disciplines. About half of those selected and trained by the program come from public health, epidemiology, sociology and psychology; the other half include individuals trained in anthropology, demography, public policy, economics, medicine, architecture/urban history, biological sciences, communications, ecology, education, environmental health, ethics, geography, gerontology, health behavior, health policy, health services, history, human development, marketing, human development, neuroscience, policy analysis/management, political science, physical therapy, social work and urban planning. Sites have purposively created cohorts of scholars who are diverse in terms of discipline but complementary in terms of skills and interests, thus further enriching the learning environment.

In addition to HSS, Appendix 2 profiles two programs – one in cancer health disparities and one in cardiovascular epidemiology training – that provide postdoctoral training relevant to population health. Both are funded by NIH T32 awards. The Cancer Health Disparities Training Program at the Gillings School of Global Public Health, University of North Carolina, Chapel Hill supports 1-3 fellows in a 2-3 year postdoc. Like HSS, this program emphasizes mentoring by faculty from multiple disciplines, career development, and involvement in interdisciplinary research. Training provides fellows with educational and research knowledge related to research on cancer health disparities based on a socio-ecological model of health. The program differs from HSS in that it has narrower substantive focus, draws faculty only from medical- and health-related schools and centers, and has a small cohort size. A larger cohort size might be

\[31\] Applications for the last three cohorts averaged 292 for 12 slots, an average of over 24 applicants per slot.
necessary to have the critical mass of trainees and faculty to engage together in informal and formal interdisciplinary exchange. However, the breadth of biological, behavioral and social factors considered in its approach to health disparities and its extensive relationships with health-related centers and departments at UNC make it a strong model for population health science training.

The Cardiovascular Disease Epidemiology Training Program at the Johns Hopkins University Bloomberg School of Public Health trains both pre- and postdoctoral fellows within the same program. The program provides fellows a multidisciplinary orientation and emphasizes collaborative approaches. It covers multiple aspects of cardiovascular epidemiology, including biology, behavior, treatment and prevention. The postdoc requires a year of structured coursework but otherwise emphasizes engagement in research. Mentors are drawn from faculty involved in population-based and clinical research. As at UNC, the program is focused on a specific substantive problem and draws faculty only from health/medical institutions. Nevertheless its long-standing commitment to collaborative approaches in research and interdisciplinary training have laid an important foundation for designing programs in population health.

As suggested above, our review of training opportunities with population health relevance has not been exhaustive. One key omission has been attention to “short courses” that provide exposure to population health issues and science for people at many stages of professional development. For example, the University of Michigan offers a 10-week summer course for students in health-professional degree programs that provides training in health disparities research through individual and team-based learning experiences. The University of Manchester offers a 6-week online Introduction to Population Health that covers basic concepts and approaches. Such courses cannot produce experienced population health scientists, but can form an important link in the training pipeline.

Each stage of the pipeline reviewed in this section can make an important contribution to the development of interdisciplinary population health scientists: by engaging interest and laying a foundation of basic skills in undergraduate education and by developing mastery of subject matter, research skills, and competencies in interdisciplinary teamwork and translation during pre- and postdoctoral training. The programs we have reviewed vary significantly. Some specifically target population health science, some provide similar training under another name, and some focus on related, but distinct, subjects. Programs also vary in the extent to which they explicitly address the competencies described in Section IV. For a field with a still-evolving vision, having a plethora of models to work with is a good thing. In the next section, we raise issues that are fundamental to identifying and implementing effective strategies for training moving forward.

32 This program was established in 1975.
V. Considerations and Questions

This final section highlights some of the issues that have been raised throughout the paper and key questions regarding next steps. This section is meant to stimulate discussion on day 1 of the June meeting “Training in Interdisciplinary Population Health Science: A Vision for the Future” in order to move us toward a set of feasible strategies for developing a robust future pipeline of interdisciplinary population health scientists.

Trajectories of training

What should be the role of interdisciplinary population health science training at each of the stages of the training pipeline? Are some stages of training a higher priority than others given the current stage of evolution in population health science? Is there an “ideal” trajectory of training in population health science?

A key question is how important it is to master a discipline before becoming an interdisciplinary scientist. Some argue that interdisciplinary training must begin at the graduate level; others that achieving full mastery of a discipline is a critical first step for an interdisciplinary scientist. The arguments for interdisciplinary training at the pre-doctoral level focus on the need to develop interdisciplinary skills and perspectives early on, before commitments to disciplinary practices become fully set. Students matriculating in interdisciplinary programs will be exposed to a wide variety of theoretical frameworks, content and methods that will provide them with an expansive overview of the state of population health. They may learn to ‘speak the language’ of various disciplines and even to use those approaches in their own work to contribute to new knowledge (Giacomini, 2004). They are likely to take classes from, conduct research with, and have on their committees, faculty members that utilize interdisciplinary approaches to population health. Because interdisciplinary efforts are often problem-focused, they are likely to receive training in knowledge and exchange activities and to learn to value this as an integral part of the research process. Because of these broad exposures, students with graduate-level interdisciplinary training may be advantaged in their ability to take leadership positions on interdisciplinary population health research teams after graduation (Giacomini, 2004).

The arguments for deferring interdisciplinary training until the post-doctoral level rest mainly on the belief that trainees need a prolonged period of study in a single discipline before becoming interdisciplinary. Proponents of this view believe that a solid grounding in the basic theory, knowledge, and methodological approaches of one discipline is needed in order to integrate it with other approaches. If knowledge is superficial, elements of disciplinary knowledge/methods could be inappropriately transferred, taken out of context, or compromised. Deep disciplinary knowledge also may be essential for critical analysis of the

33 Most of the programs that identified in the search for predoctoral programs, for example, included language about the legal and/or policy environments in their mission statements or program descriptions.
differences among disciplinary approaches, which in turn provides the basis for developing integrated models and/or innovative approaches. On the other hand, there is no doubt that students in disciplinary doctoral programs face potential disadvantages if they undertake interdisciplinary research. Such students are likely to have difficulty finding advisors to guide their research, face challenges in negotiating the validity of interdisciplinary framework(s), and may also have trouble finding an intellectual community among fellow students and faculty in graduate school (Golde & Gallagher, 1999).

Another concern that drives students to disciplinary doctoral programs is the job market. When the RJWF HSS program was first designed, advisors unanimously agreed that universities would have no use for interdisciplinary scholars trained in population health. This was a large part of the motivation for making HSS a post-doctoral program – trainees needed a disciplinary base to fall back on. However, many alumni of HSS have taken jobs outside their disciplinary homes and many who returned to disciplinary homes have continued at least some interdisciplinary work and still gotten tenure. Is this still a problem?

Key Considerations in Designing Programs

Essential competencies: We have proposed three sets of competencies related to knowledge acquisition, interdisciplinary collaboration skills, and knowledge translation and exchange. Are these appropriate? To what extent and how should these be addressed at different stages of training?

Principles for the delivery of training: Program design is inevitably driven by the specific goals and objectives of new training programs. Nevertheless, there may be some common principles and elements that make interdisciplinary training in population health science successful at one or more stages of training. Do we know enough yet to agree on some of these? For example, earlier in this document we stressed the value of immersion (co-locating multiple trainees together within an interdisciplinary environment to promote interdisciplinary learning and communication); mentorship (using multiple- and team-mentor models, and addressing not only research but interdisciplinary skills and career development); and addressing knowledge translation and exchange appropriate to the short- and long-term goals of the trainees. What other approaches to interdisciplinary training have proven effective and could be more widely applied? What are the best ways to develop knowledge translation goals and training to fit the needs of a variety of scholars?

Institutional contexts and resources: What kinds of institutional settings and resources are needed to make interdisciplinary population health science training successful?

- Should funding go to new training in institutions that already demonstrate capacity to draw on resources from across campus and conduct interdisciplinary science? Or should resources flow to build the capacity of institutions to do so?
• What kinds of institutional support can sustain programs outside of (or different from) traditional disciplinary departmental structures, including incentives for developing interdisciplinary population health courses and research experiences?
• What will it take to motivate and enable faculty to offer interdisciplinary research opportunities and mentoring to undergraduate, graduate, and postdoctoral trainees interested in population health sciences?
• What resource and incentives will attract a diverse pool of outstanding scholars from relevant disciplines to undertake training in population health science?

Increasing diversity and underrepresentation
Attention must be paid to maximizing diversity of the trainees in population health science training programs. Disparities in access to interdisciplinary training in health may begin at the undergraduate level. From 1975-2000, interdisciplinary majors thrived especially at “large, wealthy, arts and sciences-oriented universities on the East or West coasts” (Brint et al. 2009: 175). As such, undergraduate pipeline programs have produced and maintained inequalities in the population health science pipeline. One way to address this inequality would be to provide incentives to less advantaged undergraduate colleges and universities to offer interdisciplinary training relevant to population health science.

At the graduate level, many scholars have commented on the low participation of underrepresented groups in the fields that comprise population health, including the social sciences, STEM, and basic sciences (Darity, Sharpe & Swinton 2009; Crisp, Nora & Taggert 2009; Change et al. 2008). Recruitment into population health science training at the predoctoral and postdoctoral level should include strategies to recruit trainees from less privileged backgrounds and educational institutions. There is increasing awareness that it is not enough to recruit and provide financial support for underrepresented groups. Often the training environment also needs more resources to provide the types of mentorship, opportunity, and support that are crucial to academic success. Finding ways to recruit and support underrepresented trainees by promoting strong mentorship and mentor training is critical to achieving diversity of thought and continued progress in the field of population health. High quality training programs that support cohorts of population health trainees may be more effective in creating the necessary environment than individualized traineeships in separate institutions.

What are other critical approaches to increasing the diversity of the population health sciences pipeline?

Final Questions
What are the greatest opportunities/challenges to advancing interdisciplinary population health science training? What are the most important next steps to take?
VI. References

http://www.iom.edu/Global/Perspectives/2013/BuildingTheScience.


Darity WA, RV Sharpe, and OH Swinton. 2009. The state of blacks in higher education.  


Appendix 1. Searching Programs in Population Health Science: Methodologies and Results

In developing this analysis of training in population health science, the authors and contributors to the document conducted several independent searches for existing training opportunities. The targets for searches included programs at the undergraduate level, the predoctoral level, and the postdoctoral level, and also programs supported by three sets of funders – the National Institutes of Health, the National Science Foundation, and private foundations. This appendix summarizes the methods and results of these searches.

Undergraduate Level Programs

The undergraduate programs identified in the paper are part of a larger review of interdisciplinary undergraduate programs in health conducted by Brandeis University's HSSP program in Fall 2013. The total number of programs found and the number that would meet a definition of population health was not reported. The four programs highlighted in this section were selected to represent four categories of programs identified in the review and to elucidate differences in the curricular and organizational aspects of potential “pipeline” programs. A fifth category consisting of undergraduate pre-professional programs designed to prepare students for careers in health education, nursing, nutrition, and global health is not illustrated.

1) Interdepartmental Majors

Case study: Brandeis University, Health: Science, Society, and Policy Program

The objective of the Health, Science, Society, and Policy (HSSP) program is to “help students understand the biological underpinnings of health, illness and disability, as well as their social, political, legal and economic dimensions.” The learning goals of the program include interdisciplinary knowledge and skills. Students are expected to gain knowledge about the nature of disease and illness from a basic scientific perspective; the social and cultural contributions to health and illness; the impact of health care systems in diverse social and cultural settings, and; how public policies in health and health care are developed, implemented, and evaluated. Likewise, students are expected to learn core analytic and critical thinking skills, including the ability to synthesize information and perspectives from different disciplines, evaluate health care system organization and delivery, evaluate health issues using tools from epidemiology and basic biostatistics, conduct research on health-oriented problems, and communicate findings in both written and oral presentations.

The HSSP program offers a BA, BS, and minor, with elective requirements varying across these options. For all students, the core requirements of the program include introductory classes (one each) in biology, sociology, and health policy; introduction to epidemiology, biostatistics, and population health; a “hands-on-experience” (typically either an internship or independent research project); and, a capstone course (for majors), which uses a problem based learning model that requires that students

34 Sara Shostak, Chair of the HSSP program at Brandeis, directed this search with the assistance of Kathryn Howell.
35 All quotations are from the HSSP program website, at URL: http://www.brandeis.edu/programs/hssp/, accessed 1/2/2015.
integrate knowledge from the life sciences, social sciences, and policy analysis to address a contemporary population health problem.

Within 10 years of its inception, the HSSP program had become a “top five” major at Brandeis. Both program governance and academic advising for students are provided by a Faculty Executive Committee, which consists of professors from both the College of Arts and Sciences and the Heller School for Social Policy and Management. Likewise, the program chair is appointed from the faculty of the College of Arts and Sciences, with an associate chair appointed from the faculty of the Heller School for Social Policy and Management.

2) Undergraduate Public Health Majors

Case Study: University of Colorado - Denver, Department of Social and Behavioral Science, Undergraduate Program in Public Health

The Department of Social and Behavioral Sciences at the University of Colorado, Denver, offers both a BA and BS in public health, and a minor in public health, for undergraduate students. The program is a collaboration between the campus’ College of Liberal Arts and Sciences (CLAS) and the Colorado School of Public Health (CSPH). Interdisciplinarity is structured into the core classes of the major, each of which is “team taught with one faculty from the Downtown Campus (CLAS) and the other from the Anschutz Campus (CSPH).”

The program defines public health as “… working to protect the environment, identifying sources of illness in population groups, controlling disease outbreaks, evaluating the economic impacts of changing demographics, developing interventions to promote healthy behavior, and producing health policy legislation.” It emphasizes the “broad array of disciplines” that offer “unique insights” relevant to public health, including “the social and behavioral sciences, medicine, nursing, pharmacy, physical therapy, business, economics, statistics, epidemiology, law and biology.”

The program curriculum mirrors graduate training in public health: Required courses include introductory classes in public health, environmental health, epidemiology, environmental health, health policy, global health, and the social determinants of health. Students have a variety of options to fulfill additional requirements in statistics, the biological sciences, and other health focused electives.

3) Interdisciplinary Health and Society Majors

36 All quotations are from the undergraduate public health program website, at URL: http://www.ucdenver.edu/academics/colleges/CLAS/Departments/hbsc/Programs/Bachelors/Pages/Bachelors.aspx, accessed 1/2/2015.

37 The University of Pennsylvania’s Department of the History and Sociology of Science also offers a “health and society” (HSOC) major. The focus of the program is interdisciplinary, but primarily within the social sciences: “the program utilizes methods and courses from three core disciplines: history, anthropology, and sociology. Other disciplines and fields - including epidemiology, political science, business/economics, law, environmental studies, and bioethics - supplement the core disciplines and provide the skills necessary to grasp the forces that have shaped our contemporary health landscapes.” At URL: https://hss.sas.upenn.edu/hsoc, accessed 1/2/2015.
Case Study: Vanderbilt University, Center for Medicine Health and Society, **Major in Medicine, Health, and Society**

Vanderbilt University’s Center for Medicine, Health, and Society (CMHS) offers an undergraduate major for students who wish to “investigate…the cultural, economic, demographic and biological factors that impact health.” The curriculum is designed to train students “to meet emerging challenges in our healthcare system as well as changes in medical education.” The CMHS is dedicated to “training the next generation of national and international health leaders—from doctors and nurses to economists and policy makers.”

The major is located in the in CMHS, which describes itself as “an innovative multidisciplinary center that studies the social and societal dimensions of health and illness.” The program’s core faculty are appointed to the CMHS where “scholarship, teaching, and wide-ranging collaborative projects explore medicine and science in a wide array of cultural contexts, while at the same time fostering productive dialogue across disciplinary boundaries.” The Center’s mission is supported further by a network of faculty with joint appointments, between the CMHS and departments, and “affiliated faculty” with appointments in departments across the University.

The major in Medicine, Health, and Society offers a major (BA), a minor, and a combined BA/MA (4+1) program. Within the major, students can choose from a variety of concentrations, including global health; health behavior/health sciences; health policy and economics; race, inequality, and health; medicine, humanities, and the arts; and, critical health studies.

4) Biology and Society Majors

Case Study: **Cornell University, Department of Science & Technology Studies, Biology and Society Major**

The Biology and Society major at Cornell University is located in the Department of Science & Technology Studies (STS). The goal of the major is to “equip…students with the skills and perspectives needed to address…complex problems” that are linked to “recent remarkable gains in biological knowledge” and “involve…complex relations between biological and sociocultural forces.” Towards that end, majors “combine the study of the biological sciences with courses that explore the social and ethical dimensions of biological knowledge, providing an understanding of ethics, social science, and history as they relate to biological issues.”

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38 All quotations are from the MHS program website, at URL: [http://www.vanderbilt.edu/mhs/undergraduate/](http://www.vanderbilt.edu/mhs/undergraduate/), accessed 1/2/2015.

39 The Institute for Society and Genetics at UCLA also hosts a major in Biology and Society, which includes both BA and BS options. The broad goal of the major is to “bridge the gap between life sciences and humanities/social sciences, generating an interdisciplinary perspective needed to address many important and current questions of ethics, history, and public policy about food and nutrition, genetics research and commercialization, genetic origins and relatedness of human populations, medical privacy rights, etc.” The core classes for the major are offered through the Institute for Society and Genetics, with electives available from units across the University. At URL: [http://socgen.ucla.edu/academics/undergraduate/major-2/](http://socgen.ucla.edu/academics/undergraduate/major-2/), accessed 1/2/2015.
The major is very flexible, with multiple options for almost every requirement. Students must take classes in biology, math, ethics, and social sciences and/or humanities. There is a core course requirement that can be met with a variety of courses offered by faculty from the STS Department (i.e., “Science in Western Civilization,” “Life Sciences and Society,” “Nature and Culture”). Additionally, students, in consultation with their advisor, develop a “theme,” or area of substantive focus, within which they select (5) additional courses.

**Programs at the Predoctoral Level**

Identified programs at the predoctoral level were identified through two searches: a search of NIH T32 awards (described below) and a search conducted by Tiffany Green and colleagues at Virginia Commonwealth University.

Green and her colleagues used a Google search cross-referenced with Grad Schools (gradschools.com) to identify accredited U.S. and Canadian graduate-level programs with population health in the description. It found 25 U.S. and 1 Canadian University offering M.A.- or Ph.D.-level education that referred to population health. Like all searches, this one is characterized by errors of inclusion and exclusion. In some cases, it identified schools that used “population health” in their names but were not evidently offering degrees in population health as defined in this document. These schools, many of which offered traditional MPH degrees, are included in the table below. Further, the search necessarily omitted programs that offer population health-related training but do not use the term “population health” on their websites. For example, the search of NIH-supported graduate training programs revealed a large number of universities providing training in population research, including health in many instances. The University of California, Berkeley School of Public Health offers many offerings related to population health, but no programs specifically labelled as such. Thus, this search should be viewed as a providing a lower bound on relevant programs within the U.S. and Canada. Further, the programs identified appear to be variable in the extent to which they share our definition of population health and related competencies. The 26 programs identified by the search are summarized in Table 1.
# Search Results: Programs Explicitly Targeting Population Health at the Pre-Doctoral Level

<table>
<thead>
<tr>
<th>Name of Program</th>
<th>School</th>
<th>Degree</th>
<th>Program Description</th>
<th>Website</th>
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</thead>
<tbody>
<tr>
<td>Population Health Sciences</td>
<td>Virginia Tech</td>
<td>MPH</td>
<td>The Public Health Program in the Department of Population Health Sciences is administered by the Virginia-Maryland College of Veterinary Medicine in partnership with the Virginia Tech Carilion School of Medicine. The program is grounded in an interdisciplinary &quot;One Health&quot; approach which recognizes the dynamic interdependence of human, animal, and environmental health and encompasses the interdisciplinary efforts of medical, veterinary, environmental health, and public health professionals to protect, promote, and improve health. Students gain the requisite knowledge and skills to examine the human, animal, and environmental factors that contribute to the control and prevention of disease and the promotion, enhancement, and maintenance of health. Two concentrations are available: public health education and infectious disease and trainees may obtain simultaneous degrees with other Virginia Tech departments and programs. This is a 42-credit program requiring a two-year plan of study.</td>
<td><a href="http://mph.vetmed.vt.edu/">http://mph.vetmed.vt.edu/</a></td>
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<tr>
<td>School of Biological and Population Health Sciences</td>
<td>Oregon State University</td>
<td>MA, PHD</td>
<td>The School of Biological and Population Health Sciences comprises the fields of Exercise and Sport Science, Nutrition, and the Public Health disciplines of Biostatistics, Epidemiology, International Health, and Environmental and Occupational Health &amp; Safety. These disciplinary approaches link individual biology and behavior to population and environmental health to better understand how environmental and behavioral factors, including food and nutrition, physical activity, water, pollution, carcinogens, biohazards, etc., influence the development and progression of biological disease. Applying the quantitative methods of epidemiology and biostatistics allows better understanding of the causes of population-level disease as well as methods of intervention and prevention. NOTE: none of the graduate programs listed are explicitly identified as population health.</td>
<td><a href="http://health.oregonstate.edu/bphs">http://health.oregonstate.edu/bphs</a></td>
</tr>
<tr>
<td>Bouvé College of Health Sciences, Population Health</td>
<td>Northeastern University</td>
<td>PhD</td>
<td>This program trains students to become public health leaders through simultaneous examination of multiple determinations of health, including social, environmental, nutritional, and behavioral risk factors. Students investigate the underlying causes of adverse health, including disease, disparities, and disability, through training in core population health disciplines — biostatistics, epidemiology, and health services — together with individual-specific and specialized training in topics related to student research. Students are mentored by faculty who individually and together conduct innovative, solution-focused research in critical population health topics. Population Health doctoral students learn to conduct research that addresses five key health determinants: Social and Community Context, Environment and Neighborhoods, Health and Health Care Delivery, Education, and Economic Stability.</td>
<td><a href="http://www.northeastern.edu/bouve/health-sciences/programs/population-health-phd/">http://www.northeastern.edu/bouve/health-sciences/programs/population-health-phd/</a></td>
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<td>Name of Program</td>
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<tr>
<td>Center for Demographic Population</td>
<td>Florida State University</td>
<td>NA</td>
<td>Specialized training in Demography and Population Health is provided for masters and doctoral students from across campus in coordination with their individual academic departments. Training opportunities at CDPH include courses, research assistantships, and individual mentorship provided by affiliated faculty. Some departments may allow a doctoral level specialty in one or more of the subject areas represented by the CDPH faculty. For instance, Demography is a formal specialty area for the PhD in Sociology and a field for the PhD in Economics, and Population Health is a major component of the Sociology specialty in Health and Aging. Other academic programs may allow one or more specialty courses in Demography or Population Health to count as doctoral program electives.</td>
<td><a href="http://popcenter.fsu.edu/">http://popcenter.fsu.edu/</a></td>
</tr>
<tr>
<td>Clinical &amp; Population Health Research</td>
<td>University of Massachusetts</td>
<td>PhD</td>
<td>This transdisciplinary doctoral research training program is focused on epidemiology, biostatistics, and health services research geared toward translating research into effective disease prevention programs, clinical practice and policy. The program recruits a pool of pre-doctoral trainees that is diverse with respect to socio-demographic characteristics, clinical background, and disciplinary perspective. It provides trainees with individual mentoring, academic training, and technical skills necessary to ensure their success as independent investigators as well as contributors to team science. It also provides “hands on” research experience that builds on the strengths of the current environment of linkages between UMMS Departments, Centers, and Institutes. Program highlights include careful mentor matching, individualized career development planning, opportunities for students to be directly involved in research, and rigorous academic training in theory, ethics, epidemiologic methods, biostatistics, health services research, outcome measurement, and behavioral science.</td>
<td><a href="http://www.umassmed.edu/cphr/">http://www.umassmed.edu/cphr/</a></td>
</tr>
<tr>
<td>Community and Population Health</td>
<td>University of New England</td>
<td>MPH</td>
<td>The School of Community and Population Health is dedicated to advancing public health knowledge and practice in rural and global communities through innovative education, training, research, capacity building and service. The school offers a standard public health curriculum as well as an online master’s degree program in Public Health.</td>
<td><a href="http://www.une.edu/wchp/scph">http://www.une.edu/wchp/scph</a></td>
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<tr>
<td>Name of Program</td>
<td>School</td>
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<tr>
<td>Department of Global Health and Population</td>
<td>Harvard University</td>
<td>ScD, MS, MPH</td>
<td>The Department of Global Health and Population (GHP) seeks to improve global health through education, research, and service from a population-based perspective. The department’s approach to these problems combines the analysis of population and health using quantitative and qualitative methods, the investigation of policies that affect health, and a concern with the politics and ethics of health and development. Departmental research span a wide spectrum of topics, including social and economic development, health policy, and demography; design and financing of health care systems; women's and children's health; global nutritional epidemiology and practice; prevention and control of infectious and chronic diseases; program evaluation; and humanitarian assistance and ethics. The program draws on a range of disciplinary perspectives and provides students with advanced competencies covering conceptual approaches, theory and applications, problem solving and analysis, as well as a wide range of quantitative and qualitative methods. Doctoral students must select one of the three majors currently offered by the Department, Population and Reproductive Health, Health Systems, or Economics.</td>
<td><a href="http://www.hsph.harvard.edu/global-health-and-population/">http://www.hsph.harvard.edu/global-health-and-population/</a></td>
</tr>
<tr>
<td>Department of Population Health</td>
<td>NYU Langone School of Medicine</td>
<td>MS, MPH, PhD</td>
<td>The Department of Population Health focuses on research to improve human health at the population level, promoting proactive approaches to disease prevention and management at the community, health system and policy levels. By bridging diverse yet related disciplines and methodologies, the department advances discovery, translation and dissemination of health-related interventions. Faculty include investigators in epidemiology, biostatistics, and related fields of methodologic research; and medical ethicists. Degree programs include Comparative Effectiveness Research Certification Program, Master's of Bioethics, Global Master's of Public Health, Master of Science in Clinical Investigation, and PhD programs in Biostatistics and Epidemiology.</td>
<td><a href="http://pophealth.med.nyu.edu/">http://pophealth.med.nyu.edu/</a></td>
</tr>
<tr>
<td>Epidemiology &amp; Population Health</td>
<td>University of Louisville</td>
<td>MS, PhD</td>
<td>The Department of Epidemiology and Population Health seeks to identify the determinants of health, disease, disability and death in populations for the purposes of promotion, control and prevention. The Department offers an MPH concentration and MS and PhD degrees in Epidemiology. The department is also planning a PhD concentration in Outcomes Research.</td>
<td><a href="http://louisville.edu/sphis/departments/epidemiology-population-health">http://louisville.edu/sphis/departments/epidemiology-population-health</a></td>
</tr>
<tr>
<td>Name of Program</td>
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<tr>
<td>Family Medicine and Population Health</td>
<td>Virginia Commonwealth University</td>
<td>PhD, MPH</td>
<td>The Division of Epidemiology in the Department of Family Medicine and Population Health offers a Master’s of Public Health degree and a PhD in epidemiology. Close ties to the Virginia Department of Health allow us to provide opportunities for our students to immerse in experiential learning with our public health partners. The doctoral training program in epidemiology cultivates public health scientists equipped to use state-of-the-art research methods for the purpose of advancing fundamental knowledge of issues central to the improvement of population health. Faculty research is aimed at understanding the interface between behavior and physiology to integrate social, psychological and biological approaches to understanding health and illness over the life course. Division faculty research programs are in aging, cancer prevention and control, mental health, and maternal and child health.</td>
<td><a href="http://www.epidemiology.vcu.edu/">http://www.epidemiology.vcu.edu/</a></td>
</tr>
<tr>
<td>Health Education &amp; Behavioral Science</td>
<td>Rutgers</td>
<td>MPH, DrPH, PhD</td>
<td>The curriculum is designed to prepare the MPH Student to participate in the formulation of policy; assess and define health and educational needs of target populations through diagnostic and consultation skills; develop and successfully implement theory based health programs; design and conduct program evaluations; and design and conduct research. Students are prepared with skills to plan, implement and evaluate health promotion and intervention programs in settings that range from hospitals to industries, schools and communities. The doctoral programs are based on the scientist-practitioner model, and provide balanced training in behavioral science and health education research and practice. While both the DrPH and PhD programs have a series of required courses, each curriculum has flexibility to customize particular research and/or practice skills that are determined in close consultation with the academic advisor.</td>
<td><a href="http://sph.rutgers.edu/departments/health_education/index.html">http://sph.rutgers.edu/departments/health_education/index.html</a></td>
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<tr>
<td>Jefferson School of Population Health</td>
<td>Thomas Jefferson</td>
<td>MPH, PhD</td>
<td>Provides graduate academic programming in population health, public health, health policy, healthcare quality and safety, and health outcomes research. Educational offerings are enhanced by research, publications and continuing education and professional development offerings in these areas. Training at the masters level emphasizes competencies in five key public health areas – behavioral and social sciences, biostatistics, environmental health sciences, epidemiology and health policy, advocacy and management. The interdisciplinary curriculum stresses leadership skills, systems thinking, health communication, global health and cultural humility and competency. PhD students specialize in one of four areas: health policy, healthcare quality and safety, applied health economics/outcomes research and behavioral/health sciences.</td>
<td><a href="http://www.jefferson.edu/university/population_health.html">http://www.jefferson.edu/university/population_health.html</a></td>
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<td>Name of Program</td>
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<td>Program Description</td>
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<tr>
<td>Master of Population Health</td>
<td>Washington University</td>
<td>MS</td>
<td>The MPHS program prepares students for distinguished clinical research careers by accelerating and deepening their expertise in population health and clinical outcomes research. Students gain a strong foundation and hands-on experience in leading, designing, conducting and moving clinical research findings to applications that will improve patient care and treatment. Students also establish a broad network of mentors and collaborators by interacting with Washington University medical and public health faculty. The Master of Population Health Sciences program's courses are designed to ensure that students substantially advance their research methods competency and boost their research productivity through applied coursework rather than a thesis or capstone requirement.</td>
<td><a href="http://www.mphs.wustl.edu/">http://www.mphs.wustl.edu/</a></td>
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<tr>
<td>Various departments</td>
<td>Columbia University Mailman School of Public Health</td>
<td>MPH, MS, PhD, DrPH</td>
<td>Four academic departments at the Mailman School (biostatistics, epidemiology, environmental health sciences, and sociomedical sciences) offer both PhD and DrPH degree programs. In Epidemiology, students gain advanced knowledge and skills in epidemiologic methods. Building on foundational strengths in the biologic and social determinants of population health, the degrees focus on innovative, interdisciplinary research with a broad “cells-to-society” approach. Population and Family Health offers students the skills, knowledge and vision to take on leadership roles in the fields of global health and humanitarian response in an innovative DrPH in Leadership in Global Health and Humanitarian Systems. The degree program combines formal classes, and field-based research, and the opportunity for remote and work-based learning. Sociomedical Sciences students complete rigorous coursework in theories, methods, and topics relevant to social and behavioral sciences approach to public health. PhD students also work closely with, and take classes from, faculty in the Graduate School of the Arts and Sciences (in Anthropology, History, Sociology or Psychology).</td>
<td><a href="http://www.mailman.columbia.edu/academics/degree-offerings/phd-and-drph-programs">http://www.mailman.columbia.edu/academics/degree-offerings/phd-and-drph-programs</a></td>
</tr>
<tr>
<td>Population and Health</td>
<td>Johns Hopkins Bloomberg School of Public Health</td>
<td>Certificate</td>
<td>The certificate is designed to serve two audiences—masters or doctoral degree students at The Johns Hopkins University and professionals—desiring to expand their knowledge of population dynamics and its linkages with public health issues and their ability to relate population-level concepts and measures of fertility, morbidity and mortality, and migration to health conditions. Students completing the certificate gain competency in knowledge of the components and measures of population dynamics, knowledge of population dynamics' linkages with public health issues, and the ability to relate vital events and duration exposures with risk factors at the individual and population level. Note: also within the School of Public Health, the Department of Health, Behavior &amp; Society also offers degree programs, include a MHS in Social Factors in Health.</td>
<td><a href="http://www.jhsph.edu/academics/certificates-for-hopkins-and-non-degree-students/population-and-health.html">http://www.jhsph.edu/academics/certificates-for-hopkins-and-non-degree-students/population-and-health.html</a></td>
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<tr>
<td>Population Health</td>
<td>University of Ottawa</td>
<td>PhD</td>
<td>The transdisciplinary doctoral program in population health is closely linked to the University's Institute of Population Health, which brings together ten faculties within the University. The program is modeled around a framework which encompasses population health issues, determinants and causes of illness, design of multi-component interventions, health care delivery systems, and health policy. The program draws basic and applied disciplines and brings together the insights of social, biological, clinical, organizational, and political sciences; and the strengths of quantitative and qualitative methods. Its transdisciplinary approach recognizes the inherent complexity of many health problems and seeks to assemble and mobilize all pertinent scientific and scholarly disciplines. Students are encouraged to apply the science of their individual background disciplines to issues of population health. They acquire a broad knowledge of population health through courses and the comprehensive examination, and pursue in-depth study in an area of specialization (health determinants, global and local health inequities, health interventions and policies, or health risk and resilience).</td>
<td><a href="http://www.grad.uottawa.ca/Default.aspx?tabid=1727&amp;page=SubjectDetails&amp;Kind=H&amp;SubjectId=97">http://www.grad.uottawa.ca/Default.aspx?tabid=1727&amp;page=SubjectDetails&amp;Kind=H&amp;SubjectId=97</a></td>
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<td>Population Health</td>
<td>UMASS Lowell</td>
<td>MPH</td>
<td>The goal of the Population Health specialization is to educate practitioners who have a broad foundation of the fundamental principles of public health with a focus on program planning and evaluation. Targeted competencies include: find, understand, and apply relevant public health literature; design and implement programs that improve public health by fostering change in individual behaviors, environmental conditions, and social policy; evaluate public health programs through data collection and analysis; and engage individuals and communities in discussion and decision-making to clarify shared public health goals. The program includes a practicum that provides students with applied experience in health promotion and disease prevention. The school also offers other relevant degree programs, including Global Environmental Sustainability and Health, Epidemiology, and Nutrition.</td>
<td><a href="http://www.uml.edu/Health-Sciences/Public-Health/Programs-of-Study/masters/Focus-areas.aspx">http://www.uml.edu/Health-Sciences/Public-Health/Programs-of-Study/masters/Focus-areas.aspx</a></td>
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<tr>
<td>Population Health &amp; Clinical</td>
<td>Stony Brook SUNY</td>
<td>PhD</td>
<td>This small and highly specialized graduate degree program seeks to train population health and clinical outcomes researchers, academicians, and practitioners. Working under faculty mentor guidance, students conduct research on substantive current health care problems affecting population health, health policy, clinical practice, and patient-based health care decisions. Competency goals include: identification of the determinants of health and factors associated with disease prevention; assessment the health care needs of populations as related to their environment; understanding the context for population health and clinical science research questions, as well as the organization, politics, and financing of the health care system; appraisal of the performance of the health system in terms of access to care, safety, quality of care, resource consumption, cost-effectiveness, and accountability; conduct of independent studies of the health care system using state of the art research methods.</td>
<td><a href="http://www.stonybrook.edu/sb/phcor/index.html">http://www.stonybrook.edu/sb/phcor/index.html</a></td>
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<td>Name of Program</td>
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<td>Program in Nursing</td>
<td>University of Massachusetts Boston</td>
<td>PhD</td>
<td>The PhD Program in Nursing offers concentrations population health and health policy. It prepares graduates as nurse leaders in addressing critical population health problems/conditions, and for leadership roles as policy analysts, researchers and educators. The program focuses on the intersection of nursing, population health, and health policy. Graduates are prepared to: analyze the historical, sociological, economic, political and nursing perspectives of population health problems and existing proposed health policies, evaluate and critique health policies that influence the access, quality, and cost of healthcare services, conduct theory-guided qualitative, quantitative, and mixed methods research that advances knowledge of population health problems and health policies, and influence the development of innovative solutions to population health problems and health policies at local, state, national and international levels.</td>
<td><a href="http://www.umb.edu/academics/cnhs/nursing/grad/nursing_phd">http://www.umb.edu/academics/cnhs/nursing/grad/nursing_phd</a></td>
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<tr>
<td>Name of Program</td>
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<td>Population Health &amp; Disease Prevention</td>
<td>UC Irvine Program in Public Health</td>
<td>MPH, PhD</td>
<td>The MPH program educates students in the global dimensions of public health principles and prepares them to lead and work collaboratively on the assessment of health-risk factors and the management of prevention strategies. Students may concentrate in one of three emphasis areas: environmental health, epidemiology, or sociocultural diversity and health. The Ph.D in Public Health offers two concentrations, global health and disease prevention. It is not clear whether the Department of Population Health &amp; Disease Prevention offers any graduate degrees.</td>
<td><a href="http://publichealth.uci.edu/ph_docs/dphdp_message">http://publichealth.uci.edu/ph_docs/dphdp_message</a></td>
</tr>
<tr>
<td>Public Health</td>
<td>The University of Vermont</td>
<td>MPH</td>
<td>This program leads to a Generalist MPH degree focused on excellence in Environmental Public Health; Quantitative Public Health Sciences; and Health Policy, Leadership, and Advocacy. The program provides a strong foundation in population health sciences by teaching students to: evaluate and improve the health of various populations, work with a network of professionals in healthcare, government agencies, and non-profit organizations, navigate the levels of community resources, identify changes to healthcare systems and requirements for accountability, and implement new models for population-based medical practice.</td>
<td><a href="http://learn.uvm.edu/programs/public-health-programs/online-master-of-public-health/">http://learn.uvm.edu/programs/public-health-programs/online-master-of-public-health/</a></td>
</tr>
<tr>
<td>Public Health Genetics</td>
<td>University of Washington</td>
<td>MPH, PhD, JD/MPH, certif</td>
<td>All IPHG degree programs emphasize an interdisciplinary approach to using genomic advances to improve population health. The PhD program provides training in the core knowledge areas of public health genetics (genetic &amp; molecular epidemiology; ecogenetics &amp; Pharmacogenomics; clinical aspects of genomics; ethics &amp; social science; law &amp; policy; health economics &amp; outcomes research) so that graduates can address scientific and policy questions from a variety of perspectives. The MPH degree develops competencies in genetic epidemiology, pharmacogenetics, and toxicogenomics, within the broader context of law, ethics, culture, and policy. The degree requires coursework in epidemiology, biostatistics, genetic epidemiology, health services, environmental health, law, and bioethics.</td>
<td><a href="https://depts.washington.edu/phgen/">https://depts.washington.edu/phgen/</a></td>
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<tr>
<td>The Master of Public Health (MPH) Program</td>
<td>University of Maryland</td>
<td>MPH</td>
<td>This program offers three concentrations: Epidemiology, Community &amp; Population Health and Global Health.</td>
<td><a href="http://medschool.umaryland.edu/epidemiology/mph/">http://medschool.umaryland.edu/epidemiology/mph/</a></td>
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</tbody>
</table>
Programs at the Postdoctoral Level

To our knowledge, there is no national registry of postdoctoral training programs. We therefore searched on the basis of funding organizations: NSF, NIH, and Foundations. We found no relevant programs at NSF. Results for NIH and Foundations are summarized in the next two sections.

NIH-Supported Pre- and Post-Doctoral Training Programs

Because health-related training is often supported through the NIH, we surveyed current NIH training activities within the broad domain of population health. We conducted a NIH RePORTER search of all current T32 grants using the terms “population” and “epidemiology”. We also looked at information on the limited number of institutional K awards and determined that none related to population health. We limited the search to institutional awards because of the need for a critical mass of trainees in interdisciplinary training. We surveyed grants supporting pre-doctoral, post-doctoral and both levels of training, although our focus is on those providing post-doctoral training.

Although 479 T32 grants were identified through the RePORTER search, the vast majority of these did not fit the definition of population health. We included grants as meeting the definition if (1) a substantial goal of training was acquiring and/or learning to produce knowledge of the determinants of health within and across populations and (2) the program either explicitly or implicitly acknowledged a multi-level conception of health determinants ranging from the biological to the social/environmental. Programs focused entirely on health services research were not classified as population health. Only 70 of the grants met our criteria.

Our analysis of the 70 grants suggested three broad categories: (1) training programs related to specific diseases or conditions; (2) training programs in demography and aging; and (3) other training programs with a population focus. We subdivided the programs in the first category, further classifying them into groups that offer different contrasts to training in interdisciplinary population health science. Table 2 shows the number of grants in each of the categories and subcategories, along with two representative examples of the programs in each category. By necessity, our classification of grants was based on information in the abstract. The brief descriptions of example grants in the table are also adapted from the abstracts.

Not surprisingly, the largest number of programs (45) fall into the category of training related to specific diseases or conditions. Included in this number are 16 grants for which the focus on population health is unclear – for example, because a program made reference to population concerns but did not appear to address them or provided too little information to determine the range of science deemed relevant to health.

Eighteen of the disease- or condition-focused programs provide training specifically in epidemiology or address population level issues primarily through epidemiology (and in some cases also community-based research or intervention). While many of these programs offer exposure to multiple disciplines, the range of disciplines typically clusters within the basic biological, clinical and public health sciences. Integration of social science is rare even though all of the programs recognize “social” or “psychosocial” exposures that create risk. In the majority of programs, training is specifically in epidemiology. Some of these programs provide exposure to other disciplines, but trainees are nevertheless socialized to the culture, priorities, and methods of one – epidemiology.

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40 This search was conducted in August, 2014 by Christine Bachrach and Yonette Thomas. Also, we examined previous NIH initiatives that have targeted interdisciplinary training. Two Common Fund RFAs (RFA-RM-05-010 and RFA-RM-04-010) funded 8 programs in 2004 and 2005. Only one of these addressed a population health issue (obesity) but this program is no longer funded.

41 Full results from the search are available upon request, as is a complete list, with descriptions, of the 70 grants that fell within our criteria.
Only three of these programs mention training in interdisciplinary skills as a goal in their abstracts, and of these only one specifies mechanisms for providing such training.\(^{42}\)

The remaining eleven disease- or condition-focused grants provided training in population health but did not focus primarily on epidemiology. These also differed from an ideal model of training in interdisciplinary population health science. As discussed earlier, the integration of basic social sciences to address the mechanisms that produce or modify social conditions is a crucial element of population health science. Therefore, an ideal training program addresses the contributions to health of not only the biological and behavioral sciences but also the basic social sciences. While all of these training programs clearly articulate a “cells-to-society” vision of the determinants of health, only two report involving basic social science disciplines in their training programs. For one of these, there is insufficient information to judge whether the program represents social determinants of health as “exposures” that put individuals at risk of adverse health outcomes, rather than conditions or processes to be studied in their own right. The other provides pre-doctoral training only and engages social science only in relation to policy and health services research.

Among all of the 45 programs providing training related to specific diseases or conditions, nine mentioned providing training in interdisciplinary skills as a goal in the abstract or indicated practices (such as assigning multiple mentors from different disciplines) that help to promote such training. Only two of these programs (T32DA037183 and T32HL120823) indicated multiple strategies for training in interdisciplinary skills. Thus, for most programs, inter-disciplinary training appears to expose trainees to problem-specific knowledge generated by different disciplines, but does not develop the skills necessary to conduct interdisciplinary science.

**Training programs in demography and aging.** We found 18 grants that include some focus on population health in the context of training in demography and the economics and/or demography of aging supported by NICHD and NIA. These programs include training in the social sciences (largely sociology and economics) but capture a narrow disciplinary range. Public health was represented in some of these grants, but in only one case are basic biological or clinical sciences represented. For most programs, health is one aspect of the program’s focus on population (other aspects include, e.g., aging, migration, fertility, family demography, social inequality). None of these programs emphasize training in interdisciplinary skills, and most are oriented largely to pre-doctoral training. Those that do enroll post-doctoral fellows lack the critical mass needed for interdisciplinary training and typically have fellows work with a single mentor, often from their primary discipline.

**Other programs with a population focus.** In this category we include training programs that emphasize health disparities and those that focus on environmental health, gene-environment interactions, or global health. We found 7 programs across these categories. These programs also differ from the model proposed here for interdisciplinary population health science training. We found no indication of the involvement of multiple disciplines within the health disparities programs’ abstracts; two of the three were targeted to clinical scientists and did not include basic science training. The environmental programs were grounded in epidemiology, conceptualized environment as “exposures,” and lacked any involvement of the social sciences.

\(^{42}\) As discussed later, very few abstracts mentioned interdisciplinary skills training. Given the limited information available in abstracts, it was impossible to rule out that such training may occur. However, it seems reasonable to assume that if such training was a significant goal of a program, the abstract would mention it.
<table>
<thead>
<tr>
<th>Category</th>
<th># grants</th>
<th>Example 1</th>
<th>Example 2</th>
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<tbody>
<tr>
<td>Training programs related to specific diseases or conditions</td>
<td></td>
<td>IMPROVING MENTAL HEALTH CARE IN SAFETY NET MEDICAL SETTINGS; T32MH08270 (post)</td>
<td>TRAINING IN SEXUALLY TRANSMITTED DISEASES AND HIV; T32AI007001 (pre and post)</td>
</tr>
<tr>
<td>Unclear relationship to population health</td>
<td>16</td>
<td>The program aims to increase the number of early career investigators trained in mental health and addictions services research with a safety net medical setting focus, using an interdisciplinary approach embedded in an academic-public sector partnership. It draws faculty from the Departments of Psychiatry and Medicine in the School of Medicine, and from the Schools of Social Work, Nursing, and Public Health.</td>
<td>The program trains scientists from a variety of fields to conduct outstanding STD/HIV research. Other goals include the development of the skills necessary to conduct productive interdisciplinary research and facilitating professional growth and development to ensure academic and research success. The program engages faculty members from four departments (Microbiology &amp; Immunology; Infectious Diseases; Epidemiology; and Health Behavior/Health Education).</td>
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<tr>
<td>Training programs in epidemiology</td>
<td>18</td>
<td>DIGESTIVE DISEASE EPIDEMIOLOGY TRAINING PROGRAM; T32DK007634 (Pre and Post)</td>
<td>EPIDEMIOLOGY OF SUBSTANCE USE DISORDERS TRAINING PROGRAM; T32DA031099 (Pre and Post)</td>
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<td>The goal of this program is to train independent researchers who will improve our understanding of the magnitude, etiology and impact of digestive diseases. The program includes: 1) formal advanced training in epidemiologic methods and biostatistics; 2) a 2 - 3 year period of training culminating in an MPH, MSCR or PhD in epidemiology; 3) concurrent training of MD and PhD candidates in a program that ranges from molecular epidemiology to population-based health outcomes research. A stable, diverse, and multidisciplinary faculty provides trainees expert guidance in epidemiology, biostatistics, and health outcomes research.</td>
<td>This program provides specialized training for careers in substance abuse epidemiology. The program takes a cells-to-society perspective on substance abuse epidemiology, and offers training at multiple levels of causation, ranging from the molecular to large-scale social forces. Training provides fellows with broad yet intensive training in substance abuse epidemiology and related areas, depth in an area of specialization; and a set of methodological and conceptual skills.</td>
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Training programs without a central epidemiology focus

CANCER HEALTH DISPARITIES TRAINING PROGRAM; T32CA128582 (post)

The Program addresses health disparity issues in cancer from etiology and primary prevention to survivorship. Topics include genetic and molecular epidemiological bases of disparities; cancer epidemiology; research methods; cancer prevention and control (screening/early detection, health promotion, health communications, community-based participatory research, dissemination, policy); disparities related to access to care, socioeconomic status, culture, and survivorship; and critical thinking and synthesis.

Training is offered by four participating departments: Nutrition, Epidemiology, Health Behavior and Health Education, and Environmental Sciences and Engineering.

RESEARCH TRAINING PROGRAM IN SUBSTANCE ABUSE PREVENTION; T32DA019426 (Post)

This training program: 1) understands substance use/abuse and related behaviors within an ecological framework that emphasizes relevant developmental, neurobiological, environmental, and cultural contexts, such as families, schools, worksites, neighborhoods, and communities; 2) emphasizes that knowledge development and application progresses through specific phases (pre-intervention, intervention, and diffusion or going-to-scale); 3) teaches rigorous research methodologies including mixed methods designs; 4) emphasizes interdisciplinary and transdisciplinary research and the translation of research into real-world contexts that impact prevention practice and policy.

Training grants in demography and aging

TRAINING IN THE DEMOGRAPHY AND ECONOMICS OF AGING; T32AG000221 (pre and post)

In the predoctoral program students combine disciplinary training in sociology, economics, or public health specific doctoral requirements of their disciplines with specialized training in demography. Postdoctoral training is coordinated with a faculty mentor and includes course work, seminars, and collaborative or independent research. A major focus of the program is socioeconomic, racial, and ethnic disparities in health.

DEMOGRAPHY; T32HD007163 (pre and post)

This program provides interdisciplinary instruction with a firm base in the social sciences and strong training in the technical aspects of demographic and statistical methods for careers in demographic research and teaching. The program has five signature themes: (1) health and wellbeing, (2) migration and development, (3) children and families, (4) social inequality, and (5) data/methods.
Other training programs with a population focus

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<tr>
<th>Program</th>
<th>Description</th>
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<tr>
<td>TRANSDISCIPLINARY TRAINING IN HEALTH DISPARITIES SCIENCE (TTHDS); T32NR012718 (post?)</td>
<td>This program prepares nurse scientists to leverage the culture of the groups, communities, and organizations with whom they work to understand and describe disparate health outcomes, intervene to improve health outcomes, and translate and disseminate scientific findings for widespread impact.</td>
</tr>
<tr>
<td>TRANSLATIONAL RESEARCH TRAINING PROGRAM IN ENVIRONMENTAL HEALTH SCIENCES; T32ES019851 (pre and post)</td>
<td>This program is housed at the Center of Excellence in Environmental Toxicology (CEET) which is a P30 Environmental Health Sciences Core Center funded by NIEHS. The CEET is a Translational Environmental Health Sciences Center with a focus on major societal disease that affects the Philadelphia area: including but not limited to lung and airway disease, and reproductive, endocrinology, and developmental disorders (including the developmental basis of adult disease). Additionally, there is a strong emphasis on disease mechanism involving oxidative stress and gene-environment interactions. Trainees will be equipped to deal with environmental exposures, how they relate to disease and how their findings may be translated at the patient-, community- and public health- levels.</td>
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Definitions:

*Population health*: Does the goal of training include scientific knowledge of the determinants of population health (defined as health of and across populations and including a cells to society frame)?

*Training in epidemiology*: programs in which the training is specifically in epidemiology or population level analysis is brought in entirely through epidemiology.

*Unclear*: for example, because a program made reference to population concerns but did not appear to address them or provided too little information to determine the range of science deemed relevant to health.
Foundation-Supported Programs

Information on foundation support for training in population health was developed through a multi-pronged strategy. First, with the assistance of development staff at the New York Academy of Medicine, a list of foundations with potential interest in supporting activities in population health science was developed. Using expert informants, this list was narrowed to a subset of thirteen foundations most likely to have relevant interests. We then conducted a search of foundation websites using search terms such as “fellows”, “scholars”, post-doctoral, and training; and examined foundation priorities posted on the Web and information on grants awarded where available. Other searches included http://foundationcenter.org/, and http://www.pathwaystoscience.org/index.aspx. We also conducted interview with an individual supported by one of the Kaiser Permanente programs and with a staff member at the Robert Wood Johnson Foundation. We found that the Robert Wood Johnson Foundation and Kaiser Permanente are currently active in providing training programs in population health science. While other foundations have supported programs with relevance to population health, these tend to focus on leadership training for policy and/or community action. The program descriptions below are organized by foundation.

The Robert Wood Johnson Foundation (RWJF) currently supports 29 human capital programs, of which nine bear on population health concerns in some way. Of the nine, RWJF Health & Society Scholars (HSS) is the only one explicitly devoted to training in population health science. RWJF will end HSS and five of the other relevant programs listed below (denoted by *) during the period 2015-2018.

- **RWJF Health & Society Scholars** (http://www.healthandsocietysscholars.org/) is intended to produce leaders who will change the questions asked, the methods employed to analyze problems, and the range of solutions to reduce population health disparities and improve the health of all Americans. It trains scholars to investigate the connections among biological, genetic, behavioral, environmental, economic and social determinants of health and to develop, evaluate and disseminate knowledge, interventions, and policies that integrate and act on these determinants to improve health.

- **New Connections: Increasing Diversity of RWJF Programming** (www.rwjf-newconnections.org/), which uses grantmaking, career development and mentoring of early and midcareer scholars to increase participation from historically underrepresented groups in all areas of RWJF programming.

- **RWJF Center for Health Policy at Meharry Medical College** (http://www.mmc.edu/about/rwjf/), which supports training in health policy for doctoral students in economics, political science or sociology at Vanderbilt University and medical, dentistry and other graduate students at Meharry Medical College. The program also offers other professional development and externship opportunities.

- **RWJF at the University of Center for Health Policy New Mexico** (http://healthpolicy.unm.edu/about), which trains scholars in health services and health policy research through on-the-job research, policy analysis training, leadership development and community capacity building. The program invests in five disciplinary areas: economics, political science, public health, sociology, and nursing.

43 We thank Caryn Teitelbaum, Gerard Lebeda and Jo Boufford for helping with this search.
*RWJF Clinical Scholars* ([http://rwjcsp.unc.edu/about/overview/](http://rwjcsp.unc.edu/about/overview/)), which offers physicians master’s degree graduate-level study and research in a university-based, 2-year post-residency training program for physicians. The program integrates scholars’ clinical expertise with training in program development and research methods to help them find solutions for the challenges posed by the U.S. health care system and the health of U.S. communities.

**RWJF Community Health Leaders** ([http://www.rwjf.org/content/dam/farm/reports/program_results_reports/2013/rwjf69522](http://www.rwjf.org/content/dam/farm/reports/program_results_reports/2013/rwjf69522)), which makes awards to honor individuals working in communities across the country to improve health and access to care for underserved and often disenfranchised populations.

**RWJF Health Policy Fellows** ([http://www.healthpolicyfellows.org/home.php](http://www.healthpolicyfellows.org/home.php)), which provides mid-career health professionals and behavioral and social scientists the opportunity to participate for one or more years in policy processes at the federal level and gain hands-on policy experience.

*RWJF Investigator Awards in Health Policy Research* ([http://www.investigatorawards.org/](http://www.investigatorawards.org/)), which provides research funding for studies of challenging health, health care and health policy issues on topics such as prevention, health disparities, health care & public health policy, medical workforce, quality of care, and patient-provider relationships.

*RWJF Scholars in Health Policy Research* ([http://healthpolicyscholars.org/](http://healthpolicyscholars.org/), which provides two-year site-based training in health and health policy for economists, sociologists and political scientists. Scholars are expected to pursue careers within their disciplines, making important research contributions to future health policy in the United States.

Four new programs are currently under development by RWJF (RWJF, 2015). The new programs will emphasize leadership training and greatly increase the number of trainees enrolled compared to prior programs. One of these programs has a research focus: the RWJF Interdisciplinary Research Leaders will “support a network of researchers whose leadership and whose community-relevant, policy-relevant, action-oriented research will help to drive social change toward a Culture of Health.” Based on current information, none of the new programs appear to provide scientific training in population health.

*Kaiser Permanente* supports a number of training programs relevant to population health. These include the following:

- **The Kaiser Permanente Burch Minority Leadership Development Program** supports 12 junior minority researchers in developing connections and dialogue with health policymakers in federal, state and local governments; research agendas that effectively address policy concerns; and visibility as leaders promoting health and health care. The two-year leadership development program generally supports researchers with a population or public health focus.

- **A grant to the Satcher Health Leadership Institute at the Morehouse School of Medicine** supports a workforce leadership program that trains scholars to encourage effective policy and practice addressing the causes of health disparities and access to care and also develops health care leaders who will advance the integration of mental and primary health care.

- **Training for new investigators in health disparities research** takes place within the UCLA Kaiser Permanente Center for Health Equity. This collaborative “center without walls” fosters multidisciplinary research and promotes population-based intervention approaches to health
promotion and disease prevention and control with a focus on the underserved. The Center’s members include academic, government, foundation and private/non-profit investigators.

- The UC Berkeley Kaiser Permanente Public Health Scholars program enables 15-20 students a year from underserved communities to attend one of the nation’s premier schools of public health, with the goal of improving the flow of public health expertise to vulnerable communities.

The W. K. Kellogg Foundation played a major role in training scholars and leaders in health over the period 1990-2012, with a special emphasis on policy, community-based research, and health disparities. Its flagship program in this area, the Kellogg Health Scholars Program, closed in 2012. This two-year post-doctoral program provided training on the social determinants of health, academic-community partnering, community-based participatory research, and application of research to strengthen advocacy and achieve policy change. The program had its roots in three related programs:

- The Community Health Scholars Program, established in 1997, was designed to develop and strengthen the competences of university faculty in community-based approaches to teaching service and research. The program operated at three training sites\(^4^4\) and located its National Program Office at the University of Michigan. CHSP provided fellowships to 46 scholars.
- The Kellogg fellowship Program in Health Policy Research, established in 1998, supported the training of health policy researchers with expertise in the area of program evaluation and measurement and the development of a network of minority leaders in health policy research. Fellowships were awarded to minority men and women enrolled in doctoral programs in public health, health policy or social policy at seven participating schools.\(^4^5\) The Center for Advancing Health served as national program office.
- The Scholars in Health Disparities Program, established in 2001, was established to train future faculty and policy-makers in a multi-disciplinary approach to studying the social determinants of health disparities. The program emphasized increasing the diversity of faculty in schools of public health and other health-related academic settings. The program was located at the Center for the Advancement of Health.

Two of the above programs, Community Health Scholars Program and the Scholars in Health Disparities Program, were combined to create The Kellogg Health Scholars Program in 2006. The Kellogg Health Scholars offered two year postdoctoral fellowships at eight training sites. It made two tracks available. The Community Track highlighted community based participatory research and relationships between academic health disparities research, public health practices in communities, and policy development. The Multidisciplinary Track highlighted a multidisciplinary approach to studying the determinants of health inequalities and inequities. Both tracks highlighted the translation of health research into policy findings and recommendations.

In addition to these programs, the W. K. Kellogg Foundation also supported other fellows programs relevant to leadership in population health action. The Food & Society Policy Fellowship (also known as

\(^4^4\) Schools of public health at the Johns Hopkins University, the University of Michigan and the University of North Carolina.

\(^4^5\)The Heller Graduate School at Brandeis University, the Mailman School of Public Health at Columbia University, Harvard School of Public Health, the John Hopkins School of Hygiene and Public Health, the UCLA School of Public Health, the University of Michigan School of Public Health, and the Rand School.
Food and Policy Fellows and Food and Community Fellows) was a leadership program promoting cultural and policy change toward sustainable, just, and healthful food and farming. This program ended April 2013.

Finally, the Foundation has supported several international fellows programs. While one of these programs focused on food systems, none targeted population health more generally. Most emphasized leadership training and not research or academic training.

The Kresge Foundation’s health team has a strong population health focus. The Foundation seeks to “reduce health disparities by promoting conditions and environments that lead to positive health outcomes for all Americans.” The Foundation’s mission emphasizes improving health by improving the environmental and social conditions affecting low-income and vulnerable populations through cross-sector efforts to improve community-health systems. The health team has provided support to leadership development efforts to build the capacity of community-based organizations to advocate for health. Recent leadership grants include funding to support the AcademyHealth Population Health Scholars Program which provided policy “boot camps,” networking with policymakers and health leaders, and complementary participation in AcademyHealth’s National Health Policy Conference for 10 emerging community leaders in 2015. The Foundation recently launched the Emerging Leaders in Public Health program, to develop the capacity of local governmental public health leaders. This program provides resource grants and technical support for 12 teams of health department leaders working to transform their services to improve population health.

The mission of the Aetna Foundation is “to promote wellness, health, and access to high-quality health care for everyone, while supporting the communities we serve.” The Foundation provides funding for research, policy analysis, and programs in three program areas – obesity, racial and ethnic health care equity and integrated health care. Investments in obesity focus on community-based initiatives that encourage healthy eating and active living. These include structural approaches such as community gardening, access to healthy foods and policy as well as behavioral interventions. The Foundation supports five scholars programs, four of which are oriented towards careers in health care. The fifth is the AcademyHealth/Aetna Foundation Minority Scholars Program, which provides 15 students, post-doctoral trainees and fellows a scholarship to attend AcademyHealth’s annual research meeting, along with adjunct meetings and mentoring activities. The program seeks to attract men and women from underrepresented groups to the field of racial and ethnic disparities research in health outcomes and access to health care.

Two foundations, Atlantic Philanthropies and the John A. Hartford Foundation, support the Health and Aging Policy Fellows Program, which prepares professionals in health and aging to make a positive contribution to the development and implementation of health policies that affect older Americans by supporting research and work experience in policy settings.

Other programs that provide training relevant to population health also receive support from foundations along with support from federal and other sources. For example, the Satcher Health Leadership Institute receives funding from a variety of public and private sources to develop “public health leaders, foster and support leadership strategies, and influence policies and practices toward the reduction and ultimate elimination of disparities in health with the focus on neglected diseases and underserved populations...” The Institute offers two fellowship programs relevant to population health. The Health Policy Leadership Fellowship Program (est. 2009) is a multi-disciplinary postdoctoral program...
designed to prepare trainees for leadership roles promoting and implementing policies and practices that reduce health disparities and advance health equity. The Community Health Leadership Program provides leadership skills for and experience in community-based research and programs that address health disparities.
## UNDERGRADUATE PROGRAMS

<table>
<thead>
<tr>
<th>Program Name</th>
<th>Health: Science, Society, and Policy Program</th>
<th>Undergraduate Program in Public Health</th>
<th>Major in Medicine, Health, and Society</th>
</tr>
</thead>
<tbody>
<tr>
<td>University</td>
<td>Brandeis University</td>
<td>University of Colorado - Denver</td>
<td>Vanderbilt University</td>
</tr>
<tr>
<td>Goals/Description</td>
<td>The objective of the Health, Science, Society, and Policy (HSSP) program is to “help students understand the biological underpinnings of health, illness and disability, as well as their social, political, legal and economic dimensions.”</td>
<td>Emphasizes the “broad array of disciplines” that offer “unique insights” relevant to public health, including “the social and behavioral sciences, medicine, nursing, pharmacy, physical therapy, business, economics, statistics, epidemiology, law and biology.”</td>
<td>Designed for students who wish to “investigate…the cultural, economic, demographic and biological factors that impact health.” The curriculum is designed to train students “to meet emerging challenges in our healthcare system as well as changes in medical education.”</td>
</tr>
<tr>
<td>Location/Environment</td>
<td>Interdepartmental major; program governance and academic advising for students are provided by a Faculty Executive Committee, which consists of professors from both the College of Arts and Sciences and the Heller School for Social Policy and Management.</td>
<td>Department of Social and Behavioral Science, College of Liberal Arts and Sciences in partnership with Colorado School of Public Health, each course team taught by faculty from each school</td>
<td>Located in the in the Center for Medicine Health and Society, “an innovative multidisciplinary center that studies the social and societal dimensions of health and illness.” Core faculty are appointed to the CMHS; “affiliated faculty” have appointments in departments across the University.</td>
</tr>
<tr>
<td>Curriculum</td>
<td>Includes introductory classes (one each) in biology, sociology, and health policy; introduction to epidemiology, biostatistics, and population health</td>
<td>Mirrors graduate training in public health: core courses are public health, health policy, env. health, epidemiology, global health, and social determinants of health.</td>
<td>Offers a variety of concentrations: global health; health behavior/health sciences; health policy &amp; economics; race, inequality, and health; medicine, humanities, and the arts; and, critical health studies.</td>
</tr>
<tr>
<td>Program Name</td>
<td>Health: Science, Society, and Policy Program</td>
<td>Undergraduate Program in Public Health</td>
<td>Major in Medicine, Health, and Society</td>
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</tr>
<tr>
<td>Research</td>
<td>“Hands-on-experience” (internship or independent research project)</td>
<td>Capstone project</td>
<td>Not discussed</td>
</tr>
<tr>
<td>Mentoring</td>
<td>Not discussed</td>
<td>Not discussed</td>
<td>Not discussed</td>
</tr>
<tr>
<td>Interdisciplinary skills</td>
<td>Yes</td>
<td>Not discussed</td>
<td>Not discussed</td>
</tr>
<tr>
<td>Translation</td>
<td>Yes</td>
<td>Not discussed</td>
<td>Not discussed</td>
</tr>
<tr>
<td>Other comments</td>
<td>Offers BA, BS, and minor</td>
<td>BA and BS in public health, and a minor</td>
<td>Offers a major (BA), a minor, and a combined BA/MA (4+1) program.</td>
</tr>
</tbody>
</table>

**PREDOCTORAL PROGRAMS**

<table>
<thead>
<tr>
<th>Program Name</th>
<th>PhD in Population Health</th>
<th>Interdisciplinary Research Training in Public Health and Aging</th>
<th>Population and Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>University</td>
<td>North-eastern University</td>
<td>University of Michigan</td>
<td>Johns Hopkins Bloomberg School of Public Health</td>
</tr>
<tr>
<td>Goals/Description</td>
<td>This program trains students to become public health leaders through simultaneous examination of multiple determinations of health, including social, environmental, nutritional, and behavioral risk factors. Population Health doctoral students learn to conduct research that addresses five key health determinants: Social and Community Context, Environment and Neighborhoods, Health and Health Care Delivery, Education, and Economic Stability.</td>
<td>The overall objective is to provide training in the social and behavioral determinants, and their mediation through or interaction with biological susceptibility processes of adverse health outcomes in older age, such as reduced survival, geriatric syndromes and co-morbidities, cognitive decline and dementia, and disability. The rationale lies in the potential of this research to identify new opportunities for the prevention, management and treatment of aging-related chronic health conditions and their functional consequences.</td>
<td>This program offers a certificate designed to serve masters or doctoral degree students and professionals. Objectives are to expand trainees' knowledge of population dynamics and its linkages with public health issues and their ability to relate population-level concepts and measures of fertility, morbidity and mortality, and migration to health conditions.</td>
</tr>
<tr>
<td>Program Name</td>
<td>PhD in Population Health</td>
<td>Interdisciplinary Research Training in Public Health and Aging</td>
<td>Population and Health</td>
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<tr>
<td>Location/Environment</td>
<td>The Bouvé College of Health Sciences offers five undergraduate programs and over 34 graduate programs within our three schools – health professions, nursing, and pharmacy, with an interdisciplinary emphasis that reflects today’s team approach to health care.</td>
<td>Center for Social Epidemiology and Population Health, Department of Epidemiology, School of Public Health; ties to other research centers, institutes</td>
<td>Department of Population, Family and Reproductive Health.</td>
</tr>
<tr>
<td>Curriculum</td>
<td>Courses in biostatistics, epidemiology, and health services; specialized training in topics related to student research; research concentrations in Social &amp; Env. Determinants of Health and Health Service &amp; Policy.</td>
<td>Structured program including: mentored research activity; courses in epidemiology of aging and related subjects, research seminars; other training</td>
<td>Students complete 18 credits of coursework on population dynamics &amp; their linkages with public health issues and demographic methods for public health</td>
</tr>
<tr>
<td>Research</td>
<td>Yes</td>
<td>Yes</td>
<td>Not discussed</td>
</tr>
<tr>
<td>Mentoring</td>
<td>Not discussed</td>
<td>25 mentors with well-established research and training records in various disciplines</td>
<td>Not discussed</td>
</tr>
<tr>
<td>Interdisciplinary skills</td>
<td>Not discussed</td>
<td>Not discussed</td>
<td>Not discussed</td>
</tr>
<tr>
<td>Translation</td>
<td>Not discussed</td>
<td>Not discussed</td>
<td>Covered by an elective course</td>
</tr>
<tr>
<td>Other comments</td>
<td>Funded by T32AG027708, 4 pre-doctoral slots</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Program Name</td>
<td>RWJF Health &amp; Society Scholars</td>
<td>Cancer Health Disparities Training Program</td>
<td>Cardiovascular Disease Epidemiology Training Program (pre and post)</td>
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<tr>
<td>University</td>
<td>U Michigan, U Penn, Harvard, UCSF &amp; Berkeley, U Wisconsin, Columbia U</td>
<td>University of North Carolina, Chapel Hill, Gillings School of Global Public Health</td>
<td>Johns Hopkins University, Bloomberg School of Public Health</td>
</tr>
<tr>
<td>Goals/Description</td>
<td>Seeks to improve the nation’s health by addressing the full spectrum of factors that affect health and creating the evidence to inform policy in multiple sectors that can promote health. The program trains scholars to investigate the effects of contextual factors on behavior and biology in order to strengthen the knowledge base supporting population-wide interventions.</td>
<td>The Program trains public health researchers in the competencies needed to address and understand cross-cutting health disparity issues in cancer across the cancer continuum from etiology and primary prevention to survivorship. Trainees gain research skills and familiarity with the many scientific disciplines and methods involved in research on cancer health disparities based on a socio-ecological model of health.</td>
<td>The overall objective is to produce cardiovascular disease epidemiologists with training of sufficient rigor and multidisciplinary orientation to carry out high quality research in cardiovascular disease issues, and to prepare them to serve as teachers and role models of excellence for the next generation of cardiovascular disease epidemiologists. The program integrates knowledge on all aspects of cardiovascular disease: biology, behavior, treatment and prevention.</td>
</tr>
<tr>
<td>Program Name</td>
<td>RWJF Health &amp; Society Scholars</td>
<td>Cancer Health Disparities Training Program</td>
<td>Cardiovascular Disease Epidemiology Training Program</td>
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<tr>
<td>Location/Environment</td>
<td>University sites selected on the basis of outstanding talent in specific disciplines, commitment to interdisciplinary collaboration, breadth and depth of research opportunities, and the presence of faculty leaders in population health. The sites share their training and research resources for the benefit of scholars and faculty at all sites.</td>
<td>Administered through the Department of Health Behavior, but draws upon collaborative, interdisciplinary research teams that focus on cancer health disparities at UNC-Chapel Hill (18 faculty, 6 departments, 2 centers).</td>
<td>Many trainees are based in the Welch Center for Prevention, Epidemiology and Clinical Research and are mentored by individuals active in both population-based and clinical research. Close ties with the Johns Hopkins University divisions of General Internal Medicine, Cardiology and Endocrinology.</td>
</tr>
<tr>
<td>Curriculum</td>
<td>Intensive seminars, research and analysis; study of interactions among context, behavior and biology across the life span; training in leadership skills, translation.</td>
<td>A specialized curriculum includes a cancer disparities seminar, training on research ethics and courses in health disparities &amp; cultural competency.</td>
<td>Postdoctoral students complete a year of course work followed by a publishable research project. Core course on CVD risk factors and prevention; also seminars, journal club, research progress meeting.</td>
</tr>
<tr>
<td>Research</td>
<td>Scholar-directed research</td>
<td>Training experience in interdisciplinary research that focuses on cancer health disparities</td>
<td>Training emphasizes a collaborative approach and active participation in research.</td>
</tr>
<tr>
<td>Mentoring</td>
<td>All program activities conducted with the guidance or collaboration of distinguished faculty mentors</td>
<td>Mentors assigned in more than one discipline; focus on career development</td>
<td>Mentoring by individuals active in both population-based and clinical research.</td>
</tr>
<tr>
<td>Interdisciplinary skills</td>
<td>Expand cross-disciplinary thinking &amp; dialogue, collaborative competence, shared language</td>
<td>Not discussed</td>
<td>Not discussed</td>
</tr>
<tr>
<td>Translation</td>
<td>Program implementation &amp; policy change; communication to decision-makers and opinion leaders</td>
<td>Trainees learn research communication</td>
<td>Not discussed</td>
</tr>
<tr>
<td>Other comments</td>
<td>funded by T32CA128582, post only, 1-3 slots, 2-3 yr appts</td>
<td></td>
<td>Funded by T32HL007055 (pre and post)</td>
</tr>
</tbody>
</table>