Population Health Science in the United States

Trends, Evidence, and Implications for Policy

PROCEEDINGS OF A JOINT SYMPOSIUM

Theresa M. Wizemann, *Rapporteur*

Roundtable on Population Health Improvement

Board on Population Health and Public Health Practice

Health and Medicine Division

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

THE NATIONAL ACADEMIES PRESS
Washington, DC
www.nap.edu

PREPUBLICATION COPY—Uncorrected Proofs

THE NATIONAL ACADEMIES PRESS 500 Fifth Street, NW Washington, DC 20001

This activity was supported by contracts between the National Academy of Sciences and Aetna Foundation, The California Endowment, Department of Health and Human Services Program Support Center, The East Bay Community Foundation, Health Resources and Services Administration, The Kresge Foundation, New York State Health Foundation, and Robert Wood Johnson Foundation. Any opinions, findings, conclusions, or recommendations expressed in this publication do not necessarily reflect the views of any organization or agency that provided support for the project.

International Standard Book Number-13: 978-0-309-XXXXX-X
International Standard Book Number-10: 0-309-XXXXX-X
Digital Object Identifier: https://doi.org/10.17226/25631

Additional copies of this publication are available from the National Academies Press, 500 Fifth Street, NW, Keck 360, Washington, DC 20001; (800) 624-6242 or (202) 334-3313; http://www.nap.edu.

Printed in the United States of America

Suggested citation: National Academies of Sciences, Engineering, and Medicine. 2021. *Population health science in the United States: Trends, evidence, and implications for policy*. Washington, DC: The National Academies Press. https://doi.org/10.17226/25631.

The National Academies of
SCIENCES • ENGINEERING • MEDICINE

The **National Academy of Sciences** was established in 1863 by an Act of Congress, signed by President Lincoln, as a private, nongovernmental institution to advise the nation on issues related to science and technology. Members are elected by their peers for outstanding contributions to research. Dr. Marcia McNutt is president.

The **National Academy of Engineering** was established in 1964 under the charter of the National Academy of Sciences to bring the practices of engineering to advising the nation. Members are elected by their peers for extraordinary contributions to engineering. Dr. John L. Anderson is president.

The **National Academy of Medicine** (formerly the Institute of Medicine) was established in 1970 under the charter of the National Academy of Sciences to advise the nation on medical and health issues. Members are elected by their peers for distinguished contributions to medicine and health. Dr. Victor J. Dzau is president.

The three Academies work together as the **National Academies of Sciences, Engineering, and Medicine** to provide independent, objective analysis and advice to the nation and conduct other activities to solve complex problems and inform public policy decisions. The National Academies also encourage education and research, recognize outstanding contributions to knowledge, and increase public understanding in matters of science, engineering, and medicine.

Learn more about the National Academies of Sciences, Engineering, and Medicine at **www.nationalacademies.org**.

The National Academies of
SCIENCES • ENGINEERING • MEDICINE

Consensus Study Reports published by the National Academies of Sciences, Engineering, and Medicine document the evidence-based consensus on the study's statement of task by an authoring committee of experts. Reports typically include findings, conclusions, and recommendations based on information gathered by the committee and the committee's deliberations. Each report has been subjected to a rigorous and independent peer-review process and it represents the position of the National Academies on the statement of task.

Proceedings published by the National Academies of Sciences, Engineering, and Medicine chronicle the presentations and discussions at a workshop, symposium, or other event convened by the National Academies. The statements and opinions contained in proceedings are those of the participants and are not endorsed by other participants, the planning committee, or the National Academies.

For information about other products and activities of the National Academies, please visit www.nationalacademies.org/about/whatwedo.

PLANNING COMMITTEE FOR POPULATION HEALTH SCIENCE IN THE UNITED STATES: TRENDS, EVIDENCE, AND EFFECTIVE POLICY[1]

ALLISON E. AIELLO, Professor of Epidemiology, Social Epidemiology Program Leader, Carolina Population Center; Fellow, Gillings School of Global Public Health, University of North Carolina at Chapel Hill

ROBERT HUMMER, Odum Distinguished Professor of Sociology, College of Arts and Sciences, University of North Carolina

DAVID KINDIG, Emeritus Professor of Population Health Sciences and Emeritus Vice-Chancellor for Health Sciences, School of Medicine and Population Health, University of Wisconsin–Madison

PAULA LANTZ, Associate Dean for Academic Affairs, Professor of Public Policy, Gerald R. Ford School of Public Policy, University of Michigan

SANNE MAGNAN, Senior Fellow, HealthPartners Institute; Adjunct Assistant Professor, University of Minnesota

LOURDES J. RODRIGUEZ, Director, Center for Place-Based Initiatives, Associate Professor, Department of Population Health, Dell Medical School, The University of Texas at Austin

---

[1] The National Academies of Sciences, Engineering, and Medicine's planning committees are solely responsible for organizing the symposium, identifying topics, and choosing speakers. The responsibility for the published Proceedings of a Joint Symposium rests with the symposium rapporteur and the institution.

ROUNDTABLE ON POPULATION HEALTH IMPROVEMENT[1]

SANNE MAGNAN (*Co-Chair*), Adjunct Assistant Professor, Division of Medicine, University of Minnesota
JOSHUA M. SHARFSTEIN (*Co-Chair*), Associate Dean for Public Health Practice and Training, Johns Hopkins Bloomberg School of Public Health
PHILIP M. ALBERTI, Senior Director, Health Equity Research and Policy, Association of American Medical Colleges
TERRY ALLAN, Health Commissioner, Cuyahoga County Board of Health
JOHN AUERBACH, Executive Director, Trust for America's Health
CATHY BAASE, Chair, Board of Directors, Michigan Health Improvement Alliance; Consultant for Health Strategy, The Dow Chemical Company
DEBBIE I. CHANG, Senior Vice President, Policy and Prevention, Nemours
KATHY GERWIG, Vice President, Employee Safety, Health and Wellness and Environmental Stewardship Officer, Kaiser Permanente
MARTHE GOLD, Senior Scholar in Residence, The New York Academy of Medicine
MARC N. GOUREVITCH, Professor and Chair, Department of Population Health, New York University Langone Health
GARTH GRAHAM, President, Aetna Foundation
GARY R. GUNDERSON, Vice President, Faith Health School of Divinity, Wake Forest University and Wake Forest Baptist Health
WAYNE JONAS, Executive Director Integrative Health Programs, H&S Ventures
ROBERT M. KAPLAN, Professor, Center for Advanced Study in the Behavioral Sciences, Stanford University
DAVID A. KINDIG, Emeritus Professor of Population Health Sciences, Emeritus Vice Chancellor for Health Sciences, School of Medicine and Public Health, University of Wisconsin–Madison
SALLY A. KRAFT, Vice President, Population Health, Dartmouth-Hitchcock
PAULA M. LANTZ, Associate Dean for Academic Affairs and Professor of Public Policy, Gerald R. Ford School of Public Policy, University of Michigan

---

[1] The National Academies of Sciences, Engineering, and Medicine's forums and roundtables do not issue, review, or approve individual documents. The responsibility for the published Proceedings of a Joint Symposium rests with the symposium rapporteur and the institution.

MICHELLE LARKIN, Associate Vice President, Associate Chief of Staff, Robert Wood Johnson Foundation
THOMAS A. LaVEIST, Dean, School of Public Health & Tropical Medicine, Tulane University
JEFFREY LEVI, Professor, Department of Health Policy & Management, Milken Institute School of Public Health, The George Washington University
SHARRIE McINTOSH, Vice President for Programs, New York State Health Foundation
PHYLLIS MEADOWS, Senior Fellow, Health Program, The Kresge Foundation
BOBBY MILSTEIN, Director, ReThink Health
JOSÉ T. MONTERO, Director, Office for State, Tribal, Local and Territorial Support, and Deputy Director, Centers for Disease Control and Prevention
MARY PITTMAN, President and Chief Executive Officer, Public Health Institute
PAMELA RUSSO, Senior Program Officer, Robert Wood Johnson Foundation
MYLYNN TUFTE, State Health Officer, Office of the Governor, State of North Dakota
HANH CAO YU, Chief Learning Officer, The California Endowment

Health and Medicine Division Staff

ALINA B. BACIU, Roundtable Director
CARLA ALVARADO, Program Officer
KIMANI HAMILTON-WRAY, Senior Program Assistant (*through May 2019*)
HOPE HARE, Administrative Assistant
MISRAK DABI, Financial Associate
ROSE MARIE MARTINEZ, Senior Board Director

Rapporteur

THERESA WIZEMANN

Reviewers

This Proceedings of a Joint Symposium was reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise. The purpose of this independent review is to provide candid and critical comments that will assist the National Academies of Sciences, Engineering, and Medicine in making each published proceedings as sound as possible and to ensure that it meets the institutional standards for quality, objectivity, evidence, and responsiveness to the charge. The review comments and draft manuscript remain confidential to protect the integrity of the process.

We thank the following individuals for their review of this proceedings:

MERLIN CHOWKWANYUN, Mailman School of Public Health, Columbia University
DENISE DOUGHERTY, AcademyHealth
JEFFREY LEVI, Milken Institute School of Public Health, The George Washington University
LOURDES RODRIGUEZ, Dell Medical School, The University of Texas at Austin

Although the reviewers listed above provided many constructive comments and suggestions, they were not asked to endorse the content of the proceedings nor did they see the final draft before its release. The review of this proceedings was overseen by **HUGH TILSON,** Gillings School of Global Public Health, University of North Carolina. He was responsible for making certain that an independent examination of this proceedings was carried out in accordance with standards of the National Academies and that all review comments were carefully considered. Responsibility for the final content rests entirely with the rapporteur and the National Academies.

Contents

APPENDIXES

Acronyms and Abbreviations

ACA	Patient Protection and Affordable Care Act
BMI	body mass index
CDC	Centers for Disease Control and Prevention
CHD	coronary heart disease
CHIP	Children's Health Insurance Program
CMMI	Center for Medicare & Medicaid Innovation
CMS	Centers for Medicare & Medicaid Services
HI-5	Health Impact in 5 Years
IAPHS	Interdisciplinary Association for Population Health Science
MOMS	Management of Maternal Smoking program

1

Introduction[1]

On October 3, 2018, the Roundtable on Population Health Improvement of the National Academies of Sciences, Engineering, and Medicine (the National Academies) and the Interdisciplinary Association for Population Health Science (IAPHS) convened a joint symposium to consider the current state of population health science in the United States. The symposium was held in Washington, DC, at the National Academy of Sciences building in coordination with the IAPHS annual meeting. Sanne Magnan, senior fellow at HealthPartners Institute, said that the goal of the symposium was to reflect on trends in population health, the state of the science, and effective policy. The intent was not to consider specific programs or activities, she explained, but rather to reflect in broad terms on challenges and future direction(s) for the field.

---

[1] This joint symposium was organized by an independent planning committee whose role was limited to identification of topics and speakers. This proceedings was prepared by the rapporteur as a factual summary of the presentations and discussions that took place at the symposium. Statements, recommendations, and opinions expressed are those of individual presenters and participants and are not necessarily endorsed or verified by the National Academies, the roundtable, or IAPHS, and they should not be construed as reflecting any group consensus.

SYMPOSIUM OBJECTIVES

Since 2013, the Roundtable on Population Health Improvement has been convening workshops for members, stakeholders, and the public to discuss issues of importance to improving the nation's health. The roundtable's vision is of a strong, healthy, and productive society that cultivates human capital and equal opportunity. This vision rests on the recognition that outcomes such as improved life expectancy, quality of life, and health for all are shaped by interdependent social, economic, environmental, genetic, behavioral, and health care factors, and that achieving this vision will require robust national and community-based policies and dependable resources.

The agenda for the joint symposium was developed by an independent planning committee with assistance from roundtable and IAPHS staff. Planning committee members included Allison Aiello, Bob Hummer, David Kindig, Paula Lantz, Lourdes Rodriguez, and Sanne Magnan. (The planning committee's Statement of Task is provided in Box 1-1.) As described by Bruce Link, distinguished professor of public policy and sociology at the University of California, Riverside, and president of IAPHS, the objectives of the symposium were the following:

- Highlight major trends and patterns in U.S. population health and challenges to current thinking, including socioeconomic, gender, racial, ethnic, and other social disparities;
- Explore how population health science could inform policy to improve outcomes and how policies can have unintended consequences if not grounded in research and evaluation; and
- Showcase perspectives on how to build common ground for development and implementation of effective policy based on science.

ORGANIZATION OF THE SYMPOSIUM AND PROCEEDINGS

This joint symposium of the Roundtable on Population Health Improvement and IAPHS was the agenda item for the first part of the 2018 IAPHS annual meeting. The symposium opened with an overview of population health in the United States, including current trends in health and mortality, and racial, ethnic, and socioeconomic disparities (Chapter 2). The discussion then turned to the complexities of policy implementation with attention to evidence generation and to surfacing and mitigating negative unintended consequences of policies for population health (Chapter 3). In the final panel of the symposium, speakers representing city-, state-, and federal-level agencies shared their perspectives on finding common ground to move population health forward (Chapter 4). The

BOX 1-1
Planning Committee Statement of Task

An ad hoc planning committee will plan and convene a part-day public workshop focused on interdisciplinary approaches to and perspectives on key issues in population health science. The committee will define meeting objectives, produce an agenda, and identify appropriate speakers. The workshop will focus on exploring (1) the policy implications of racial, ethnic, and socioeconomic disparities in the U.S. population and the role of researchers; (2) the state of science and evidence in population health; and (3) the status, gaps, and future frontiers in building common ground between population health science and policy. Proceedings of the presentations and discussion at the workshop will be prepared by a designated rapporteur in accordance with institutional guidelines.

symposium concluded with observations and reflections shared by David Kindig (Chapter 5). Points of interest were shared on Twitter throughout the day by participants using the hashtag #pophealthrt.[2]

---

[2] The Twitter discussion that took place on October 3, 2018, in association with the joint symposium can be viewed at https://twitter.com/hashtag/Pophealthrt (accessed December 23, 2020).

2

Population Health in the United States

The symposium opened with an overview of population health in the United States. Eileen Crimmins, the AARP Professor of Gerontology at the University of Southern California, reviewed current trends in U.S. health and mortality compared to other high-income countries. David Williams, the Florence Sprague Norman and Laura Smart Norman Professor of Public Health and professor of African and African American studies and sociology at Harvard University, discussed racial, ethnic, and socioeconomic disparities in population health and their causes. The session was moderated by Robert Hummer, the Howard W. Odum Professor of Sociology at the University of North Carolina. Highlights of this session are presented in Box 2-1.

RECENT TRENDS IN POPULATION HEALTH

Relative Mortality as an Indicator of National Health

As a baseline, Crimmins referred participants to three reports published in 2010, 2011, and 2013 that assessed key differences in health and mortality between the United States and other high-income countries (NRC, 2010, 2011; NRC and IOM, 2013). Although life expectancy at birth for both men and women in the United States increased between 1980 and 2008, the data show that Americans live shorter lives relative to men and women in economically comparable countries. Over the past decade, U.S. life expectancy relative to other countries has continued to decline, she said.

BOX 2-1
Key Points Made by Individual Speakers[a]

- Life expectancy of Americans is shorter relative to men and women in economically comparable countries, and U.S. life expectancy relative to other countries has declined over the past decade. (Crimmins)
- Place, social cohesion, and economic factors are linked with mortality rates. In some areas of the United States, life expectancy for women is lower than it was 30 years ago. (Crimmins)
- Increases in deaths caused by diseases of despair, defined as drug abuse, alcoholism, and suicide, contribute to declining life expectancy in the United States. (Crimmins)
- It is important to collect population-specific data and disaggregate data to better understand trends and disparities in mortality, both between populations and within populations. (Williams)
- Heterogeneity in health and mortality is associated with race and ethnicity, racial groups, sex/gender, and age, as well as immigration history, socioeconomic status, educational attainment, and other life-course and transgenerational factors. (Williams)
- Life-course factors, such as discrimination and allostatic load, need to be better understood to account for contributions to inequities in health and variations across racial and ethnic status. (Williams)
- It is important to monitor policy changes and study their effect on health, including health inequities. (Williams)

---

[a] This list is the rapporteur's summary of the main points made by individual speakers and participants (noted in parentheses) and does not reflect any consensus among symposium participants or endorsement by the National Academies.

Where U.S. life expectancy actually ranks globally depends on the countries included in the comparison. For example, a 2016 analysis from the World Bank that excluded a number of small island nations ranked the United States as 36th for life expectancy. Had the excluded nations been included, Crimmins explained, the United States would have been ranked in the range of 40th to 42nd. Crimmins also pointed out that several countries including Chile, Korea, Lebanon, and Singapore that once ranked below the United States have made significant gains and now rank above the United States.

Trends in Absolute Mortality

Over the past 2 years, Crimmins said, the absolute life expectancy in the United States has unexpectedly decreased, albeit by a very small amount. Some demographic groups are faring worse than others, and inequalities are generally growing. The life expectancy of men is increasing more than that of women. The life expectancy of people with higher education has increased more than that of those with lower levels of education. One positive trend is a closing of the gap in life expectancy between white and black populations, as black life expectancy has increased more than white life expectancy in recent years. The largest increases in life expectancy have been among black men. Despite these gains, major gaps persist between black and white life expectancy. At every educational level, white individuals have a life expectancy that is 2 to 4 years longer than black individuals with the same level of education (Sasson, 2016).

Place matters, too, as trends in mortality for women, which are influenced by social cohesion and economic factors, also vary widely by state (Montez et al., 2016). In some U.S. counties, current life expectancy for women is actually lower than it was 30 years ago, which Crimmins said "is really quite shocking."

Explaining Differences in Mortality Rates

A variety of explanations have been offered to account for the differences in mortality rates between the United States and other economically comparable countries. Contributing factors include smoking history, obesity, access to medical care, policies that are not supportive of health, and a lack of social safety nets. Crimmins highlighted obesity in particular as affecting U.S. life expectancy relative to other countries. She pointed out that many of these factors affect people before age 50, not in old age. The 2013 National Research Council and Institute of Medicine report *U.S. Health in International Perspective: Shorter Lives, Poorer Health* found that among 17 comparable countries, the United States ranked worst (16th or 17th) for mortality at most ages, up until after age 70, after which point the United States ranks among the best (NRC and IOM, 2013).

Case and Deaton (2015) have studied the rising mortality rates of middle-aged white men and women in the United States and suggest that "deaths of despair" are a large contributor, Crimmins said (see Figure 2-1). Deaths of despair include deaths related to drug and alcohol poisoning, suicide, and chronic liver disease. Such deaths rose significantly in the United States after 2000 to a level far above that of economically comparable countries. Drug overdose deaths have been increasing, particularly among people with low levels of education, and most strikingly among the non-Hispanic/white population with limited education (Ho, 2017). Adverse midlife mortality trends are apparent in a range of groups across the U.S. population (Woolf et al., 2018). Crimmins added that the United States has the highest rate of maternal mortality in the developed world

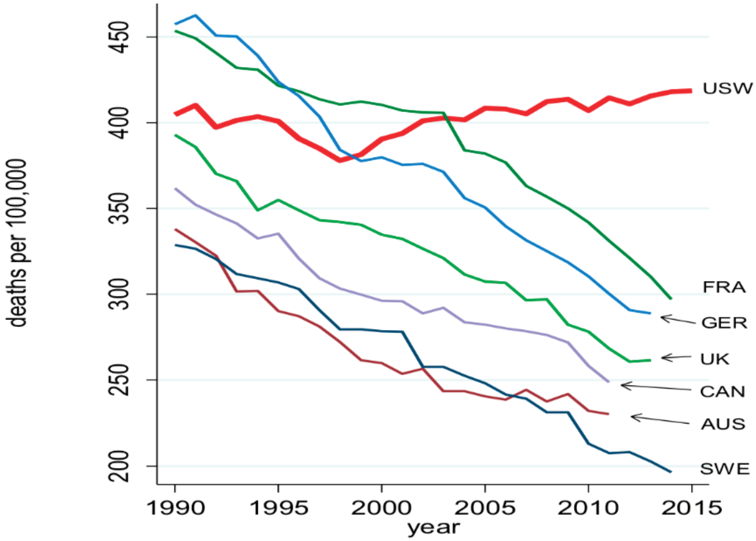


FIGURE 2-1 All-cause mortality rate for U.S. white men and women aged 45–54 compared to peer countries.
NOTE: AUS = Austria; CAN = Canada; FRA = French; GER = Germany; SWE = Sweden; UK = United Kingdom; USW = US whites.
SOURCES: Crimmins presentation, October 3, 2018; Case and Deaton, 2015, Figure 1.

(GBD, 2016). In addition, while cardiovascular mortality has continued to decline, the rate of the decline has decreased (Ma et al., 2015).

In a study of 18 countries economically comparable to the United States, Ho and Hendi (2018) found that the majority of countries had a decline in life expectancy in 2014–2015, but subsequently recovered that lost life expectancy and even experienced gains. Life expectancy in the United States, however, has continued to decline, and this has been attributed to midlife so-called deaths of despair (e.g., suicide and drug overdose) and other external causes. The decline in European peer countries was attributed to increased deaths in old age from chronic conditions. Another study of the effect of the 2008 economic crisis found no change in the declining mortality rate trend among people in Western Europe with low levels of education (Mackenback et al., 2018). This is in contrast to the increased inequality and unfavorable mortality trends observed in the United States following the 2008 crisis.

Root Causes and Proposed Solutions

Health and mortality in the United States continue to worsen relative to economically comparable countries, Crimmins summarized. Many inequalities are increasing, and some populations are experiencing deterioration in multiple aspects of health. Some of the proximate causes of increased mortality (e.g., the opioid epidemic, poor mental health, maternal mortality) are amenable to interventions, she said. It is the root causes of adverse mortality trends that differentiate the United States from economically comparable countries, she said. Macroeconomic change has led to job losses in some sectors and stagnant income for many people. Families are stressed, and there is a lack of supportive social policies. A national strategy to increase life expectancy is needed, Crimmins said, if the United States is to achieve levels of health that are comparable to those enjoyed by peer countries. She emphasized the need to recognize that individuals and families have a right to health care, to health, to jobs, and to support if they cannot work. In closing, Crimmins noted that she expected legislation on a life expectancy strategy to be proposed in the coming days.[1]

RACIAL, ETHNIC, AND SOCIOECONOMIC STATUS DISPARITIES IN HEALTH

Racial disparities in health have persisted over time, Williams said, and in his remarks he shared his perspective on priority areas to address this challenge. He reiterated the point made by Crimmins that the gap in life expectancy between white and black populations is much smaller today than it was in 1950, but there is still a gap. He emphasized the importance of applying an intersectional lens as there are complexities that can be missed when only considering overall life expectancy. For example, black women have had a longer life expectancy than white males since 1970 (NCHS, 2017). Since 1950, black women have had the largest gain in life expectancy of all groups, which Williams said was a result of policies stemming from the Civil Rights movement.

Intersection of Migration and Socioeconomic Status

Williams noted the need to consider the extent to which the narrowing of the black–white health gap over the past two decades is a function of changes in the black population as a result of black migration. Regardless of origin, these immigrants tend to have better health than their native-born counterparts (Hamilton and Green, 2018). Black migration from Africa has outpaced migration from the Caribbean since 2000, and African immigrants experience a smaller decline in their health with increasing length of stay in the United States than their Caribbean peers (Hamilton

---

[1] The National Strategy to Increase Life Expectancy Act of 2018, or H.R. 7035, was introduced on October 5, 2018. Information about the legislation may be found at https://www.congress.gov/bill/115th-congress/house-bill/7035 (accessed December 23, 2020).

and Green, 2018). In addition, black immigrants from Africa are twice as likely as whites to have a college degree, Williams said. It is estimated that nearly 20 percent of the black population in the United States are immigrants (Hamilton and Green, 2018). This demonstrates the importance of disaggregating data to better understand trends, and to better elucidate the effect of the changing composition of the black population versus improved outcomes for the historic black population in the United States.

Disaggregated data are also needed to better understand the health stresses facing Hispanic populations and Asian populations in the United States, Williams stated. For example, the health of Mexican immigrants in the decade after arrival in the United States is similar to that of the U.S.-born white population; however, their health profile changes negatively over their years of residence in the United States and becomes similar to that of the U.S.-born black and Mexican American populations (Kaestner et al., 2009). Similarly, hypertension profiles are different for U.S.-born and foreign-born Hispanic residents (Dominguez et al., 2015). As above, these nuances would not be apparent from simply analyzing data for Latinos in the United States. Williams also noted the need to consider the heterogeneity of the Hispanic population beyond ethnicity. For example, he said that about 5 percent of immigrants from Mexico have a college degree or higher compared to 50 percent of immigrants from Venezuela. It is necessary to understand how this combination of immigration and socioeconomic status affects health status, he said.

Interrelationship of Race, Ethnicity, and Socioeconomic Status and Their Combined Effect on Health

The National Longitudinal Mortality Study 1988–1998 found that, overall, there is a 5-year gap in life expectancy at age 25 between white and black populations in the United States. When education is taken into account, there is a 6.4-year gap in life expectancy between white individuals with a college degree versus those with a high school education or less. There is a 5.3-year gap in life expectancy of black Americans with a college degree versus those with a high school education or less. Williams pointed out that the education-based life expectancy gap within each racial and ethnic group is greater than the overall variation between the racial and ethnic populations. When considered by level of education, Williams said that black individuals with a college degree have lower life expectancy than white individuals with only a high school diploma. He added that similar patterns are observed relative to income. He encouraged health systems to more routinely collect and report data by race and socioeconomic status together, rather than by race only.

Data on All Populations, Including Very Small Populations

To illustrate the value of data on small populations Williams described a study of workplace discrimination by the American Psychological Association. The study gathered national data and also oversampled specific populations, including Native Americans. Survey data collected from white, black, Hispanic, Asian, and Native American individuals found that Native Americans reported the highest levels of discrimination for three indicators of job discrimination: unfairly fired, unfairly denied promotion, and unfairly not hired for a job (APA, 2016). When asked about everyday discrimination, more Native Americans surveyed reported experiencing discrimination at least once per week than any other population (Native American, 34 percent; black, 23 percent; Hispanic, 19 percent; white, 11 percent; and Asian, 11 percent). This information about the Native American experience would be unknown if population-specific data were not collected, he said (APA, 2016).

Research on Life-Course and Transgenerational Sources of Inequities

Williams shared several examples of the effect life course has on health inequities. A study in Sweden found that preconception stress (stressors in the life of the mother that occur in the 6 months prior to conception) is associated with a 53 percent higher risk of infant mortality (Class et al., 2013). Another study conducted in the United States found an association between preconception stress and low birth weight. Childhood abuse of the mother has been suggested to predict depressive symptoms in her children in adolescence and young adulthood (Roberts et al., 2015). Finally, a study conducted by Brody and colleagues (2014) found that perceived discrimination against black adolescents in Georgia (age 16 to 18) was associated with a higher allostatic load at age 20 (higher levels of stress hormones, and increased systolic and diastolic blood pressure, inflammation, and body mass index). This shows systematic biological dysregulation linked to stress exposure during their teens. Williams emphasized the need to better understand how these life-course factors and outcomes vary across racial and ethnic status and contribute to inequities in health.

Cost of Resilience

Another study by Brody and colleagues (2013) assessed the cost of resilience. The study followed black teens from low socioeconomic circumstances who had high levels of self-control and self-regulation, which predicts higher academic success and emotional stability in their 20s. These young adults are likely to go on to college and have lower rates of drug and alcohol use. However, they have greater obesity, higher blood pressure, higher stress hormones, and higher levels of epigenetic aging than both low socioeconomic status peers who have low self-control and higher socioeconomic status peers. Their success seems to come at a cost, and Williams noted the need to better understand what drives this and what can be done to address it.

Effect of the Social Environment on Child and Adolescent Health

Shortly after the 2016 election, a survey of 2,000 K–12 teachers about their classroom environment found that 67 percent had students who expressed fears about what would happen to their family; one-third reported observing increased anti-Muslim or anti-immigrant sentiment among students; and more than half said there was an increase in uncivil political discourse in the classroom (SPLC, 2016). Teachers reported that "some students were emboldened to use slurs and name calling and say bigoted and hostile things," Williams relayed. This hostile environment has been growing since the election, and Williams said there has been an increase in hate crimes and harassment. In fact, he said, since the election, primary and secondary schools currently rank as the number one site of hostility and hate crimes in the United States.

A better understanding of the health effect of the social environment on young people is needed, Williams said. He cited a study of more than 2,500 11th-grade students in Los Angeles assessing their level of concern about increasing hostility and discrimination because of a person's race, ethnicity, sexual identity, immigrant status, religion, or disability. Students were interviewed in spring 2016, and again in spring 2017, and each time more than 40 percent said they were very or extremely concerned about increasing discrimination. In 2016, students that reported higher levels of concern also reported increased smoking and use of alcohol and marijuana, and increased symptoms of depression and attention-deficit/hyperactivity disorder (Leventhal et al., 2018). Some associations were more prevalent among Hispanic and black students. These data suggest that the current environment is affecting health behaviors and potentially mental health among teens, Williams said. The American Psychological Association has found that the current political climate is a "very significant or somewhat significant source of stress" for many Americans across age and racial groups (APA, 2017).

Williams described one of many recent studies that document the health effects of hostility in the current environment. Leitner and colleagues (2016) studied the association between circulatory disease-related deaths and racial prejudice against black residents in more than 1,800 counties. The results show that death rates are higher in counties with high levels of explicit prejudice. He added that similar findings have been demonstrated for the lesbian, gay, bisexual, transgender, queer and/or questioning population. There is a consistent pattern across a broad range of outcomes and measures of prejudice at the community level that needs to be better understood, he said.

Current Issues Affecting the Health of Immigrants

Arizona's Support Our Law Enforcement and Safe Neighborhoods Act (SB 1070) authorizes police to stop anyone suspected of being in the United States illegally and to detain those without proper documentation. Williams and colleagues studied pairs of young mothers and their mother figures (their own mothers, grandmothers, aunts) for their use of public assistance and preventive routine care for their children before and after passage of the law. The data show a decline in the use of health and social services for the children after the law was enacted (Toomey et al., 2014). Interestingly, the decline was steepest among U.S.-born Mexican American mothers who, Williams pointed out, were U.S. citizens and therefore not at risk.

The health effect of immigration raids has also been studied. The largest single-site immigration raid in U.S. history (at the time) took place in Postville, Iowa, in 2008. Nearly 400 persons were detained until their immigration status could be confirmed. Families were separated, and ultimately, 300 people were deported. The community was extremely fearful, and some slept in churches instead of their homes. One study found an increased risk of low birth weight for infants born to Latina mothers in the Postville area during the year after the raid (Novak et al., 2017). Williams added that there was no change in birth weight of infants born to non-Hispanic white mothers during this time.

Creating Resilient Environments

Much of the work on resilience has been focused on individual resilience, Williams said, but policy interventions are also needed that can create resilience at the societal level. Such interventions could help to buffer the effects of childhood poverty, for example. The United States currently ranks 34th in a ranking of child poverty in 35 economically comparable countries (UNICEF, 2012). When the level of child poverty is considered both before and after taxes and transfers (i.e., the effect of the economic system of the country on child poverty), it becomes apparent that many other countries' economic policies help to reduce child poverty, while U.S. economic policies do not appear to greatly benefit children in poverty (see Figure 2-2).

Permission pending for this figure.

FIGURE 2-2 Child poverty rate before (dark blue) and after (light blue) taxes and transfers.
SOURCES: Williams presentation, October 3, 2018; adapted from UNICEF, 2012, Figure 8.

Williams added that "poverty is not randomly distributed in the United States" where a greater proportion of black (31 percent), Hispanic (27 percent), and Native American (34 percent) children live in poverty compared to their Asian and white counterparts (both at 10 percent). Williams emphasized the role of the social safety net as a "resilience resource," and said that keeping the safety net in place is a strategy for societal resilience.

Williams offered the Omnibus Budget Reconciliation Act in 1981 as an example of the negative effect that U.S. economic policies can have on health (Mundinger, 1985). Funding cuts to health and social services during the Reagan administration resulted in 500,000 people losing their eligibility for Aid to Families with Dependent Children, 1 million people losing eligibility for food stamps, 600,000 people becoming no longer eligible for Medicaid, and the closing of numerous community health centers. "A broad range of negative effects occurred when the safety net was harmed," Williams said. For example, as more people had reduced access to care, there were increases in the incidence of low birth weight newborns, pregnant women with anemia, preventable childhood diseases, lead poisoning in children, and chronic diseases in adults. Williams reiterated the need to secure the safety net and emphasized the importance of monitoring policy changes and studying their effect on health, including health inequities. These data are needed to inform advocacy efforts for strengthening the safety net.

Understanding and Addressing Deeply Embedded Racism

One of the many ways that racism manifests is through negative stereotyping, Williams said. In a recent study, Williams and colleagues found that 52 percent of white individuals who work or volunteer with children perceived black adults as being prone to violence. With regard to other populations, 43 percent of these white adults endorsed this negative stereotype toward Hispanic adults, 29 percent toward American Indian adults, 29 percent toward Arab American adults, 10 percent toward Asian adults, and 22 percent toward other white adults (Priest et al., 2018). These white adults who work or volunteer with children were also asked about their beliefs regarding the tendency for violence by young children and teens of different races and ethnicities. Fewer of these white adults endorsed this stereotype for children. For example, 23 percent believed that black children under the age of 10 were prone to violence (16 percent toward Hispanic children, and fewer toward other subgroups). Williams shared a quote from an 1899 book by W. E. B. Du Bois in which Du Bois identifies an empathy gap, specifically, the indifferent attitude of the general population regarding the health and well-being of the black population as the single biggest challenge concerning racial inequities in health. A recent study suggests that this lack of empathy persists and is evident in early life (Dore et al., 2014).

Moving Forward

It is necessary to raise awareness of the inequities in society and health, Williams said, adding that research is needed to identify ways to "reduce the perception of inequities as politically contentious and polarizing." The stories of the disadvantaged need to be told in a compelling way that resonates with the public and fosters empathy. Finally, a strong science base is needed to make the case for addressing inequities in health and to garner the political will to effect change (Williams and Purdie-Vaughns, 2017).

DISCUSSION

The discussion period included several questions and comments about data—from exceptions from national life expectancy trends to the effects of the Patient Protection and Affordable Care Act (ACA) on life expectancy—and about structural factors and systems that affect population health trends.

A participant asked whether there are data to suggest that particular states or counties have been able improve on the life expectancy trends seen nationwide. Crimmins responded that there are regions that are outliers relative to the national trends. She referred participants to the work of Christopher Murray at the Institute for Health Metrics and Evaluation, who has identified "eight Americas" based on geographic and sociodemographic characteristics (see Murray et al., 2006). Areas that buck the trend tend to be wealthier or have better health or health behaviors. She suggested that the difference in trends is more related to different social and economic characteristics of an area and less to policies. As another resource for data on health and the determinants of health across all states, Williams referred participants to the work of Brian Smedley, Steven Woolf, and others with the Health Opportunity and Equity Initiative.[2]

Whitney Robinson of the University of North Carolina at Chapel Hill reiterated the point made by Williams about the importance of viewing the data through an intersectional lens. There are insights to be gained, for example, by considering immigrant versus nonimmigrant populations. She asked about variables by which to stratify the data (beyond sex/gender, race/ethnicity) in order to include intersectionality when evaluating these trends. Williams added that socioeconomic status and nativity status are also important to consider, and Crimmins noted that data on educational attainment are similarly valuable.

John Auerbach from Trust for America's Health noted that the passage of the ACA and the subsequent drastic reduction in the number of uninsured Americans was expected to improve health. He asked about data on health relative to whether a state chose to expand Medicaid under the ACA. Crimmins suggested that, based on the maps she discussed, the states that did not expand Medicaid appear to also be those that are the worst with regard to life expectancy. Williams agreed, but noted that a dramatic change in health would not necessarily be expected, even if the use of preventive services was improved. Access to quality care is essential, but medical care alone cannot solve the range of population health issues.

Based on the presentations, a participant said she understood that maternal outcomes were changing across all populations, and that she believed that biases in society were actually affecting all populations. She asked what agencies might do to demonstrate that what happens in some populations affects all populations over time. She also said that the connections between child health and adult health outcomes need to be communicated more effectively. Crimmins responded that research is being done on the link between early, mid, and late life, trying to better understand how early life shapes one's life course and aging trajectory. Williams added that both negative and positive early-life exposures affect biological functioning later in life. It is important to try to understand how these exposures accumulate over time to affect health outcomes. "Early-life exposures do affect adult health for all individuals, but they are not randomly distributed," he said, and he reiterated that health patterns are influenced by race, ethnicity, socioeconomic status, and immigrant status.

---

[2] See http://www.nationalcollaborative.org/our-programs/hope-initiative-project (accessed December 23, 2020).

3

Policy-Relevant Evidence for Population Health: Promise and Challenges

The second panel of the symposium considered the complexity of policy implementation with attention to mitigating negative unintended consequences for population health. Sandro Galea, dean and the Robert A. Knox Professor in the School of Public Health at Boston University, discussed four key challenges to generating the evidence needed to inform population health initiatives. Paula Lantz, associate dean for academic affairs and professor of public policy at the Gerald R. Ford School of Public Policy at the University of Michigan, discussed current definitions of population health and population health management, and the importance of targeting policy efforts upstream to address the fundamental drivers of population health inequities. Jennifer Doleac, associate professor of economics at Texas A&M University and director of the Justice Tech Lab, described ban-the-box policies and policies that increased access to naloxone as examples of how policy interventions can have unintended consequences. The panel was moderated by Allison Aiello, professor of epidemiology at the Gillings School of Global Public Health at the University of North Carolina. Highlights of this session are presented in Box 3-1.

CREATING POLICY-RELEVANT EVIDENCE

"There is a long tradition of population health interventions," Galea began. He briefly described an early intervention, a population-wide experiment done in the 1970s and 1980s in Finland, which took a population-level approach to lowering cholesterol and thereby lowering

BOX 3-1
Key Points Made by Individual Speakers[a]

- Four key challenges to generating policy-relevant evidence include failing to consider the external validity of interventions; failing to consider the effect of ubiquitous factors; thinking in dichotomies; and making predictions at the population level. (Galea)
- Population health is becoming medicalized as population health management. This is shifting the focus downstream from fostering health to treating sickness and from interventions at the population level to the individual level. (Lantz)
- A life-course approach is needed to better understand the drivers of health and health inequities, and interventions are needed both downstream and upstream. (Lantz)
- Human behavior is complicated, and not all policy initiatives will have the intended benefits. Policy implementation needs to include a plan for rigorous evaluation to understand benefits and costs. (Doleac)

[a] This list is the rapporteur's summary of the main points made by individual speakers and participants (noted in parentheses) and does not reflect any consensus among symposium participants, or endorsement by the National Academies.

mortality from coronary heart disease (CHD). As experiments in population health continue, there are challenges to generating policy-relevant evidence. Before discussing the challenges, he emphasized that there is an existing body of evidence to support population health interventions. As an example, he referred participants to the Centers for Disease Control and Prevention's (CDC's) Health Impact in 5 Years (HI-5) website, which is a repository of data from numerous current population health interventions.[1] He also drew attention to a recent report from the Yale Global Health Leadership Institute that summarizes the current state of evidence on the social determinants of health.[2] Galea then described four key challenges to generating the evidence that is needed to inform population health initiatives: external validity, ubiquitous factors, thinking in dichotomies, and making predictions.

---

[1] For more information about CDC's HI-5 initiative, see https://www.cdc.gov/policy/hst/hi5/interventions/index.html (accessed December 23, 2020). The HI-5 initiative "highlights nonclinical, community-wide approaches that have evidence reporting (1) positive health impacts, (2) results within 5 years, and (3) cost-effectiveness and/or cost savings over the lifetime of the population or earlier."

[2] See https://bluecrossmafoundation.org/sites/default/files/download/publication/Social_Equity_Report_Final.pdf (accessed December 23, 2020).

External Validity

The first challenge to generating policy-relevant evidence is the external validity of the intervention. Epidemiology has long favored internal validity over external validity, Galea said, but external validity is important when looking to implement evidence-based solutions to population health problems.

As an example of why external validity matters, Galea described a hypothetical study to determine if a particular intervention results in normal blood pressure levels (see Figure 3-1).[3] A population is selected and individuals are sorted to one of four subgroups: diseased and exposed to the intervention; diseased and unexposed to the intervention; not diseased and exposed; and not diseased and unexposed.

The first population studied has a risk difference of zero (i.e., there is no association between normotension and the intervention). A second population is sampled, and a risk difference of 0.33 is calculated (i.e., 33 additional cases of normotension for every 100 cases that receive the intervention). A third population is then studied, and the risk difference is calculated to be 0.10 (i.e., 10 additional cases of normotension for every 100 cases that get the intervention).

It is not uncommon for different samples to have different results, Galea said; there could be issues with the internal validity of the study (e.g., design flaws). However, different results are often related to the external validity of the study. The intervention alone does not result in normotension, Galea said. Rather, "the intervention needs to happen together with exposure to other conditions." He explained that a basic principle of epidemiology is that two causes of an outcome might both be necessary, but individually insufficient. This is why the different samples resulted in different outcomes. In this example, one cause is the intervention being applied. The other cause is often a population-wide factor or social condition that is not being measured. Neither alone results in normotension. Galea explained further that in the first population sample the social condition was absent, and no one developed normotension from the intervention as the other factor was absent. In the second and third population samples, 50 percent and 40 percent, respectively, had the social condition, and correspondingly achieved normotension.

In summary, Galea said, it is plausible to assume that there are co-occurring causes. The association between the intervention and the health outcome can only be understood by also understanding the other factors that influence the outcome, and how they vary across samples.

---

[3] For full details see Keyes and Galea (2014).

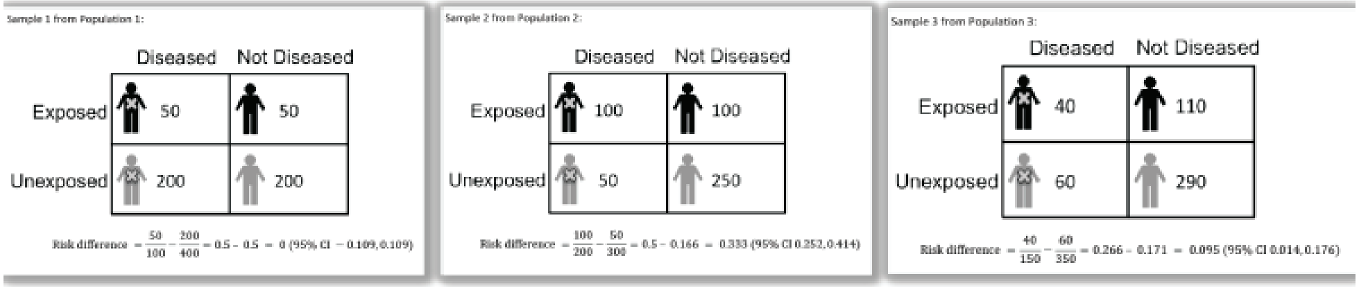


FIGURE 3-1 Sampling different populations to determine if a certain intervention has an effect on bringing blood pressure to normal levels.
SOURCE: Galea presentation, October 3, 2018.

Ubiquitous Factors

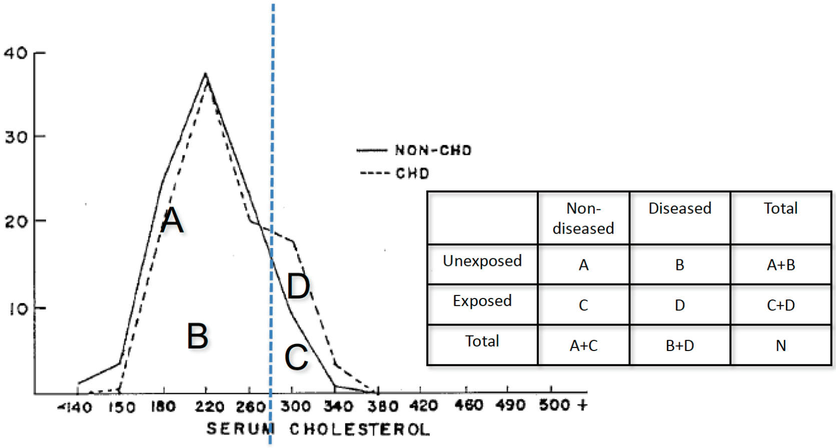
Populations are affected by the social forces that surround them. As they are ever present, it is easy to forget about these ubiquitous forces when designing studies, noted Galea. He listed several examples, including racism, gender inequity, income inequality, and lack of social cohesion. These factors can be difficult to see and difficult to measure, he said.

As an example of the errors that can happen when ubiquitous factors are ignored, Galea reminded participants of the early coverage of the risks of gestational crack cocaine in the 1980s. Despite early conclusions to the contrary, it later became clear that there was no difference in cognitive functioning between children exposed to crack cocaine in utero and children who were not exposed, Galea explained (Betancourt et al., 2011). The differences in cognitive functioning were likely caused by different levels of environmental stimulation. Many of the mothers who used cocaine while pregnant were also deeply poor, Galea noted, and poverty was a ubiquitous factor for these children that was not considered.

As another example, Galea asked participants to consider the extent to which one's cognitive ability is determined by one's genes versus being raised in a positive environment. He described a population in which some people have a gene for being "smart" (which might or might not manifest), some people are raised in an environment that fosters intellect (and they might or might not become smart), and some people happen to be smart despite lacking the genes or environment. He illustrated two scenarios that demonstrated that, when genes and environment both contribute to cognitive ability, it is not possible to determine what proportion of intellect is attributable to one's genes unless details about their environment are also known.

Thinking in Dichotomies

People "are used to thinking in dichotomies," Galea said, such as thinking in terms of disease versus no disease. He cautioned against thinking in dichotomies. To illustrate, he shared cholesterol data from the Framingham Study. (The study developed a CHD risk formula on the premise that high cholesterol increases risk.) As a result of the study, cholesterol screening is commonly done for many people, and actions are prescribed for those predicted to be at high risk (e.g., drugs, exercise). The Framingham data on serum cholesterol for people who do and do not develop CHD look quite similar (see Figure 3-2). Although one might wonder if the data or the risk equation are wrong, Galea explained that such confusion is because defining (high) cholesterol as a risk factor is dichotomizing. When the data curves are viewed relative to individuals who are diseased or nondiseased and exposed or unexposed, it becomes clear that exposure



	Non-diseased	Diseased	Total
Unexposed	A	B	A+B
Exposed	C	D	C+D
Total	A+C	B+D	N

FIGURE 3-2 Percentage distribution of serum cholesterol (mg/dl) in men aged 50–62 who did or did not subsequently develop CHD (from the Framingham Study).
SOURCES: Galea presentation, October 3, 2018; adapted from Rose, 2001, Figure 3. Geoffrey Rose's seminal 1985 paper *Sick Individuals and Sick Populations* examined the difference between interventions for individuals versus populations, explaining the greater benefits of preventive interventions at the population level (Rose, 2001).

to high cholesterol is a risk factor for CHD (see populations C and D in Figure 3-2). "A population health intervention approach should focus on shifting population curves," Galea said, but relative risk measures do not provide population level differentiation and curve separation (Pepe et al., 2004).

Making Predictions

Populations are complex systems that frequently behave in unpredictable ways, making it difficult to make predictions in population health, Galea said. He illustrated this by using another example from the Framingham Study. When genotype scores for diabetes (calculated based on 18 risk alelles) are plotted against the cumulative incidence of diabetes, it is clear that a higher genotype score is associated with a greater risk of developing diabetes (Meigs et al., 2008). Seeing this might make a person wonder what his or her genotype score is, Galea said. Galea then shared another graph from the same publication that compares genotype scores of those with diabetes and those without (genotype score versus percentage of subjects) in which the overlaid curves of those with and without diabetes are quite similar. "The distinction at the population level is not usefully predictive of who will have diabetes or not," Galea said. He elaborated on the mathematical limitations of prediction, cautioning that genetic prediction does not necessarily lead to disease prediction.

In studying the predictive capacity of particular genes, Galea and colleagues took into account the prevalence of genetic factors and the level of presence of environmental conditions (Keyes et al., 2015). They found that, at every level of gene prevalence, "the risk ratio ultimately is driven not by the gene itself, but by the environment, and by the likelihood of particular factors such as the background rate of disease." Specifically, "the risk ratio increases as the prevalence of the environmental factor increases," and "the risk ratio decreases as the background rate of disease increases." The forces are ubiquitous, he said, and shifting a ubiquitous factor leads to a shift in the population's health.

Principles of Population Health Science

In closing, Galea explained that these four challenges to creating evidence to inform population health policy fit into a larger set of principles of population health science (Keyes and Galea, 2016; see Box 3-2). Popu-

BOX 3-2
Principles of Population Health Science (as presented by Galea on October 3, 2018)

1. **Population health manifests as a continuum.**
2. The causes of differences in health across populations are not necessarily an aggregate of the causes of differences in health within populations.
3. Large benefits to population health may not improve the lives of all individuals.
4. The causes of population health are multilevel, accumulate throughout the life course, and are embedded in dynamic interpersonal relationships.
5. **Small changes in ubiquitous causes may result in more substantial change in the health of populations than larger changes in rarer causes.**
6. **The magnitude of an effect of exposure on disease is dependent on the prevalence of the factors that interact with that exposure.**
7. Prevention of disease often yields a greater return on investment than curing disease after it has started.
8. Efforts to improve overall population health may be a disadvantage to some groups; whether equity or efficiency is preferable is a matter of values.
9. **We can predict health in populations with much more certainty than we can predict health in individuals.**

NOTE: Challenges discussed are associated with principles in bold.
SOURCES: Galea presentation, October 3, 2018; Keyes and Galea, 2016.

lations are complex, and in generating evidence for population health policy there are few simple solutions, he concluded. There have been successful population-based interventions, he reiterated, and there is evidence to support interventions that work. The challenges to generating the evidence must be met to be able to meet the population health challenges described by Crimmins and Williams.

THE IMPERATIVE TO STAY UPSTREAM

Lantz began her presentation by referring to how Kindig and Stoddard (2003) define population health as health outcomes and their distribution within a population as being influenced by patterns of determinants over the life course. These determinants and outcomes are shaped by policies and interventions at both the individual and societal levels. There are many models of health determinants, Lantz said. The social ecological model of health determinants, for example, considers the factors that influence health and health equity from upstream to downstream, spanning the individual, interpersonal, organizational, community, and public policy levels. The World Health Organization conceptual framework for social determinants of health also shows the upstream structural determinants (e.g., the social and public policies that influence socioeconomic position).[4]

Interest in the social causes of health spans centuries, and Lantz shared a quote from Johan Peter Frank in a book published in 1790: “The diseases caused by the poverty of the people and by the lack of all goods of life are exceedingly numerous.” She suggested that the term *population health* really gained traction in 2007 with the development of the Institute for Healthcare Improvement Triple Aim framework. The Triple Aim calls for concurrent attention to improving patient care (i.e., quality), improving the health of the population, and reducing the per capita costs of care (Berwick et al., 2008).

There is a conflation of the fields of population health, public health, preventive medicine, population medicine, population health management, precision medicine, and precision public health, Lantz said, and those working in these fields often define and use these terms in different ways. Lantz said that a cursory search identified 63 institutes of higher education in the United States with degree programs, departments, or colleges of population health, population medicine, or population health management, each using the terms differently. Although different institutions have different definitions of population health and population health management, there are common themes, Lantz continued, includ-

---

[4] See http://www.who.int/sdhconference/resources/ConceptualframeworkforactiononSDH_eng.pdf (accessed December 23, 2020).

ing the concepts of public health and community engagement. Other themes include training and workforce issues, research, and services and products.

Lantz raised the concern that population health has become medicalized as population health management. She defined medicalization as a "process by which nonmedical, social issues become viewed as medical problems or individual pathologies." This medicalization is concerning because it shifts the focus of population health from health toward sickness, and it moves population health management downstream toward the individual level. Population health management is growing into a big business, she said, with an interest in providing services and products at the patient level. An Internet search of the phrase "population health management" returns a list of consulting groups and companies offering products and services that health care organizations and providers can purchase to better manage the health of the population they serve. In this regard, she raised concerns that the focus of research, interventions, and policy are also moving downstream to the individual level.

Shifting the focus of population health management to outcomes and individuals has implications for population health research and policy, Lantz said. One issue is denominator shrinkage as data are collected from smaller and smaller groups. There is also conflation of population health and population health management, and of health inequities and health care inequities. The framing of research problems, the targets of policies and interventions, and allocation of resources all move downstream. As such, macrolevel factors (including policy) that lead to population health issues and disparities are ignored. This is particularly concerning because, Lantz said, "When downstream efforts do not solve the problem, it reinforces notions that marginalized and disenfranchised subpopulations and their problems are intractable."

There is currently a lot of interest in screening patients for social determinants of health. Health systems, community health centers, and others are asking patients about their job status and whether they have a steady source of income, if they have concerns about paying their utility bills, and whether they feel unsafe in their home or neighborhood. On one hand, Lantz said, understanding the social situations and contexts of their patients can help clinicians provide better care. On the other hand, such screening can detect exposures and conditions that are beyond the resources of clinical care. Screening without the capacity to refer to appropriate interventions is ineffective, and may in some ways be unethical, Lantz said, as it "could create a lot of unfulfilled expectations and further mistrust of the health care system."

Another current area of research is identifying superutilizers of health care (e.g., the 5 percent of patients who account for more than half of health care costs) and applying interventions upstream to keep them healthier and reduce their need for services. Lantz emphasized the need for high-quality research in this area to fully understand the effects of the interventions. As superutilizers are extreme outliers, it is challenging to determine if improvement (reduction in service utilization) is attributable to the intervention being tested or whether it is simply the result of statistical regression toward the mean.

In closing, Lantz repeated her earlier statement that the health care system cannot solve the fundamental structural and social drivers of health inequities, and she summarized some of the major challenges. As discussed by Crimmins, life expectancy in the United States ranks 36th in the world and is declining. Forty percent of children in the United States live in poverty. Social and racial disparities persist in educational attainment and wealth. Mental health concerns and suicide rates are high among lesbian, gay, bisexual, transgender, queer and/or questioning youth and adults. Expanding on the Kindig and Stoddard definition, Lantz suggested that population health is the "physical, mental, and social well-being in an entire population." A life-course approach is needed to better understand the drivers of health and health inequities, and interventions are needed both downstream and upstream. She acknowledged that working upstream, where the fundamental drivers of social and health inequities stem from, is much more challenging.

POLICY EVALUATION AND THE RISK OF UNINTENDED CONSEQUENCES

Despite the best of intentions, there are often unintended consequences of policy interventions. Doleac discussed two examples: the ban-the-box policies and the efforts to broaden access to naloxone.

Ban-the-Box Policies

Ban-the-box policies are intended to help individuals with criminal records obtain employment. Specifically, the policies prohibit employers from asking about an applicant's criminal record until later in the hiring process (i.e., the policies ban including a box to check on a job application if one has a criminal history). Doleac noted that cities, counties, and states across the country have implemented ban-the-box policies.

A key issue with ban-the-box policies is that they do not address employers' concerns about hiring people with criminal records. When unable to ask directly on the application, employers who are reluctant to hire people with criminal records might resort to guessing, Doleac said. There are large racial disparities in the U.S. criminal justice system, she noted, and employers attempting to guess which applicants have a criminal record might simply avoid interviewing and hiring applicants from groups more likely to have recent convictions (e.g., young black men). "This policy then has the potential to effectively broaden discrimination to the entire group rather than reducing it," Doleac said. This potential consequence was raised by economists when ban-the-box policies were first proposed, she added, but the counter argument given was that racial discrimination is illegal (i.e., people would not engage in illegal conduct).

Doleac described two recent studies investigating the effect of ban-the-box policies. Agan and Starr (2018) submitted thousands of job applications from fictitious applicants of various races and criminal histories before and after ban-the-box policies were implemented in New Jersey and New York City. They found that before the policies were implemented, applicants with criminal histories were called back at much lower rates than those with no criminal history, but the racial gap between black and white applicants in both groups was small. After implementation of policies, they observed a six-fold increase in racial disparities in applicant callbacks. These data suggest that, in the absence of the criminal history checkbox, employers were using information on race as a proxy for the likelihood of having a criminal record, Doleac said. She noted that because the applicants were fictitious and the study only looked at callback rates, it is also important to understand the real-world consequences of ban-the-box policies on racial disparities in employment.

A study by Doleac and Hanson took advantage of the gradual rollout of ban-the-box policies as a natural experiment that allowed them to measure those real-world effects.[5] They found that implementation of the policies reduced the probability of employment for young black men by 3.4 percentage points (5.1 percent). She added that the effect increases over time (i.e., it is not a short-term blip attributable to implementing the new policy). This is potentially "a major, long-term effect on employment for a group that was already struggling in the labor market," she said.

Broadening Naloxone Access

Opioid-related mortality has increased across the United States, Doleac said, and many states have broadened access to the opioid antagonist, naloxone, in an attempt to mitigate the deadly consequences of opioid abuse. There are a range of approaches to expanding access, from standing orders that allow a pharmacy to dispense without a patient having a prescription to distribution by community groups.

---

[5] A preprint is available at http://jenniferdoleac.com/wp-content/uploads/2018/08/Doleac_Hansen_JOLE_preprint.pdf (accessed December 23, 2020).

Evidence from the field of economics has shown that a reduction in the risk associated with a particular behavior can lead to an increase in that behavior, Doleac said. A classic example is the relationship between the implementation of seatbelts in vehicles and an increase in unsafe driving (as drivers felt they were now less likely to die if they had an accident). There are also studies that suggest that the availability of life-saving HIV medication was associated with increased risky sexual practices and the incidence of other sexually transmitted diseases. These moral hazard effects can counter some of the beneficial effects that are intended from these policies, she said.

In Doleac's study of laws that gave broader access to naloxone, her and her coauthor's research suggests that the laws may have made people more likely to abuse opioid drugs or to use more potent opioids (e.g., fentanyl). Doleac also raised concerns that people might be less careful about the source or the content of the heroin they use, potentially resulting in more overdose deaths instead of fewer.

Similar to the design of the ban-the-box study, Doleac and her colleagues made use of the gradual implementation of naloxone access laws across the United States to measure the effects of the policies on a set of outcomes related to opioid abuse. She noted that outcomes such as mortality and emergency department admissions are readily measurable, but it is more challenging to develop a picture of changes in risky use of opioids. She shared data from the Midwest that shows that opioid- and fentanyl-related mortality were both fairly steady in the year or so prior to implementation of expanded naloxone access policies. After the laws went into effect, however, mortality rates associated with use of both drugs increased (Doleac and Mukherjee, 2018).

Pushback and Controversy: The Challenges of Delivering Bad News

Following the publication of the results of the ban-the-box and naloxone access studies, Doleac and colleagues faced a wide range of reactions. There was pushback against the ban-the-box study from advocates, she said, and there was much discussion about the research methodology. With regard to the naloxone access study she said that, while she expected the findings would be controversial, she was taken aback by the viciousness of some of the criticism, especially from the public health community. She added that the conversation was different than the one researchers had had with the criminal justice advocacy groups regarding ban-the-box policies.

Doleac shared a sampling of the comments about the studies that were posted or published on blogs, social media (especially Twitter), and online news sources, as well as in mainstream publications. Many comments were sincere efforts to understand the methodology, and she noted that others in the economics community joined the conversation to attempt to explain the types of research methods economists use to those less familiar with them. There were discussions of correlation versus causation. Some people expressed fear that policy makers would respond to the findings by reversing the broadened naloxone access policies. Some comments were simply inflammatory. Ultimately, Doleac and Mukherjee posted a response addressing the criticisms and concerns. In the response they emphasized that "academics have a responsibility to facilitate accurate interpretations of their research" and that they "don't agree that academics should quash research results that don't fit the narrative of one advocacy group or another."[6] She added that the response from policy makers and practitioners was gratifying in that they recognized that "even worthwhile policies involve cost as well as benefits."

Moving Forward

In closing, Doleac emphasized the need to rigorously evaluate policy initiatives because not all of them will meet expectations. Many efforts in public health, education, criminal justice, and other areas will not have the intended effects because human behavior is complicated. "Be humble and aim to fail quickly," she said, and keep trying because there are solutions to these problems. "Even worthwhile policies involve trade-offs," she continued. There are costs, and rigorous evaluation helps to clarify the costs relative to the desired benefits and to possibly mitigate those costs. Finally, implementation should include a plan for evaluation, she said.

DISCUSSION

Tim Bruckner of the University of California, Irvine, commented that he has observed academic researchers downplaying potentially controversial study findings about the benefits or lack thereof of implemented policies. When pressed as to why, he said some expressed concern about how decision makers opposed to the policy might use the results. Bruckner asked how population health professionals can move forward on difficult issues while being respectful of academic discourse. Doleac added that she has heard from junior researchers in public health who are so concerned about backlash they might experience from publishing

---

[6] Quoted text presented by Doleac is taken from the response that is posted on the Institute of Labor Economics Newsroom webpage and is available at https://newsroom.iza.org/en/archive/research/the-moral-hazard-of-life-saving-innovations-naloxone-access-opioid-abuse-and-crime (accessed December 23, 2020).

their research that they consider abandoning it or not publishing. “There is a cultural norm here that needs to change,” she said. Researchers need to be able to discuss study findings even if they are not what they (or the field) anticipated.

In response, Jeffrey Levi of The George Washington University referred to the presentations by the first panel of the symposium and said that they demonstrate that the field of population health is willing to acknowledge that there are problems and to discuss current findings that are not ideal. He also suggested that the association between the availability of HIV medication and risky sexual behaviors mentioned by Doleac is not commonly accepted, and wondered what other explanations might be plausible for the increased opioid mortality rates observed after implementation of expanded naloxone access. Galea responded that the specifics of the studies presented by Doleac were better addressed in a separate discussion. Instead, he said that a key takeaway from her presentation for him was the need for tolerance in discussions about potentially controversial studies. He also said it would be a disservice to the public to not attempt to explain the complexities of the research. He observed that public health, as a scholarly community, is often conflating scholarship with advocacy.

Joshua Sharfstein of John Hopkins University agreed with the need for respectful dialogue and added that serious academic critiques should not be discounted as invalid or simply as an affront from advocates because they question the findings. He mentioned, for example, a naloxone study done at Boston University that had a strong design and was peer reviewed; it found a significant reduction in opioid mortality after broadened access (Walley et al., 2013). There is “a real evidentiary discussion that can be had respectfully,” he said. Galea agreed that dialogue is needed and should be encouraged, but he also repeated his concern that there are increasing “instances of conflating what should be a scientific discussion with what might suit an advocacy agenda.” Doleac emphasized that she and her coauthor are very open to serious academic discussions about the methodology, especially conversations across the disciplinary lines of health and economics.

Levi also felt that the discussion about health care turning attention to the social determinants of health was unnecessarily negative, as health care has resources, access to people, and political clout that are useful to population health. He mentioned, for example, that accountable communities for health focus on upstream factors. He felt that downstream attention to population health in the form of population health management was positive. Lantz said she agreed but reiterated her concerns about the monetization and medicalization of population health. She clarified that she is not against population health management, but rather, she was emphasizing the need for continued attention to upstream factors that shape health.

Philip Alberti of the Association of American Medical Colleges raised the need to engage the community and end users in the development and evaluation of population health policies. He observed that policy makers often fail to anticipate unintended consequences or to consider other outcomes that might be relevant to stakeholders beyond the health field. Doleac agreed that academic researchers need to expand beyond their silos, policy makers need to take research findings into account, and input from the community is needed to inform research and policy making. Galea, referring to the prior discussion, underscored both the value of discussion among the experts who have the knowledge and expertise to understand the methodological nuances and complexities of the issues, and the value to "being responsive to and sensitive to contemporary concerns" to ensure that policies are relevant to the community. These are not necessarily contradictions, he said.

4

Effective Population Health Policy and Science: Finding Common Ground

The final panel of the symposium focused on finding common ground to move population health forward. Joneigh Khaldun, director and health officer for the City of Detroit Health Department and emergency room physician, provided a local-level perspective. Rahul Gupta, state health officer and commissioner of the West Virginia Department of Health & Human Resources Bureau for Public Health and internist, shared his state-level perspective. A viewpoint from the federal level was given by Ellen Marie Whelan, chief population health officer at the Center for Medicaid and Children's Health Insurance Program (CHIP) Services at the Centers for Medicare & Medicaid Services (CMS) and pediatric nurse practitioner. The panel was moderated by Joshua Sharfstein, vice dean for public health practice and training at the Johns Hopkins Bloomberg School of Public Health. (Highlights of this session are presented in Box 4-1.)

FINDING COMMON GROUND

To start the panel discussion, Sharfstein asked the participants to comment on how they establish common ground for progress at their respective institutions. Khaldun said that public health in Detroit has seen a lot of transition recently (with at least five health commissioners over the past decade). As the current Detroit health commissioner, she has been focused on the public health ecosystem, working to identify the players (e.g., hospitals, emergency medical services, police, schools) and their strengths and needs. The focus has been on bringing people together, aligning around

BOX 4-1
Key Points Made by Individual Speakers[a]

- Building trust and credibility with the communities being served is essential. The foundations of trust and credibility are accountability, transparency, and a data-driven approach to action. The needs of the community should inform the direction of scientific inquiry, which, in turn, drives policy. (Gupta)
- An ecosystem approach to population health identifies the strengths and needs of all of the stakeholders (both within and outside the health sector) and aligns around common goals to fill gaps. (Khaldun)
- There is a need for a better understanding of the total cost of care, beyond the costs of health care. (Whelan)
- There are two approaches to advancing population health that are not mutually exclusive: finding common ground to work together, and exerting the power of public health (e.g., regulatory authority, political power). (Sharfstein)

[a] This list is the rapporteur's summary of the main points made by individual speakers and participants (noted in parentheses) and does not reflect any consensus among symposium participants, or endorsement by the National Academies.

common goals, and identifying and filling gaps. She noted that Michigan has a diverse population and, although the city of Detroit does not fully reflect the rest of the state demographically, initiatives in Detroit significantly affect overall outcomes for the region and the state.

Gupta said there is an art to public health that complements the science. Having been a local health officer for 6 years and then a state health officer for about 4 years, he emphasized the importance of building trust and credibility within the communities the department serves. The foundations of trust and credibility are accountability, transparency, and a data-driven approach to action. He likened the latter to showing the community their reflection in the mirror. To begin to understand the opioid epidemic in West Virginia (which still ranks as first in the United States for opioid overdose deaths) the health department initiated a "social autopsy."[1] Together with several other agencies in the states, they collected data to develop a more complete picture of the individuals who died, and to then identify themes across the population. Information was gathered not only on the medical cause of the drug-related death, but also on the person's employment status, educational attainment, health insur-

---

[1] One of the earliest uses of the term was in the 2002 work of sociologist Eric Klinenberg, titled *Heat Wave: A Social Autopsy of Disaster in Chicago*.

ance status, marital status, incarceration status, and a range of other social factors that make up the whole individual. An opioid response plan was developed, and the process was open to the public for comment, Gupta continued. Nearly 500 comments were submitted online (the de-identified comments are posted for the public to see), and a public meeting was held. Within months, he said, a policy was drafted, and laws were passed. "The bottom line," he repeated, "is transparency, accountability, and a data-driven approach that now several other states and local jurisdictions are also following."

In her role as chief population health officer at a federal agency, Whelan said she looks at the range of population health management. With regard to finding common ground, she said there are several points for which there is general agreement. First, most agree that the fee-for-service approach to health care results in the receipt of services that are paid for, but it does not create a healthier population. Second, there is broad agreement that there are limited resources, and the amount of resources is not going to increase. Maximizing the available resources is essential. Third, there is agreement that spending is not necessarily associated with better outcomes.

Having worked in both the current and prior administrations, she said that approaches to moving population health forward span the political spectrum, and there are many approaches that are not partisan. The Center for Medicare & Medicaid Innovation (CMMI) was created by the Patient Protection and Affordable Care Act to identify different models of care delivery and payment that would be more effective than the fee-for-service model. One model, for example, is the accountable care organization. Another model, the bipartisan Medicare Access and CHIP Reauthorization Act of 2015, moves Medicare away from the fee-for-service model to a quality-based payment model. Whelan noted that the secretary of the Department of Health and Human Services has identified value-based health care as one of his top four priorities.

There is an array of approaches aimed at paying for outcomes, and the intent of payers and health systems is to maximize health through the health care delivery system. As an example, Whelan said that health insurers are spending hundreds of millions of dollars on housing for covered individuals because they have come to understand the effect housing has on achieving improved health outcomes.[2]

---

[2] Whelan referred participants to a *Forbes* article. See https://www.forbes.com/sites/brucejapsen/2018/08/14/to-keep-you-healthy-health-insurers-may-soon-pay-your-rent/?sh=36c3142867ce (accessed December 23, 2020).

STAKEHOLDER ENGAGEMENT

Sharfstein asked panelists how they engage their audiences at the city, state, and federal levels as partners in population health efforts. As an example, Khaldun described the unintended teen pregnancy challenge that was launched in the city of Detroit (where a teen is 2.5 times more likely to become pregnant than a teen across the rest of Michigan). Over a 2-year time span, all of the long-acting reversible contraceptive providers in Detroit were contacted and asked about their practices, including which products they prescribe as well as which they do not have access to, their office hours, the types of insurance they take, and challenges in serving the teen population in need of contraceptives. A campaign was launched to educate the community and to connect them to a network of providers. A hotline was established, as well as a health department clinic that is open after hours and on weekends. All patients are seen by providers, regardless of insurance status, she said. Because Detroit lacks a robust transportation system, the health department provides transportation through Lyft. This fits in with the overall approach of looking at the entire ecosystem and filling the gaps where needed, she said.

Gupta said that the state of West Virginia's approach is results oriented. Process is important, he said, but one can get bogged down in the process and lose sight of the goals. As an example of engaging the population, he discussed the Management of Maternal Smoking (MOMS) program. Smoking is a significant health concern in Appalachia, particularly in West Virginia. The rate of smoking during pregnancy in West Virginia was about 29 percent compared to about 8 percent nationally, he said. The rate of smoking among pregnant women on Medicaid was about 42 percent. Rates were even higher in counties in southern West Virginia, where nearly half (49 percent) of pregnant women were smoking. The MOMS program engaged federal, state, and local stakeholders in planning. The program includes education and training for providers, universal screening of women, connecting women to the Tobacco Quit Line, a text-to-mom program that sends reminders, and an evaluation of the payment policies of the state's Medicaid partners. He said that 2 years after the launch of the program, data from the Centers for Disease Control and Prevention's (CDC's) Pregnancy Risk Assessment Monitoring System show a nearly 25 percent reduction in smoking among pregnant women (from about 29 percent to about 22 percent). Engaging stakeholders, patients, and providers as partners is important, he said, as is developing clear goals for the outcomes desired so that programs can have a long-lasting effect.

Sharfstein asked Whelan what incentives might encourage health care, such as Medicaid programs, to be more engaged in the structural issues underlying health (e.g., employment, environmental conditions, access to food). Whelan referred to two CMMI models that are working to bridge the community and clinical care aspects of health. The accountable health communities model is funding bridge organizations that refer people to community services. Data are being collected to determine how referral on social issues influences health care costs. The Integrated Care for Kids model was just announced and will also collect data on how supporting upstream identification and treatment efforts for children affects costs and quality of care. She noted that, by law, all CMMI models must be rigorously evaluated. States are also taking creative approaches and are looking to measure outcomes of value, she said, including metrics such as school readiness or reading by third grade. In that regard, Sharfstein referred participants to a roundtable workshop on education metrics and population health.[3]

Looking beyond the health care sector, Sharfstein asked panelists how they communicate and engage with the business sector about solving community health problems. Gupta emphasized having an agenda that is data driven and working to understand the needs of the community being served and the issues that drive stakeholders. Public health agencies "can no longer afford to exist in a vacuum," he said. As an example, he described the development of clean indoor air regulations in West Virginia. In listening to the stakeholders, the Kanawha-Charleston health department gained an understanding of the root causes of resistance by businesses owners to these types of policies. Providing the right assistance to business owners led them to embrace the clean indoor air policies. Khaldun agreed with the need to genuinely engage the community in the development of population health programs and policies. The community "may not have the evidence, they may not be as articulate, they may not have a degree," she said, but they understand the challenges the community is facing and should thus be equal partners in creating solutions. To garner community support it is important to be able to describe real, tangible benefits that programs are designed to achieve, she said. Communication across stakeholders needs improvement, and public health needs to learn to speak the language of the stakeholders when engaging, she continued.

DATA NEEDS

Sharfstein asked panelists to comment on what might help them move their work forward. Khaldun emphasized both the need to listen to

---

[3] Information about the workshop is available at http://nationalacademies.org/hmd/Activities/PublicHealth/PopulationHealthImprovementRT/2018-JUN-14.aspx (accessed December 23, 2020).

the community and the need to recognize that there is politics in everything. Having the evidence is necessary but not sufficient for success. It is important to consider the stakeholders. Public health educators need to help their students understand politics, policy, and how to engage with policy makers, she said. Policy makers are less interested in large meta-analyses and more interested in human stories, real outcomes, and how a policy will benefit them or their constituents. Gupta said that academic partners in population health can help to address the research gaps. For example, there is a great need for research on the opioid crisis. The needs of the community should inform the direction of the scientific inquiry, which, in turn, drives policy.

Whelan urged those in population health to find opportunities to partner with the health care delivery system. She noted that CMS has been working to develop in-house partnerships by reaching out and working with colleagues at the Health Resources and Services Administration and CDC.

DISCUSSION

Responding to the needs of communities and patients, Terry Allan of the Cuyahoga County Health Department raised the issue of dealing with politics in the midst of a crisis (e.g., the Flint, Michigan, water crisis or the Elk River, West Virginia, chemical spill). Khaldun said that a key lesson from these situations is the need to really listen to people's concerns and focus on the facts and the science while still being respectful of the community. Gupta noted that the chemical spill in 2014 resulted in 300,000 people in 9 West Virginia counties having contaminated drinking water. The first lesson in these situations, he said, is "Never let crises go to waste," but seize the opportunity to make changes; in this case, enacting stronger clean water policies to protect the public's health. The second lesson is that meaningful work can sometimes put one at risk of losing his or her job, but it is important to not let that stand in the way of doing what is right for the public.

Lih Young noted the challenges of creating real change that improves people's well-being. She asked about mechanisms of accountability and ways to ensure that programs are effective, have value, and are actually meeting the needs of the intended recipients. Khaldun said that silos and competition impede the ability to deliver change in public health. In a given city there will often be different hospital systems competing for the same patients or for the same grant funding. In addition, when programs evaluate their effectiveness, they are often evaluating a specific population, and it is not known whether those with the highest need are being served. She said that aligning programs, identifying the gaps, and sharing data across health systems and with public health will help to generate better accountability and understand effectiveness. Whelan noted that there is now a dataset for Medicaid that provides an opportunity to compare data across states and link health data with the services an individual receives, such as the Special Supplemental Nutrition Program for Women, Infants, and Children or Early Head Start. Previously, this was not possible as every state was collecting data differently. However, all states are now collecting data in a standardized format. One of the underlying issues, Gupta added, is that there is a thriving "medical industrial complex" that can be at odds with the creation of health and well-being. Social determinants also come into play, and he emphasized the need to focus upstream on prevention of adverse health outcomes.

Engaging Health Care Providers in Population Health

A participant said that, as payment systems are changing, providers will be paid to keep people healthy. Unfortunately, health care providers are often unaware of the work of public health professionals that can help them achieve this goal (e.g., convening community stakeholders). He asked how the public health profession could reach out to the health care professions more effectively to work together on solutions that foster health. Instead, he said, providers reach out to public health management consultants for cost-control measures. There are missed opportunities, Gupta said, and in some cases, there are disincentives. As an example of a missed opportunity, he said approximately 9,000 inmates in West Virginia have substance use disorder. Public options for intervention are not available in prisons and across the country—only about 150 of approximately 5,000 prisons offer some type of treatment for substance use disorder. This is a large population that is not receiving treatment or vocational education to prepare them for reentry into communities.

Khaldun said population health needs to be better able to persuade decision makers of its value (including speaking the other stakeholder's language) and to simply be bold and insert itself into the process. As an example, she said that during the hepatitis A outbreak in southeast Michigan, she engaged all of the Detroit emergency departments to urge them to start screening and vaccinating the most vulnerable people (e.g., the homeless or those with substance use disorders, who often end up in the emergency department). Public health provided support for providers, making it as simple as possible for them to acquire vaccines, necessary refrigerators, and so on. All of the emergency departments in Detroit are screening and vaccinating for hepatitis A now, she said.

Sharfstein observed that there are two schools of thought about how population health can assert and insert itself. One approach is to speak a common language and find common ground to work together. The other approach uses power to accomplish goals, including regulatory authority, orders of the health commissioner, and political power. These two approaches are not mutually exclusive, he said. Public health has power, and in the examples discussed, people have not been afraid to use it.

Rural Health

Joni Nelson of the James B. Edwards College of Dental Medicine at the Medical University of South Carolina pointed to the challenges of addressing rural health disparities and added that certain policies may hinder rural health outcomes. Gupta said the fact that many rural communities still do not have broadband Internet connectivity is a significant challenge that needs to be addressed. Some physicians in West Virginia still receive health alert network advisories via fax machine. Access to high-speed Internet is needed for rural areas across the nation to take advantage of telemedicine. Building Internet connectivity is as important as building roads. To address health inequities, rural and frontier areas need to be brought into the twenty-first century, he said, adding that there are rural areas in West Virginia that still do not have clean drinking water. It is necessary to identify the root causes behind why small water systems cannot be adequately maintained.

Khaldun reiterated that Detroit is geographically large and lacks a robust transportation system. As such, one way they are approaching public health in Detroit is to bring services into the community. It should not require a day off from work and travel on three busses to come to the health department, she said. Mobile strategies based in neighborhoods meet people where they are, and this approach aligns with rural work as well.

Whelan added that CMS now has a rural health strategy. When addressing any issue, it is also necessary to consider what differences there might be for frontier areas. CMS has a learning collaborative of rural states that facilitates the sharing best practices. CMS, as the convener, can help rural health agencies determine how to maximize their efforts. Payment models for rural hospitals can also be unique. CMS is working with rural hospitals that are struggling with volume and expertise to help them transition toward more value-based purchasing.

Investing in Children

Sanne Magnan of HealthPartners asked about building common ground for policies and investment in very young children. Investing in children is an area where a lot of common ground exists, and few would disagree that it is necessary, Whelan said. One of the barriers to progress is that children are not expensive from a health care perspective. When seeking to invest for the most cost benefit, investing in children does not generate much near-term savings. The challenge is to change the discussion to focus on the long-term implications (perhaps decades away) of focusing on early childhood areas. She suggested taking a multigenerational approach, investing in both the child and the family at the same time. Another approach is to work with employers who are purchasers of health care and show them how investment in the health of a child has implications for the parents who are their employees, as well as for growing an able workforce in the long term. The argument must be made that intervention early on can have longer-term returns.

Khaldun agreed that common ground exists for investing in children. An issue, however, is that society overall lacks demonstrated compassion for poor and minority children. For example, does society believe a black child in Detroit is as important as a white child living elsewhere in the state? Clearly, they are equally important, and it is important to "bring that humanity to all of society," she said.

In West Virginia, the decline in teen pregnancy is attributable not only to access to services, but it is also a multigenerational issue, Gupta said. Women who used contraception are now mothers themselves and pass that knowledge to their teens. He also suggested the need to move children's health initiatives further upstream to before a woman is pregnant, addressing issues such as adverse childhood experiences from a multigenerational standpoint. A participant agreed that taking a life-course approach shows how much needs to be done before a child is born. In many states, a woman becomes eligible for Medicaid when she becomes pregnant and becomes ineligible 6 weeks after giving birth. This policy "treats women as a vessel for delivering babies with no concern for their health in the long run," he said. To ensure healthy babies there also needs to be attention to the prepartum and intrapartum periods. He noted that South Carolina now pays for group prenatal care.

Sharfstein noted that there are important opportunities for public health to draw attention to these issues. The evidence of profound injustice abounds, particularly as it affects children (e.g., the effect of immigration policies).

Priorities

To close the session, Sharfstein asked panelists to suggest the most promising areas on which to focus over the next 5 to 10 years. Population health is a multigenerational issue, Gupta said, and urgent action is needed because the next generation is at risk. Premature birth, neonatal abstinence syndrome, and smoking during pregnancy, for example, have lifelong ramifications for an individual from the moment they are born. For the medium term, Gupta said that obesity, tobacco, and substance use and mental health should be priorities. For the long term, policy approaches are needed that move away from medicalization and toward a population health approach.

Whelan said a better understanding of total cost of care is needed. Most of the focus has been on the costs of health care and shared savings based on the cost. Total cost of care is a broader circle, and might include, for example, the cost of using meals-on-wheels to decrease social isolation and food deserts. As another example, how might initiatives that increase school success factor into the total cost of care for children? It is also necessary to understand the total cost of care and improvement over time. What are the longer-term implications of an intervention, not just for the following 30, 60, or 90 days, but after 5 or 10 years?

Khaldun agreed and added the need for enhanced accountability. She suggested that funds need to be withdrawn if broader community health or population health outcomes do not improve. “Incentives have to be aligned with accountability,” she said.

5

Closing Remarks[1]

In the final session of the joint National Academies of Sciences, Engineering, and Medicine and Interdisciplinary Association for Population Health Science (IAPHS) symposium, David Kindig, emeritus professor of population health sciences at the University of Wisconsin–Madison, reflected on the discussions and shared his perspective on the primary challenge for population health going forward.

More than two decades ago, Kindig published a book on population health improvement in which he said he "laid out a very ambitious timeline for research, debate, and implementation in several phases." A key principle of the book, Kindig said, was that "population health improvement will not be achieved until appropriate financial incentives are aligned for this outcome" (Kindig, 1997). Reflecting on the current state of population health he acknowledged that there have been accomplishments, including a recognition of the importance of health equity and the role of social determinants of health, but there is much still to be done, he said.

The Roundtable on Population Health Improvement has highlighted resources, goals and metrics, science-informed interventions, policies, communication and movement building, and partnerships as key drivers of population health improvement. However, finances loom large, and

---

[1] The comments in this section refer solely to remarks made by David Kindig of the University of Wisconsin–Madison and are not necessarily endorsed or verified by the National Academies of Sciences, Engineering, and Medicine, and they should not be construed as reflecting any group consensus.

Kindig referred to his prior work in which he said that *the* key population health question to be addressed is the following:

> In a resource-limited world, what is the optimal national and local per capita investment, and policy strength across sectors (health care, public health, health behavior, social factors, physical environment) for improving overall health and reducing disparities?

Referring to the comments by Whelan (see Chapter 4) about the need to understand the total cost of care (beyond the cost of health care), Kindig said that the total health budget required is unknown. The figures provided by the Centers for Medicare & Medicaid Services Office of the Actuary report on health care spending, he said. A complete health budget, he continued, would include adequate resources for public health, as well as a share of investments in other sectors that have a role in promoting health (e.g., education, housing, economic development). He acknowledged that there are many challenges to developing such a budget.

The roundtable mission states that population health improvement, including health equity, will require more robust national and community-based actions and dependable resources.[2] To develop more dependable streams of financial resources, Kindig said that it is necessary to move beyond grants and short-term appropriations. He mentioned the funding of crop subsidies, mortgage interest deductions, and Medicare medical education payments as examples of dependable funding formulas. He also called on the population health sector to use its political clout to support resource allocation for other sectors that affect health (as mentioned above, early childhood support, economic development, housing). Kindig referred participants to a publication (Kindig, 2015) in which he challenged the population health field to move from benchmarks based only on health determinants (e.g., smoking, poverty rates) to benchmarks based on investments in health (e.g., per capita investment to achieve determinant benchmarks).

In closing, Kindig drew attention to an electronic survey about future population health research priorities for IAPHS meeting attendees to

---

[2] The roundtable mission, as described on the roundtable webpage at the time of the joint symposium, was:

> to catalyze urgently needed action toward a stronger, more healthful, and more productive society. The roundtable will therefore facilitate sustainable collaborative action by a community of science-informed leaders in public health, health care, business, education and early childhood development, housing, agriculture, transportation, economic development and nonprofit and faith-based organizations.

respond to.[3] Results would then be summarized in a presentation on the final day of the IAPHS meeting.

---

[3] The survey can be viewed at https://iaphs.org/population-health-survey (accessed July 27, 2020).

Appendix A

References

Agan, A., and S. Starr. 2018. Ban the box, criminal records, and racial discrimination: A field experiment. *Quarterly Journal of Economics* 133(1):191–235.

APA (American Psychological Association). 2016. *Stress in America: The impact of discrimination*. Stress in America Survey. https://www.apa.org/news/press/releases/stress/2015/impact-of-discrimination.pdf (accessed December 23, 2020).

APA. 2017. *Stress in America: The state of our nation.* Stress in America Survey. https://www.apa.org/news/press/releases/stress/2017/state-nation.pdf (accessed December 23, 2020).

Berwick, D. M., T. W. Nolan, and J. Whittington. 2008. The Triple Aim: Care, health, and cost. *Health Affairs (Millwood)* 27(3):759–769.

Betancourt, L. M., W. Yang, N. L. Brodsky, P. R. Gallagher, E. K. Malmud, J. M. Giannetta, M. J. Farah, and H. Hurt. 2011. Adolescents with and without gestational cocaine exposure: Longitudinal analysis of inhibitory control, memory and receptive language. *Neurotoxicology and Teratology* 33(1):36–46.

Brody, G. H., T. Yu, E. Chen, G. E. Miller, S. M. Kogan, and S. R. Beach. 2013. Is resilience only skin deep? Rural African Americans' socioeconomic status-related risk and competence in preadolescence and psychological adjustment and allostatic load at age 19. *Psychological Science* 24(7):1285–1293.

Brody, G. H., M. K. Lei, D. H. Chae, T. Yu, S. M. Kogan, and S. R. H. Beach. 2014. Perceived discrimination among African American adolescents and allostatic load: A longitudinal analysis with buffering effects. *Child Development* 85(3):989–1002.

Case, A., and A. Deaton. 2015. Rising morbidity and mortality in midlife among white non-Hispanic Americans in the 21st century. *Proceedings of the National Academy of Science of the United States of America* 112(49):15078–15083.

Class, Q. A., A. S. Khashan, P. Lichtenstein, N. Långström, and B. M. D'Onofrio. 2013. Maternal stress and infant mortality: The importance of the preconception period. *Psychological Science* 24(7):1309–1316.

Doleac, J., and A. Mukhrjee. 2018. *The moral hazard of life-saving innovations: Naloxone access, opioid abuse, and crime.* IZA Discussion Paper 11489. http://ftp.iza.org/dp11489.pdf (accessed December 23, 2020).

Dominguez, K., A. Penman-Aguilar, M. H. Chang, R. Moonesinghe, T. Castellanos, A. Rodriguez-Lainz, and R. Schieber. 2015. Vital signs: Leading causes of death, prevalence of diseases and risk factors, and use of health services among Hispanics in the United States—2009–2013. *Morbidity and Mortality Weekly Report* 64(17):469–478.

Dore, R. A., K. M. Hoffman, A. S. Lillard, and S. Trawalter. 2014. Children's racial bias in perceptions of others' pain. *British Journal of Developmental Psychology* 32(2):218–231.

GBD (Global Burden of Disease) 2015 Maternal Mortality Collaborators. 2016. Global, regional, and national levels of maternal mortality, 1990-2015: A systematic analysis for the Global Burden of Disease Study 2015. *Lancet* 388(10053):1775–1812.

Hamilton, T. G., and T. L. Green. 2018. From the West Indies to Africa: A universal generational decline in health among blacks in the United States. *Social Science Research* 73:163–174.

Ho, J. Y. 2017. The contribution of drug overdose to educational gradients in life expectancy in the United States, 1992–2011. *Demography* 54:1175–1202.

Ho, J. Y., and A. S. Hendi. 2018. Recent trends in life expectancy across high income countries: Retrospective observational study. *BMJ* 362:k2562.

Kaestner, R., J. A. Pearson, D. Keene, and A. T. Geronimus. 2009. Stress, allostatic load and health of Mexican immigrants. *Social Science Quarterly* 90(5):1089–1111.

Keyes, K. M., and S. Galea. 2014. *Epidemiology matters: A new introduction to epidemiologic foundations.* Oxford, England: Oxford University Press.

Keyes, K. M., and S. Galea. 2016. *Population health science*. Oxford, England: Oxford University Press.

Keyes, K. M., G. D. Smith, K. C. Koenen, and S. Galea. 2015. The mathematical limits of genetic prediction for complex chronic disease. *Journal of Epidemiology and Community Health* 69(6):574–579.

Kindig, D. 1997. *Purchasing population health: Paying for results.* Ann Arbor, MI: University of Michigan Press.

Kindig, D. 2015. From health determinant benchmarks to health investment benchmarks. *Preventing Chronic Disease* 12:E41.

Kindig, D., and G. Stoddart. 2003. What is population health? *American Journal of Public Health* 93(3):380–383.

Leitner, J. B., E. Hehman, O. Ayduk, and R. Mendoza-Denton. 2016. Blacks' death rate due to circulatory diseases is positively related to whites' explicit racial bias. *Psychological Science* 27(10):1299–1311.

Leventhal, A. M., J. Cho, N. Andrabi, and J. Barrington-Trimis. 2018. Association of reported concern about increasing societal discrimination with adverse behavioral health outcomes in late adolescence. *JAMA Pediatrics* 172(10):924–933.

Ma, J., E. M. Ward, R. L. Siegel, and A. Jemal. 2015. Temporal trends in mortality in the United States, 1969–2013. *JAMA* 314(16):1731–1739.

Mackenbach, J. P., J. R. Valverde, B. Artnik, M. Bopp, H. Brønnum-Hansen, P. Deboosere, R. Kalediene, K. Kovács, M. Leinsalu, P. Martikainen, G. Menvielle, E. Regidor, J. Rychtaříková, M. Rodriguez-Sanz, P. Vineis, C. White, B. Wojtyniak, Y. Hu, and W. J. Nusselder. Trends in health inequalities in 27 European countries. *Proceedings of the National Academy of Sciences of the United States of America* 115(25):6440–6445.

Meigs, J. B., P. Shrader, L. M. Sullivan, J. B. McAteer, C. S. Fox, J. Dupuis, A. K. Manning, J. C. Florez, P. W. Wilson, R. B. D'Agostino, Sr., and L. A. Cupples. 2008. Genotype score in addition to common risk factors for prediction of type 2 diabetes. *New England Journal of Medicine* 359(21):2208–2219.

Montez, J. K., A. Zajacova, and M. D. Hayward. Explaining inequalities in women's mortality between U.S. states. *SSM Population Health* 2:561–571.

Mundinger, M. O. 1985. Health service funding cuts and the declining health of the poor. *New England Journal of Medicine* 313(1):44–47.

Murray, C. J. L., S. C. Kulkarni, C. Michaud, N. Tomijima, M. T. Bulzacchelli, T. J. Iandiorio, and M. Ezzati. 2006. Eight Americas: Investigating mortality disparities across races, counties, and race-counties in the United States. *PLoS Medicine* 3(9):e260.

NCHS (National Center for Health Statistics). 2017. *Health, United States, 2016: With chartbook on long-term trends in health*. Hyattsville, MD: National Center for Health Statistics.

Novak, N. L., A. T. Geronimus, and A. M. Martinez-Cardoso. 2017. Change in birth outcomes among infants born to Latina mothers after a major immigration raid. *International Journal of Epidemiology* 46(3):839–849.

NRC (National Research Council). 2010. *International differences in mortality at older ages: Dimensions and sources.* Washington, DC: The National Academies Press.

NRC. 2011. *Explaining divergent levels of longevity in high-income countries.* Washington, DC: The National Academies Press.

NRC and IOM (Institute of Medicine). 2013. *U.S. health in international perspective: Shorter lives, poorer health.* Washington, DC: The National Academies Press.

Pepe, M. S., H. Janes, G. Longton, W. Leisenring, and P. Newcomb. 2004. Limitations of the odds ratio in gauging the performance of a diagnostic, prognostic, or screening marker. *American Journal of Epidemiology* 159:882–890.

Priest, N., N. Slopen, S. Woolford, J. T. Philip, D. Singer, A. D. Kauffman, K. Mosely, M. Davis, Y. Ransome, and D. Williams. 2018. Stereotyping across intersections of race and age: Racial stereotyping among white adults working with children. *PLoS One* 13(9):e0201696.

Roberts, A. L., Y. Chen, N. Slopen, K. A. McLaughlin, K. C. Koenen, and S. B. Austin. 2015. Maternal experience of abuse in childhood and depressive symptoms in adolescent and adult offspring: A 21-year longitudinal study. *Depression and Anxiety* 32(10):709–719.

Rose, G. 2001. Sick individuals and sick populations. *International Journal of Epidemiology* 30(3):427–432. https://doi.org/10.1093/ije/30.3.427. (Reprint of 1985 article in the journal.)

Sasson, I. 2016. Trends in life expectancy and lifespan variation by educational attainment: United States, 1990–2010. *Demography* 53(2):269–293.

SPLC (Southern Poverty Law Center). 2016. The Trump effect: The impact of the 2016 presidential election on our nation's schools. https://www.splcenter.org/20161128/trump-effect-impact-2016-presidential-election-our-nations-schools (accessed December 23, 2020).

Toomey, R. B., A. J. Umaña-Taylor, D. R. Williams, E. Harvey-Mendoza, L. B. Jahromi, and K. A. Updegraff. 2014. Impact of Arizona's SB 1070 immigration law on utilization of health care and public assistance among Mexican-origin adolescent mothers and their mother figures. *American Journal of Public Health* 104(Suppl 1):S28–S34.

UNICEF (United Nations Children's Fund). 2012. *Measuring child poverty: New league tables of child poverty in the world's rich countries.* Innocenti Report Card 10. Florence, Italy: UNICEF Innocenti Research Centre. https://www.unicef-irc.org/publications/pdf/rc10_eng.pdf (accessed December 23, 2020).

Walley, A. Y., Z. Xuan, H. H. Hackman, E. Quinn, M. Doe-Simkins, A. Sorensen-Alawad, S. Ruiz, and A. Ozonoff. 2013. Opioid overdose rates and implementation of overdose education and nasal naloxone distribution in Massachusetts: Interrupted time series analysis. *British Medical Journal* 346:174.

Williams, D. R., and V. Purdie-Vaughns. 2017. Needed interventions to reduce racial/ethnic disparities in health. *Journal of Health, Politics and Policy Law* 41(4):627–651.

Woolf, S. H., D. A. Chapman, J. M. Buchanich, K. J. Bobby, E. B. Zimmerman, and S. M. Blackburn. 2018. Changes in midlife death rates across racial and ethnic groups in the United States: Systematic analysis of vital statistics. *BMJ* 362:k3096.

Appendix B

Symposium Agenda

National Academy of Sciences Building
Auditorium
2101 Constitution Avenue, NW, Washington, DC

SYMPOSIUM OBJECTIVES

1. Identify key trends and patterns in U.S. population health and provocative challenges to our current thinking, including socioeconomic, gender, racial, ethnic, and other social disparities.
2. Explore how population health science can inform policy to improve outcomes and how policies can have unintended consequences if not grounded in research and evaluation.
3. Showcase perspectives on how we build common ground for development and implementation of effective policy based on science.

8:15 Welcome from the Interdisciplinary Association for Population Health Science (IAPHS) and the Roundtable on Population Health Improvement

Sanne Magnan, Senior Fellow, HealthPartners Institute, and Adjunct Assistant Professor, University of Minnesota; Co-Chair, Roundtable on Population Health Improvement

Bruce Link, Distinguished Professor of Public Policy and Sociology, University of California, Riverside, and Emeritus Professor of Epidemiology and Sociomedical Sciences, Mailman School of Public Health, Columbia University

8:30 Population Health in the United States: The Stakes Are High

Moderator: Robert Hummer, Howard W. Odum Professor of Sociology, Carolina Population Center, University of North Carolina, and Co-Chair, IAPHS Annual Meeting Program Committee

Speakers:
Eileen Crimmins, AARP Professor of Gerontology, Leonard Davis School of Gerontology, University of Southern California
David Williams, Florence Sprague Norman and Laura Smart Norman Professor of Public Health, Professor of African and African American Studies and Sociology; Co-Leader, Cancer Risk and Disparities Program, Dana-Farber/Harvard Cancer Center, Harvard University

9:45 Break

10:00 Policy-Relevant Evidence for Population Health: Promise and Challenges

Moderator: Allison Aiello, Professor of Epidemiology, Gillings School of Global Public Health, University of North Carolina
Speaker: Sandro Galea, Dean and Robert A. Knox Professor, School of Public Health, Boston University

Discussants:
Jennifer Doleac, Associate Professor of Economics, Texas A&M University; Director, Justice Tech Lab
Paula Lantz, Associate Dean for Academic Affairs; Professor of Public Policy, Gerald R. Ford School of Public Policy, University of Michigan

11:15 Break

11:30 Effective Population Health Policy and the Science: Finding Common Ground

Moderator: Josh Sharfstein, Vice Dean, Public Health Practice and Training, Bloomberg School of Public Health, Johns Hopkins University

Speakers:
Joneigh S. Khaldun, Director and Health Officer, City of Detroit Health Department
Ellen Marie Whelan, Chief Population Health Officer, Center for Medicaid and Children's Health Insurance Plan Services, Senior Advisor, Center for Medicare & Medicaid Innovation, Centers for Medicare & Medicaid Services
Rahul Gupta, State Health Officer and Commissioner, Department of Health & Human Resources Bureau for Public Health, West Virginia

12:45 Closing Remarks

David Kindig, Emeritus Co-Chair, Roundtable on Population Health Improvement; Emeritus Professor of Population Health Sciences and Emeritus Vice-Chancellor for Health Sciences, School of Medicine and Public Health at the University of Wisconsin–Madison

1:00 Adjourn and Transition to IAPHS Annual Meeting

Appendix C

Biosketches of Speakers and Moderators[1]

Allison Aiello, Ph.D.,* is a professor of epidemiology at the University of North Carolina (UNC) Gillings School of Global Public Health and an adjunct professor of social medicine at the UNC School of Medicine. She leads the Social Epidemiology Program in the Department of Epidemiology, directs the Integrating Special Populations Program of the North Carolina Translational and Clinical Sciences Institute at the UNC School of Medicine, and co-directs the Interdisciplinary Training in Life Course Research Program at the Carolina Population Center. Dr. Aiello is a fellow at the Carolina Population Center and an alumna of the Robert Wood Johnson Foundation Health & Society Scholars Program. Her multidisciplinary research has applied approaches from epidemiology, genomics, sociology, and immunology to address complex health questions related to social determinants, infection, and chronic disease.

Eileen Crimmins, Ph.D., is the AARP Chair in Gerontology and a University Professor at the Leonard Davis School of Gerontology at the University of Southern California (USC) in Los Angeles. She co-directs the USC/University of California, Los Angeles, Center on Biodemography and Population Health, the National Institute on Aging–sponsored Biomarker Network, and the Multidisciplinary Research in Gerontology Training Program at USC. She is a member of the National Academy of Sciences and the National Academy of Medicine, and a fellow of the American

---

[1] * denotes planning committee member; † denotes roundtable member.

Association for the Advancement of Science. Dr. Crimmins is a demographer whose work focuses on health and aging. Dr. Crimmins's research is in the area of factors promoting healthy aging and healthy life expectancy, which examines the interaction of trends in life expectancy and population health. She has received the Kleemeier Award for research from the Gerontological Society of America and the Matilda White Riley Distinguished Scholar Award from the Section on Aging and the Lifecourse of the American Sociological Association.

Jennifer Doleac, Ph.D., is an associate professor of economics at Texas A&M University and the director of the Justice Tech Lab. She is also a nonresident fellow in economic studies at the Brookings Institution, a research fellow at the Institute of Labor Economics, and a research affiliate at the University of Wisconsin–Madison's Institute for Research on Poverty. Professor Doleac studies the economics of crime and discrimination, with a particular focus on the effects of technology on public safety. Past and current work addresses topics such as DNA databases, gun violence, and prisoner reentry. Her research has been supported by several governmental and philanthropic organizations and published in leading academic journals, including the *Review of Economics and Statistics*, the *American Economic Journal: Applied Economics*, and the *Economic Journal*. Professor Doleac's work has been highlighted in an array of media outlets, including *The Washington Post*, *The Wall Street Journal*, *The Atlantic*, *The Guardian*, and *Time*. She holds a Ph.D. in economics from Stanford University and a B.A. in mathematics and economics from Williams College.

Sandro Galea, M.D., M.P.H., Dr.P.H., a physician, epidemiologist, and author, is the dean and the Robert A. Knox Professor at the Boston University School of Public Health. He previously held academic and leadership positions at Columbia University, the University of Michigan, and The New York Academy of Medicine. He has published more than 750 scientific journal articles, 50 chapters, and 13 books, and his research has been featured extensively in current periodicals and newspapers. His latest book, *Healthier: Fifty Thoughts on the Foundations of Population Health*, was published by Oxford University Press in 2017. *Fortune* magazine called it "The book everyone interested in health must read." Dr. Galea holds a medical degree from the University of Toronto and graduate degrees from Harvard University and Columbia University. He also holds an honorary doctorate from the University of Glasgow. Dr. Galea was named one of *Time* magazine's epidemiology innovators and has been listed as one of the "World's Most Influential Scientific Minds." He is the past president of the Society for Epidemiologic Research and the Interdisciplinary Association for Population Health Science. He is an elected member of the

National Academy of Medicine and the American Epidemiological Society. Dr. Galea has received several lifetime achievement awards, including the Rema Lapouse Award from the American Public Health Association and the Robert S. Laufer Memorial Award from the International Society for Traumatic Stress Studies. He is a regular contributor to, and his work is regularly featured in, a range of public media.

Rahul Gupta, M.D., M.P.H., M.B.A., serves as the commissioner for the West Virginia Department of Health and Human Resources' Bureau for Public Health and the West Virginia State Health Officer. Dr. Gupta is a practicing internist with 25 years of clinical experience who also has faculty appointments as an adjunct professor of management and leadership in the Department of Health Policy at the West Virginia University School of Public Health, an associate professor at the University of Charleston School of Pharmacy, and visiting faculty at the Harvard T.H. Chan School of Public Health.

Dr. Gupta earned an M.D. and subspecialty training in pulmonary medicine from the prestigious University of Delhi and completed his internship and residency training at St. Joseph Hospital at Northwestern University in Chicago, Illinois. Additionally, he earned an M.P.H. in healthcare organization and policy from the The University of Alabama at Birmingham and an M.B.A. in Innovation and Technology Management at the London School of Business & Finance. He is also a fellow of the American College of Physicians.

Dr. Gupta has authored more than 125 peer-reviewed scientific publications in medicine and public health and served as a principal investigator for numerous well-known clinical trials. He presently serves as the secretary of the West Virginia Board of Medicine. He was elected to lead his peers as the 2016–2017 president of the West Virginia State Medical Association.

Dr. Gupta is a steering committee member on Population Health at the National Quality Forum and the Institute for Health Metrics and Evaluation. He currently serves as the Region III director of the Association of State and Territorial Health Officials (ASTHO) Board of Directors. He also serves as the chair of ASTHO's Prevention Policy Committee and the Tobacco Issues Forum. He is a former member of the National Association of County & City Health Officials Board of Directors.

As the recipient of several state and national awards, including the 2016 Howell Special Meritorious Service Award to Public Health by the Southern Health Association; the 2015 Milton and Ruth Roemer Prize for Creative Local Public Health Work by the American Public Health Association; the 2015 Jay Rockefeller Lifetime Achievement Award for advancements in public policy in health care; and the 2013 Marie Fallon

Award for Public Health Leadership by the National Association of Local Boards of Health, Dr. Gupta is a national and global leader in transforming public health practice to advance health equity and create healthier communities. In 2017, the West Virginia Human Rights Commission recognized Dr. Gupta as a Civil Rights Day Award honoree for his outstanding contributions in the areas of civil rights, human rights, and the betterment of West Virginia's citizens. Also in 2017, Dr. Gupta was named West Virginian of the Year for his work toward battling the opioid epidemic by the Pulitzer Prize–winning *Charleston Gazette-Mail*.

Robert Hummer, Ph.D.,* is the Howard W. Odum Distinguished Professor of Sociology and a fellow of the Carolina Population Center at the University of North Carolina at Chapel Hill (UNC). He came to UNC in summer 2015 after spending 19 years at The University of Texas at Austin, where he served as the director of its Population Research Center between 2001–2005 and the chairperson of their Department of Sociology from 2006–2010. In 2010, he was presented with the Clifford Clogg Award for Early Career Achievement by the Population Association of America. Dr. Hummer's research focuses on the accurate description and more complete understanding of population health and mortality patterns and trends in the United States. His recent move to UNC was made in large part to become centrally involved in the long-running National Longitudinal Study of Adolescent to Adult Health (Add Health). He is currently an investigator on the Wave V data collection funded by the National Institute of Child Health and Human Development (NICHD) and is the principal investigator of an NICHD grant to make Add Health data more easily accessible and usable. He is slated to become the director of Add Health for the sixth wave of data collection.

Joneigh S. Khaldun, M.D., M.P.H., FACEP, FAAEM, is the director and the health officer for the Detroit Health Department and a practicing emergency physician at Henry Ford Hospital. Under Dr. Khaldun's leadership, Detroit implemented a robust community health assessment and accreditation process, bridged health systems and public health in an effort to reduce infant mortality and teen pregnancy, and successfully responded to the largest hepatitis A outbreak in modern history. She is the driving force behind a proactive strategy to prevent child lead poisoning, and is leading the expansion and restructuring of the city's animal welfare services.

Previously, Dr. Khaldun was the Baltimore City Health Department's chief medical officer, where she oversaw seven health department clinics and led efforts to combat the opioid epidemic and youth violence. She has held several local and national leadership positions, including the director of the Center for Injury Prevention and Control at The George Washington University, the founder and the director of the Fellowship in Health Policy in the University of Maryland Department of Emergency Medicine, and a fellow in the Obama administration's Office of Health Reform. She serves on several local and national boards and committees, including Big Brothers Big Sisters of Southeastern Michigan, the Governor-appointed Michigan Public Health Advisory Council, and the Centers for Disease Control and Prevention Health Disparities Subcommittee. She was recently selected for the 40 Under 40 Leaders in Minority Health Award by the National Minority Quality Forum.

Dr. Khaldun obtained her undergraduate degree in biology from the University of Michigan, her M.D. from the Perelman School of Medicine at the University of Pennsylvania, and an M.P.H. in health policy from The George Washington University.

David A. Kindig, M.D., Ph.D.,*† is an emeritus professor of population health sciences and the emeritus vice-chancellor for health sciences at the University of Wisconsin–Madison School of Medicine and Public Health. He is the former co-chair of the National Academies of Sciences, Engineering, and Medicine's Roundtable on Population Health Improvement and co-directs the Wisconsin site of the Robert Wood Johnson Foundation (RWJF) Health & Society Scholars Program. He was an initial co-principal investigator on the RWJF MATCH grant, under which the County Health Rankings & Roadmaps was developed, and was the founder of the RWJF Roadmaps to Health Prize. From 2011 to 2013 he was the editor of the Improving Population Health blog.

He received a B.A. from Carleton College in 1962 and an M.D. and a Ph.D. from the University of Chicago Pritzker School of Medicine in 1968. He completed residency training in social pediatrics at the Montefiore Medical Center in 1971.

Dr. Kindig served as a professor of preventive medicine/population health sciences at the University of Wisconsin from 1980–2003. He was the vice chancellor for health sciences at the University of Wisconsin–Madison from 1980–1985, the director of the Montefiore Medical Center (1976–1980), the deputy director of the Bureau of Health Workforce, Department of Health, Education, and Welfare (1974–1976), and the first medical director of the National Health Services Corps (1971–1973). He was the national president of the American Medical Student Association in 1967–1968.

He served as the chair of the federal Council on Graduate Medical Education (1995–1997), the president of the Association for Health Services Research (1997–1998), a Prospective Payment Assessment Commission commissioner from 1991–1994, and as the senior advisor to Donna

Shalala, Secretary of Health and Human Services from 1993–1995. In 1996 he was elected to the National Academy of Medicine. He received the Distinguished Service Award of the University of Chicago School of Medicine in 2003. He chaired the Institute of Medicine Committee on Health Literacy in 2002–2004, chaired Wisconsin Governor Doyle's Healthy Wisconsin Taskforce in 2006, and received the 2007 Wisconsin Public Health Association's Distinguished Service to Public Health Award.

Paula Lantz, Ph.D.,*† is a professor and the associate dean for academic affairs at the Gerald R. Ford School of Public Policy and a professor of health management policy in the School of Public Health at the University of Michigan. As a social demographer and social epidemiologist, Professor Lantz teaches and conducts research regarding public policy approaches to reducing health disparities in the United States. She is currently researching the potential for pay-for-success financing and other social impact investment approaches to funding interventions aimed at upstream social determinants of health, especially in low-income populations. She is an elected member of the National Academy of Medicine and the National Academy of Social Insurance.

Bruce Link, Ph.D., is a Distinguished Professor of Public Policy and Sociology at the University of California, Riverside. Dr. Link's interests are centered on topics in psychiatric and social epidemiology as they bear on policy issues. He has written on the connection between socioeconomic status and health, homelessness, violence, stigma, and discrimination. With Jo Phelan, he has advanced the theory of social conditions as fundamental causes of disease. Currently, he is conducting research on the life-course origins of health inequalities by race/ethnicity and socioeconomic status, the consequences of social stigma for the life chances of people who are subject to stigma, and on evaluating intervention efforts aimed at reducing mental illness stigma in children attending middle school.

Sanne Magnan, M.D., Ph.D.,*† is the co-chair of the Roundtable on Population Health Improvement of the National Academies of Sciences, Engineering, and Medicine. She is the former president and chief executive officer of the Institute for Clinical Systems Improvement (2006–2007; 2011–2016). In 2007, she was appointed Commissioner of the Minnesota Department of Health by Minnesota Governor Tim Pawlenty. She served from 2007 to 2010 and had significant responsibility for implementation of Minnesota's 2008 health reform legislation, including the Statewide Health Improvement Program, standardized quality reporting, development of provider peer grouping, certification process for health care homes, and baskets of care.

Dr. Magnan was a staff physician at the Tuberculosis Clinic at St. Paul–Ramsey County Department of Public Health (2002–2015). She was a member of the Population-Based Payment Model Workgroup of the Healthcare Payment Learning and Action Network (2015–2016) and a member of the Centers for Medicare & Medicaid Services Multi-Sector Collaboration Measure Development Technical Expert Panel (2016). She is on Epic's Population Health Steering Board and on the Healthy People 2030 engagement subcommittee.

She served on the board of MN Community Measurement and the board of NorthPoint Health & Wellness Center, a federally qualified health center and part of Hennepin Health. Her previous experience also includes vice president and medical director of consumer health at Blue Cross and Blue Shield of Minnesota. Currently, she is a senior fellow with HealthPartners Institute and an adjunct assistant professor of medicine at the University of Minnesota. Dr. Magnan holds an M.D. and a Ph.D. in medicinal chemistry from the University of Minnesota, and is a board-certified internist.

Lourdes J. Rodríguez, Dr.P.H.,*† serves as the director of the Center for Place-Based Initiatives at the The University of Texas at Austin Dell Medical School. She works on community-engaged research and practice projects that build on ideas elicited from community colleagues. Previously, she served as the program officer at the New York State Health Foundation. From 2004–2012, she was a faculty member of the Columbia University Mailman School of Public Health. Dr. Rodríguez received a B.S. in industrial biotechnology from the University of Puerto Rico at Mayagüez, an M.P.H. from the University of Connecticut, and a Dr.P.H. from Columbia University.

Joshua M. Sharfstein, M.D.,† is the vice dean for public health practice and community engagement and a professor of the practice in health policy and management at the Johns Hopkins Bloomberg School of Public Health. He is also the director of the Bloomberg American Health Initiative. His book, *The Public Health Crisis Survival Guide: Leadership and Management in Trying Times*, was published in 2018 by Oxford University Press.

Previously, Dr. Sharfstein served as the secretary of the Maryland Department of Health & Mental Hygiene from January 2011 to December 2014. In this position, he led efforts to align Maryland's health care system with improved health outcomes, culminating in the adoption of a revised payment model for all hospital care for Maryland residents. He also oversaw the development of a statewide health improvement process with 18 local public–private coalitions and the reshaping of the state's approach to health information exchange, long-term care, and behavioral health.

From March 2009 to January 2011, Dr. Sharfstein served as the principal deputy commissioner of the Food and Drug Administration, where he oversaw the agency's successful performance management and transparency initiatives. From December 2005 to March 2009, as the commissioner of health for the City of Baltimore, Dr. Sharfstein led innovative efforts that contributed to major declines in both overdose deaths and infant mortality rates. From July 2001 to December 2005, as minority professional staff and the health policy advisor for Congressman Henry A. Waxman, Dr. Sharfstein was engaged in a wide range of oversight and legislative activities on health care topics, including emergency preparedness, HIV, and the politicization of science.

Dr. Sharfstein graduated summa cum laude with an A.B. in social studies from Harvard College in 1991. From August 1991 to August 1992, he worked on public health projects in Guatemala and Costa Rica with a Frederick Sheldon Traveling Fellowship. He graduated from Harvard Medical School in 1996 from the Boston Combined Residency Program in Pediatrics at the Boston Medical Center and Boston Children's Hospital in 1999 and from the fellowship in general academic pediatrics at the Boston University School of Medicine in 2001.

Dr. Sharfstein is an elected fellow of the National Academy of Medicine (2014) and the National Academy of Public Administration (2013). He serves on the Board of Population Health and Public Health Practice of the Health and Medicine Division of the National Academies of Sciences, Engineering, and Medicine and on the editorial board of the *Journal of the American Medical Association*. His awards have included the Jay S. Drotman Memorial Award from the American Public Health Association (1994), Public Official of the Year from *Governing* magazine (2008) and the Circle of Commendation Award from the Consumer Product Safety Commission (2013).

Ellen-Marie Whelan, Ph.D., CRNP, FAAN,*† is a senior advisor at the Innovation Center within the Centers for Medicare & Medicaid Services, where she is working to develop, implement, and test innovative payment and service delivery models strengthening primary care, accountable care, perinatal care, and community-based population health. She coordinates the pediatric portfolio across the Innovation Center.

Previously, Dr. Whelan was the associate director of health policy at the Center for American Progress, and she was also a health policy advisor in the U.S. Senate for 5 years, working for both Senate Democratic Leader Tom Daschle and as the staff director for the Subcommittee on Aging to the U.S. Senate Committee on Health, Education, Labor & Pensions with Senator Barbara Mikulski. In this capacity she worked on developing and passing legislation related to Medicare, Medicaid, the

Children's Health Insurance Program, public health, and the Food and Drug Administration.

She has worked in a variety of primary care settings and started an adolescent primary care clinic in West Philadelphia. For this effort she received the Secretary's Award for Innovations in Health Promotion and Disease Prevention, presented by Donna Shalala, and was one of the first nurse practitioners in Pennsylvania to obtain an independent Medicaid provider number. In 2011 the American Association of Colleges of Nursing honored Dr. Whelan with its Luminary Award acknowledging her contributions in public policy.

David Williams, Ph.D., M.P.H., is the Florence Sprague Norman and Laura Smart Norman Professor of Public Health at the Harvard T.H. Chan School of Public Health and a professor of African and African American studies and sociology at Harvard University. His prior academic appointments were at Yale University and the University of Michigan. He holds an M.P.H. from Loma Linda University and a Ph.D. in sociology from the University of Michigan.

Dr. Williams is an internationally recognized authority on social influences on health. He has been invited to keynote scientific conferences in Europe, Africa, Australia, the Middle East, South America, and across the United States. As the author of more than 400 scientific papers, his research has enhanced our understanding of the complex ways in which race, socioeconomic status, stress, racism, health behavior, and religious involvement can affect health. The Everyday Discrimination Scale that he developed is one of the most widely used measures of discrimination in health studies.

He is an elected member of the National Academy of Medicine and the American Academy of Arts & Sciences. He was ranked as one of the Top 10 Most Cited Social Scientists in the world in 2005, as the Most Cited Black Scholar in the Social Sciences in 2008, and as one of the World's Most Influential Scientific Minds in 2014. He has also received Distinguished Contributions awards from the American Sociological Association, the American Psychological Association, and The New York Academy of Medicine.

Dr. Williams has served on the National Committee on Vital and Health Statistics and on eight committees for the National Academy of Medicine, including the committee that produced the report *Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care*. He has also played a visible, national leadership role in raising awareness levels of the problem of health inequalities and identifying interventions to address them. This includes his service as the staff director of the Robert Wood Johnson Foundation's Commission to Build a Healthier America and as a key scientific advisor to the award-winning PBS film series *Unnatural Causes: Is Inequality Making Us Sick?* His research has been featured by some of the nation's top news organizations and in his TEDMED talk released in 2017.