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Health Policy Brief

AUGUST 21, 2014

The Relative Contribution of Multiple Determinants to Health Outcomes.

Researchers continue to study the many interconnected factors that affect people's health.

WHAT'S THE ISSUE?

The last several decades have seen a growing interest in what defines and shapes health. Despite having the highest per capita health spending, the United States lags behind many other countries in many health indicators, and glaring health disparities remain. The United States devotes a small share of its health expenditures (less than 9 percent) toward disease prevention.

One theme gaining strength in the research literature posits that many benefits from the extremely high health care spending in the United States are undermined by the nation's very low investments in social services, broadly defined to include support services for older adults, survivor benefits, disability and sickness benefits, family supports, housing programs, employment programs, unemployment benefits, and other social policy issues.

Furthermore, there is an increasing awareness that other nonclinical factors such as education and income have a major impact on health. To understand and address these issues, researchers have focused on understanding the factors that affect people's health, commonly referred to as health determinants. The goal of this research is to effectively design interventions and create policy choices that value health for all people and that address not only the more obvious, direct determinants of health but also the structural and societal issues that may be causing persistent health disparities. A better understanding of what influences health outcomes will ultimately lead to better policies and allow for more effective use of limited resources—directly on health and otherwise.

In this issue brief we focus on multiple determinant studies that seek to quantify the relative influence of the major categories of determinants on health (in contrast to the extensive body of research that examines single classes of determinants in detail). This brief is part of a larger project, under a grant from the Robert Wood Johnson Foundation, which aims to create a structure for conducting analyses that demonstrate the value of investments in nonclinical primary prevention and their impact on health care costs.

A foundation for this structure is provided by a high-level representation of the process by which an investment in primary prevention acts through the determinants of health to produce impacts on health, costs, and other outcomes of interest to various stakeholder groups. Central to this representation is an understanding of the relative contribution of the determinants of health to health outcomes

10.1377/hpb2014.17

and costs. Where possible, we aim to simplify this construct per David Kindig's assertion in his blog "Population Health: If It's Everything, Is it Nothing?" to prioritize and focus on a smaller number of specific determinants that are known, a priori, to be important.

WHAT'S THE BACKGROUND?

The literature highlights five major categories of health determinants: genetics, behavior, social circumstances, environmental and physical influences, and medical care. There are diverging opinions as to how those categories relate to each other and to health and health-related outcomes. A number of researchers and organizations such as the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) have proposed models to explain these complex relationships. These models generally reflect four elements of complexity, including:

- Multiple *determinants* of health, such as the factors described in this brief.

- Multiple *dimensions* of health that are influenced by determinants, including mortality, morbidity, functioning, and well-being, among others.

- Multiple causal *pathways* through which determinants influence each other and health outcomes, including direct and indirect influences on health and different time frames across which effects and outcomes are realized (including across the life course and generations).

- Multiple *levels* of influence, including individual, interpersonal, community, and societal effects.

One model, developed by the CDC, highlights the role of "social determinants of health," which refer to determinants that are "not controllable by the individual but affect the individual's environment." Different organizations have proposed definitions to delineate the social determinants: The WHO refers to social determinants as "the conditions in which people are born, grow, live, work and age, and which are shaped by the distribution of money, power and resources at global, national and local levels," and are "mostly responsible for health inequities," while Paula Braveman and coauthors state that "the term social determinant of health is often used to refer broadly to any nonmedical factors influencing health."

Social determinants of health generally encompass the social and physical environment and health services. They include things such as income and wealth, family and household structure, social support and isolation, education, occupation, discrimination, neighborhood conditions, and social institutions, among others.

While the five categories of determinants are generally accepted as the major contributors to health, recent research has suggested that other factors have a strong and unique impact on health and might be considered as possible mechanisms linking direct and indirect determinants, or as determinants in their own right. For example, stress is often considered a component of social or "psychosocial" circumstances. However, although the research is still evolving, particularly with regard to the subjectivity of the experience of stress and how to appropriately measure it, stress appears to have a direct effect on health outcomes and may influence the way in which a person responds to other determinants.

Peggy Thoits states that "the bulk of the literature indicates that differential exposure to stressful experiences is one of the central ways that gender, racial-ethnic, marital status, and social class inequalities in health are produced." The National Research Council and Institute of Medicine review the physiological mechanisms involved in stress, noting the cumulative damage caused by chronic lifelong stress as well as the potentially harmful and permanent effects of stressful experiences in early life.

WHAT'S THE RESEARCH?

Estimating the Contribution to Health Outcomes. As stated by Ali Mokdad and coauthors, "Most diseases and injuries have multiple potential causes and several factors and conditions may contribute to a single death. Therefore, it is a challenge to estimate the contribution of each factor to mortality." The WHO's *2002 World Health Report: Reducing Risks, Promoting Health* states that "a key initial question when assessing the impact of a risk to health is to ask 'compared to what?'"

Comparisons of health outcomes can occur across socioeconomic status (including income and education), race and ethnicity, sex, age, marital status, and geographic location, among others. In addition, health can be defined and measured in a number of ways, including but not limited to morbidity (both

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mental and physical health outcomes), mortality, life expectancy, health expenditures, health status, and functional limitations. The major contributors to health may depend on the outcome or outcomes and population studied.

Other issues to consider when measuring impact include the importance of using life-course and intergenerational perspectives, the availability of data, and the existence of socioeconomic gradients with regard to health outcomes. It is also important to consider the timing of impacts and outcomes. For example Goodarz Danaei and coauthors note that "the hazardous effects of some risk factors accumulate gradually after exposure begins and decline slowly after exposure is reduced. This is illustrated by results from trials that have lowered blood pressure and cholesterol, and from studies in which people quit smoking. Risk's dependence on time may further vary by disease, for example, the effects of tobacco smoking on lung cancer versus cardiovascular diseases."

Despite these challenges, researchers have calculated a range of estimates to assess the contribution of health determinants. It is important to consider relative contribution rather than absolute and to note that determinants do not act alone or in "simple additive fashion," but rather in concert with one another in complex, interdependent, bidirectional relationships.

These complexities introduce considerable uncertainties in the empirical estimates of relative contributions to health. For example, as noted above, feedback loops among health determinants play out over the life course, intergenerationally, and at both the individual and the population and community levels—making it difficult to parse out cause and effect. The estimated contribution of a health determinant will depend upon the time frame and perspective employed by the research.

However, as noted by J. Michael McGinnis and coauthors, "More important than these proportions is the nature of the influences in play where the domains intersect." For example, while beyond the scope of this brief, there is a body of literature that addresses the intersections of environmental and socioeconomic determinants. As noted by Janet Currie in "Inequality at Birth: Some Causes and Consequences," the study of prenatal exposures to environmental hazards demonstrates that "differences that appear to be innate may in fact be the product of environmental factors;" that those of lower socioeconomic status are disproportionately exposed to pollution and other environmental hazards; and that these prenatal exposures, in turn, affect people as adults and the next generation as well, leading to the propagation of disadvantage.

Exhibit 1 (on next page) summarizes the evidence of relative contribution by source for each determinant. While these papers are presented in tandem, comparisons are contentious, given the variation in methods, outcome measures, differences in the definition of health, problems identifying causality, and other methodological differences that arise when attempting to parse out relative contributions of individual, community, and societal level factors on health outcomes over the life course.

Relative Contribution. These papers support the belief that investments that directly or indirectly affect a small number of modifiable risk factors (namely tobacco, poor diet, and physical activity) can have a large impact on mortality reduction and disease burden. A number of sources come to similar conclusions without offering a quantitative assessment of contribution to health outcomes but reaffirming the significant contribution of a small number of determinants, mostly behavioral in nature, to health outcomes.

However, health behaviors happen in larger social contexts. They are a downstream link between social environments and other upstream determinants and health status and outcomes, and should, therefore, not be thought to be the sole drivers of health disparities. For example, the recently released 2014 County Health Rankings, as well as a new study by the Institute for Health Metrics and Evaluation, highlight the importance of addressing health behaviors according to multiple dimensions and at various points of intervention. The progress against tobacco use clearly supports this claim.

The latest County Health Rankings, developed by the University of Wisconsin Population Health Institute in collaboration with the Robert Wood Johnson Foundation, lists smoking and physical activity as two of their five "key measures," indicating that they are "more influential than others when it comes to how healthy you are or how long you live." In addition, seven new measures were added in 2014, including food environment and access to exercise opportunities, underscoring the belief

EXHIBIT 1

Relative Contributions of Health Determinants to Health Outcomes

		Determinants of health					
Source	**Metric**	**Behaviors**	**Social circumstances**	**Environment**	**Genetics**	**Medical care**	**Stress**
DHHS, Public Health Service, "Ten Leading Causes of Death in the United States," Atlanta (GA): Bureau of State Services, July 1980[a]	Percentage of total deaths in 1977 (US)	50%	—	20%	20%	10%	—
J. M. McGinnis and W. H. Foege, "Actual Causes of Death in the United States," *JAMA* 270, no. 18 (1993):2207–12	Percentage of total deaths in 1990 (US)	Tobacco: 19% Diet/activity patterns: 14% Alcohol: 5% **Total = 38%**	—	Microbial agents: 4% Toxic agents: 3%	—	—	—
P. Lantz et al., "Socioeconomic Factors, Health Behaviors, and Mortality: Results from a Nationally Representative Prospective Study of US Adults," *JAMA* 279, no. 21 (1998):1703–8	Mortality hazard rate ratio (HRR) attributable to income (controlling for sociodemographic variables and 4 health behaviors)	Controlled for: Cigarette smoking Alcohol drinking Sedentary lifestyle Relative body weight	Mortality HRR for middle-income group: 2.14 Mortality HRR for low-income group: 2.77	—	—	—	—
J.M. McGinnis et al., "The Case for More Active Policy Attention to Health Promotion," *Health Affairs* 21, no. 2 (2002):78–93	Percentage of "early deaths" (undefined)	40%	15%	5%	30%	10%	—
A. Mokdad et al., "Actual Causes of Death in the United States, 2000," *JAMA* 291, no. 10 (2004):1238–45	Percentage of total deaths in 2000 (US)	Tobacco: 18% Poor diet/physical inactivity: 17% Alcohol: 3.5% **Total = 39%**	—	Microbial agents: 3.1% Toxic agents: 2.3%	—	—	—
G. Danaei et al., "The Preventable Causes of Death in the United States: Comparative Risk Assessment of Dietary, Lifestyle, and Metabolic Risk Factors," *PLoS Medicine* 6, no. 4 (2009):e1000058[b]	Percentage of total death (US) (various years, depending on variable)	Tobacco: 19% Overweight/obesity: 9% Physical inactivity: 8% **Total = 36%**	—	—	—	—	—

		Determinants of health					
Source	**Metric**	**Behaviors**	**Social circumstances**	**Environment**	**Genetics**	**Medical care**	**Stress**
World Health Organization, Global Health Risks: Mortality and Burden of Disease Attributable to Selected Major Risks, Geneva: WHO, 2009[c]	Percentage of total deaths in 2004, in high-income countries	Diet and physical inactivity (high blood pressure, high blood glucose, physical inactivity, overweight and obesity, high cholesterol, low fruit and vegetable intake): 25% Alcohol and drug use: 2% Tobacco use: 18% **Total = 45%**	—	3% (urban outdoor air pollution, unsafe water/ sanitation, and lead exposure)	—	—	—
B. Booske et al., "Different Perspectives for Assigning Weights to Determinants of Health," County Health Rankings Working Paper. Madison (WI): University of Wisconsin Population Health Institute, 2010[d]	Estimates derived to assign weights to determinants for County Health Rankings, drawing on a number of different perspectives	30%	40%	10%	—	20%	—
S. Stringhini et al., "Association of Socioeconomic Position with Health Behaviors and Mortality," *JAMA* 303, no. 12 (2010):1159–66	SES differences (gradient) in all-cause mortality, 1985–2009 (civil service population in London, England)	Health behaviors (smoking, diet, alcohol consumption, and physical activity): 42% (when assessed at baseline) 72% (assessed 4 times over 24 years of follow-up)	—	—	—	—	—
P. Thoits, "Stress and Health: Major Findings and Policy Implications," *Journal of Health and Social Behavior* 51 Suppl (2010): S41–53[e]	Percentage of the variance in psychological distress and depressive symptoms	—	—	—	—	—	25–40%

SOURCES See table. **NOTES** As noted, this brief focuses on studies of multiple determinants for which relative, quantitative contributions to health outcomes are estimated. There are, however, many summaries of the social determinants of health; this table is not intended to be an exhaustive list. For a superb and fascinating survey and theoretical assessment of mortality determinants that spans human history, international comparisons (including rich versus poor countries), and within-country analysis of social determinants of health, see David Cutler, Angus Deaton, and Adriana Lleras-Muney, "The Determinants of Mortality," *Journal of Economic Perspectives* 20, no. 3 (2006): 97–120. Unfortunately, Cutler and colleagues' paper does not align well with the basic approach we take in this policy brief of apportioning health (in varied ways) to factors (coefficients). Accordingly, we do not incorporate it into Exhibit 1. SES is socioeconomic status. [a]DHHS (1980) uses the "four elements of the health field"—lifestyle, human biology, environment, and the health care system—listed here as behavior, genetics, environment, and the health care system, respectively. [b]Danaei et al. also estimate mortality due to high blood pressure (16%) and high blood glucose (8%), but these are left out of this exhibit based on their physiological, rather than behavioral, nature. [c]The WHO (2009) focuses on two factors: behavioral and environmental risks. [d]Booske et al. explain the absence of genetics from their model, noting that when reviewing other models of the contribution of various determinants, "these estimates also include the contribution of genetic factors that are generally considered, at least for the moment, to be both non-modifiable and non-measurable." [e]Thoits uses measures of "cumulative stress burden" or "cumulative adversity" (events, strains, and lifetime traumas taken together) to explain the variance in psychological distress and depressive symptoms (see Turner et al. 1995 and Wheaton 1999 in the brief's Resources section) rather than mortality and notes that "although comparable studies of combined stressors on physical health outcomes have not been done, similar findings are probable, given that hundreds of studies show that at least one type of stress (negative events) harms physical and mental health alike."

5 major categories

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that indirect or upstream determinants are extremely influential in shaping individual health behaviors.

Researchers, noting the fundamental contribution of social factors to mortality and morbidity, emphasize the need for both individual and population-based interventions—both upstream and downstream—in order to make a lasting impact on behavior change and resultant health outcomes. As noted by Paula Braveman and Susan Egerter, positive changes in health behaviors require action on the part of the individual, but also require "that the environments in which people live, work and play support healthier choices. Efforts focused solely on informing or encouraging individuals to modify behaviors, without taking into account their physical and social environments, often fail to reduce health inequalities. Making further improvements in health-related behaviors, and in particular, reducing disparities in those behaviors, may require adopting a much broader perspective based on a deeper understanding of what shapes behaviors."

Paula Lantz and colleagues echo this conclusion, having found that while risky health behaviors are prevalent among people with lower incomes or educational attainment, these health behaviors do not fully explain the relationship between income and mortality. And as noted earlier, these behaviors may develop as a result of early life experiences and exposures, both adverse and protective, further complicating and broadening the possible points of intervention.

WHAT'S THE POLICY?

Policy has often focused on health care rather than health, with a significant lack of emphasis on prevention, in spite of the fact, as the literature suggests, that the multilevel promotion and adoption of healthy behaviors stands to reap the most "bang" for our health care "buck." Knowledge of the relative importance of health determinants can help design programs that prioritize interventions in areas where they are likely to have the greatest impact. However, addressing even the few determinants that are thought to be most responsible for good health requires policy makers to work across all sectors, public and private, and at the federal, state, and local level.

In his blog, "Obstacles to Population Health Policy: Is Anyone Accountable?" Kindig highlights a number of obstacles to the use of population heath policy as a means of community health improvement, including the broad array of determinants and the resultant diffusion of accountability across a range of stakeholders (such as employers, businesses, health care professionals, schools, and government), including those not typically associated with health. Public health agencies also play roles in mobilizing community-level interventions through their assessment and planning functions along with their regulatory and program implementation responsibilities.

Despite these challenges, there are a number of innovative policy approaches that address the promotion of population health through action on health determinants and the possible causes of their unequal distribution. While it is beyond the scope of this brief to highlight them all, we briefly discuss a few notable examples, including the "health in all policies" approach, prevention and population health elements of the Affordable Care Act (ACA), and a more specific example of cross-cutting policy aimed at addressing early childhood development.

At a global level, the "health in all policies" (HiAP) approach challenges policy makers at all levels to consider the health ramifications of policies in all sectors, including those not directly related to health, such as transportation, education, agriculture, and housing. The HiAP approach requires strong intersectoral and interagency collaboration, with a focus on the broader, upstream determinants of health that are thought to create the greatest inequities in health.

While noting there is no one "right way" to implement HiAP, and there are many mechanisms through which it can be achieved, the American Public Health Association (APHA) outlines five major elements of the HiAP approach: promoting health, equity, and sustainability (through the incorporation of health considerations into specific policies, but also by embedding health into governmental decision making overall); supporting intersectoral collaboration; benefiting multiple partners (such as policies that improve health can also benefit other nonhealth partners); engaging stakeholders; and creating structural or process change. The WHO states that efforts to include health as part of all policies is happening "almost everywhere," and the approach has been promoted and supported by the Institute of Medicine (IOM), the APHA, and the National Association of County and City Health Officials, and is reflected in the

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Healthy People 2020 goals around social determinants of health and in the National Prevention Strategy.

In "Health in All Policies: Prospects and Potentials," the WHO highlights a number of examples of HiAP in practice across Europe, while the APHA, the Public Health Institute, and the California Department of Health offer "Health in All Policies: A Guide for State and Local Governments" to assist policy makers in the implementation of HiAP, drawing on the experiences of the California Health in All Policies Task Force.

At the national level, the ACA provides a number of opportunities for population health improvement—"an unprecedented opportunity," as noted in the IOM's "Population Health Implications of the Affordable Care Act" Workshop Summary, "to shift the focus of health experts, policy makers, and the public beyond health care delivery to the broader array of factors that play a role in shaping health outcomes."

As noted by Michael Stoto in "Population Health in the Affordable Care Act Era," the ACA addresses population health in a number of ways that go beyond the expansion of insurance coverage and improvement in quality of care—including the enhancement of health promotion and prevention within the health care delivery system (for example, through the implementation of accountable care organizations) and, perhaps more importantly, beyond it as well, through the establishment of National Prevention, Health Promotion, and Public Health Council and the Prevention and Public Health Fund.

Other ACA funding mechanisms with the potential to improve population health include Community Transformation Grants (focused on community-level efforts to prevent chronic disease) and workplace wellness program incentives for small businesses, as well as Internal Revenue Service requirements for tax-exempt hospitals to develop Community Health Needs Assessments, and Community Health Assessment requirements for health departments seeking accreditation through the Public Health Accreditation Board. The latter two strategies tackle the challenging aspect of accountability by not only creating measures of population health, but measures for performance as well, and require the identification of entities accountable for specific activities that contribute to overall community and population health.

WHAT'S NEXT?

As noted above, behavior change is particularly difficult to realize and requires multifaceted approaches using tools from a variety of fields and across sectors, including health psychology, health behavior and education, health communications, community psychology, program evaluation, public policy, and behavioral economics. Despite a small number of (mostly behavioral) "targets," there are still many possible interventions (and combinations of interventions) that may make a difference at both an individual and population level. In the process, it is also important to take into account the many environmental and social factors that can influence behavior over the life course, beginning before birth.

Early childhood investments offer a promising cross-cutting solution to many social determinant pathways. Early life exposures affect health over the life course, including the propensity for risky health behaviors. Research shows that early life exposures affect cognitive and noncognitive development (for example, executive function and prefrontal cortex development), which, in turn, affects time preferences and self-control skills (delayed gratification), which are major determinants of risky health behaviors.

These are key neuro-psycho-social pathways connecting socioeconomic status, health behavior, and health outcomes. The challenge with investments in early childhood is that they require up-front costs that will produce health and economic benefits only over the long term. This has led to the development of novel long-term financing mechanisms, such as Social Impact Bonds (SIBs). According to the Brookings Institution, in this model, "private investors put up capital to fund a social intervention and governments repay the investor only if an agreed-upon outcome is achieved. An independent evaluator then confirms whether the outcome is achieved through a rigorous impact evaluation. The key feature of a SIB is funding for prevention programs that have the potential to reduce more costly remediation later on. In addition, SIBs introduce an incentive for government agencies to work together to capture savings jointly."

Underpinning all of the above efforts, as well as the literature regarding the determinants of health, is the need for more robust data on what produces health, the effectiveness of interventions that work through health

determinants to produce health, timely outcomes data, and measures that capture population health and progress toward those goals.

There is a need for more precise measures and comparability between studies of health determinants to bolster the evidence regarding the relative contribution and importance of various determinants in the production of health. A number of studies cited above and reviewed for this brief do not precisely define their measures and methodology employed, and the majority of papers cited in Exhibit 1 discuss the lack of comparability between studies as a result of to these differences.

In addition, as the most potent health determinants are identified, policy makers will need more information on the effectiveness of interventions that act on those determinants in order to target limited resources and to determine "what works for whom in what context" (as stated by Stoto), given the wide variation in communities and populations in the United States.

Timely outcomes data—in particular measures that assess population health rather than individual-level outcomes, especially in the context of shared accountability—are also needed. Despite these methodological challenges, there are many interventions to improve population health that are being implemented and have substantial evidential bases.

With the increasing appreciation of health as the product of more than access to the health care system and individual behaviors, along with the many opportunities afforded by the ACA, comes the chance to transform how we think about health and how we can improve it for the population as a whole. ■

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Health Policy Briefs are produced under a partnership of *Health Affairs* and the Robert Wood Johnson Foundation.

Cite as:
"Health Policy Brief: The Relative Contribution of Multiple Determinants to Health Outcomes," *Health Affairs*, August 21, 2014.

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