

Applying population health science principles to guide behavioral health policy setting

Catherine Ettman, Salma M. Abdalla, & Sandro Galea

abstract

Many behaviors, such as smoking and overeating, strongly affect a population's health. Further, social, physical, and economic contexts—for example, housing, transportation, education, and employment—shape health-related behaviors. To improve a population's health, policies must include actions that alter elements of these larger contexts. But the elements are vast and complex, and resources are limited. How can policymakers determine the right priorities to focus on? Building on the emerging field of population health science, we suggest four principles to guide priority setting: view population health as a continuum, focus on affecting ubiquitous influences on health, consider the trade-offs between efficiency and equity, and evaluate return on investment. This proposal offers a novel approach to setting policy for improving health behaviors.

Ettman, C., Abdalla, S. M., & Galea, S. (2018). Applying population health science principles to guide behavioral health policy setting. *Behavioral Science & Policy*, 4(1), 17–24.

Population health science researchers aim to understand the factors that affect the distribution of health-related features, such as cardiovascular disease, in a population so that policymakers can intervene and improve health on a societal scale.¹ This endeavor requires population health scholars to assess a broad range of health determinants, including global and national influences, urban structures and environments, individual behaviors, and the mechanisms that explain how each of these factors affects health.²

There is no easy way to determine what matters most. A recent book on population health science has, however, proposed a formal set of nine principles that can guide scholarship in population health⁴ and the setting of policy. Here we focus on four of these principles—the ones readily translatable to policy—and their application.

Core Findings

What is the issue?

Policymakers need to implement formal principles from population health science into decisionmaking. These emphasize a broader understanding of health and equity while measuring the appropriate return on their investments. This will allow them to increase both the effectiveness and cost savings of public health care interventions.

How can you act?

Selected recommendations include:

- 1) Lowering obesity by increasing retail access to healthy food through tax breaks or subsidized loans
- 2) Providing preventative screening to populations composed of particularly vulnerable member groups
- 3) Measuring the savings from improvements in health care outcomes against the costs of direct and/or area-adjacent policy interventions

Who should take the lead?

Researchers, policymakers, and stakeholders in health care

Consider, for instance, how the principles of population health science could help guide policymakers deciding on the right interventions for addressing the obesity epidemic. Obesity arises from molecular, individual, social network, and national causes. At the molecular level, genes shape people's vulnerability to obesity to some extent. Individual motivation dictates individual approaches to weight control, and friends in social networks affect individual decisions. National factors related to food availability—such as food policy and accessibility of safe areas for physical exercise—also determine whether people are likely to eat well and exercise. Therefore, any intervention to reduce obesity should rest on an understanding of the causes of obesity; their prevalence, complexity, and interactions; and how amendable any of these causes are to an intervention.

The challenges posed by a population health science approach to health policy are enormous and require enough insight into all the factors that affect health to be confident in the chosen interventions. If researchers and policymakers are to understand and intervene in factors ranging from national policy to individual behaviors, from urban planning to the molecular mechanisms that affect health, what should they focus on, and which of these factors are most likely to contribute to improved health in populations? Ultimately, to answer these questions, they must ask additional questions: What matters most?³ What are the most important elements to study, and what are the best policy investments for improving population health?

Principle 1: View Population Health as a Continuum

The first principle we explore holds that population health is best viewed as a continuum. This notion nudges thinking away from conceptualizing health as a binary (someone is sick or not sick) and toward recognizing that a population includes people with symptoms ranging from mild to severe, with only the people toward the severe end of the range meeting the criteria for a diagnosis. If health is framed as a continuum, behavioral health policies should focus on improving health in as broad a swath of the population as possible rather than focusing primarily on finding and treating people with a specific diagnosis.

The common approach to cholesterol testing in the United States is an example of misplaced emphasis. If a screening shows a person has high cholesterol, a health care provider is likely to worry about that person being at increased risk of cardiovascular disease. To counteract the high cholesterol and its possible effects, the health care provider is thus likely to prescribe cholesterol-lowering agents and recommend eating fewer saturated fats and exercising more. This practice, however, ignores the burden of poor health being borne by those whose cholesterol is certainly higher than the population's mean cholesterol but not over the cutoff that might suggest the need for intervention. These "borderliners" may get no such medicine or advice. A population health recommendation would rely on policy approaches that encourage everyone to eat healthy foods, not just those who already have high cholesterol, and would thus also protect the health of people who fall below the cutoff for what is considered a dangerous cholesterol level. Such advice, if

followed, might prevent some from raising their cholesterol in the first place.

This emphasis on healthy eating rather than on cholesterol management would also help improve other aspects of population health that occur on a continuum. Policies to reduce the consumption of unhealthy food on a population scale could reduce the number of people who have or would otherwise come to have a high body mass index (BMI), which is a sign of being overweight or obese. Like having high cholesterol, being overweight or obese can increase the risk for heart disease. It also increases the risk of diabetes, which can contribute to heart attacks and other disorders.

How might policy achieve the more far-reaching goal of increasing healthy eating across a population? What people eat is driven in no small part by what is accessible, and there is a gap in healthy food accessibility in the United States. People living in low-income or minority-majority areas are more likely than those who live in middle-income areas to have access to overprocessed food, through inexpensive fast food outlets and convenience stores, and limited access to healthy food, which is usually available in large supermarkets. However, among participants in the U.S. food stamp program, easy access to supermarkets that provide fresh fruit and vegetables is associated with increased consumption of both.⁵ One way to increase access to healthy food would be to encourage the establishment of retail stores and supermarkets that sell healthy foods in low-income neighborhoods, perhaps via subsidized loans or tax breaks.

In England, opening supermarkets in low-income neighborhoods led to a 60% increase in the consumption of fruit and vegetables among those who had poor diets before the intervention.⁶ Opening stores in urban areas, where property is rarely cheap, may seem expensive, but here is why it makes economic sense: implementing interventions that shift a population's cholesterol or blood pressure levels in the right direction will lead to fewer people experiencing heart attacks or strokes in the future, reducing

“This notion nudges thinking away from conceptualizing health as a binary”

costs to both the health care system and the labor market. This approach was successful in both Finland and Japan.⁷

Another strategy to encourage a population to make better food choices would be to impose taxes on sugar-sweetened food and drinks, which play a role in increasing a population's BMI. Several countries and cities have implemented these taxes, which have reduced consumption of the taxed items. In Mexico, taxes on sugar-sweetened beverages reduced sales by 5% during the first year of their imposition and by almost 10% further during the second year. In Berkeley, California, a 25% tax increase on sugar-sweetened beverages resulted in a 21% reduction of sales in low-income neighborhoods merely four months after implementation.⁸

These examples suggest that policymakers who want to improve health behaviors related to food should shift their focus from trying to understand how to change people's specific dietary choices to thinking about how to ensure that healthy food is available to all and how to reduce the population's consumption of unhealthy food. Although this advice may make intuitive sense, it has not typically been followed. To date, enormous effort has been expended on behavior modification efforts that can only plausibly benefit people who are at high risk for heart disease or other specific conditions rather than serving whole populations.

Principle 2: Focus on Affecting Ubiquitous Influences on Health

Health policymakers and health science researchers have historically been drawn to tackling factors that dramatically affect a person's health. They therefore tend to expend



substantial energy on mitigating very dangerous behaviors, such as injecting heroin.⁹ These efforts are important, and we do not mean to suggest that extraordinarily harmful behaviors should be ignored.

Yet, because extremely harmful behaviors are not particularly prevalent, behavioral policies aimed at them have a very small effect on overall population health. For example, in 2016, an estimated 948,000 people in the United States used heroin. By comparison, an estimated 3.7 million adults—nearly four times as many people—had a major depressive episode that same year. In 2016, roughly 35 million adults received mental health care, 37 times as many people as there are heroin users.¹⁰ Although major depression is not as acutely threatening as heroin abuse, it is an important risk factor for a range of adverse consequences, including drug abuse¹¹ and suicide.¹² A population health approach would encourage policymakers to consider interventions that could influence the mental health of whole populations rather than that of people in one small, specific subgroup of the population. For instance, depression is influenced by stressors that may be ubiquitous in populations, such as food insecurity and housing instability.¹³ Society may be better served, then, by instituting policies that reduce food insecurity and housing instability than by concentrating efforts solely on high-risk, low-prevalence behaviors that affect the health of only a few. Putting such policies in place will also help put a dent in the U.S. opioid epidemic.¹⁴

The city of Denver offers evidence for the wisdom of this approach. A supportive housing initiative for the chronically homeless there led to improvement in the overall health of participants. Specifically, 43% of those served by the initiative showed better mental health outcomes and a 15% reduction in substance use.¹⁵ Another example is the Moving to Opportunity experiment in New York City, which relocated families living in public housing in high-poverty neighborhoods to low-poverty neighborhoods. Adult participants in the experiment showed a 20% reduction in depressive symptoms compared with participants in the control group.¹⁶

Once again, this principle can suggest a sea change in priority setting in behavioral science, from the factors that policymakers and researchers may be accustomed to focusing on—high-risk behaviors—to more common behavioral influences that may affect many more people on a daily basis.

Principle 3: Consider the Trade-Offs Between Efficiency & Equity

A danger of thinking in terms of populations is that it is easy to forget they consist of individuals of different races, ethnicities, genders, and socioeconomic classes and that these differences, as well as a range of other factors, can lead to variance in how these individuals behave and respond to different conditions. Helping one part of a population by implementing the easiest health policy intervention will certainly boost overall measures of health, but it may fail to assist other parts of the population, often those who are disadvantaged. To choose among potential interventions, policymakers therefore need to consider whether they value efficiency over health equity or vice versa.

The United States approach to colorectal cancer screening illustrates this trade-off. To increase screening rates, the U.S. Preventive Services Task Force developed national guidelines. The guidelines, which focused on reaching health care providers and on educational campaigns, led to an increase in screening rates in the United States from 38.2% in 2000 to 62.9% in 2015.¹⁷ Yet follow-up studies consistently showed a gap in screening rates. One nationally representative analysis found that people with a primary health care provider (that is, someone they thought of as their doctor) were almost four times as likely to receive a screening test as were those without such a provider. The analysis also found that race, educational level, and income all contributed to the probability of undergoing a screening test. Those with at least one primary health care provider tended to be older, female, and non-Hispanic White; tended to have higher income, more education, and health insurance; and were most likely to receive up-to-date colorectal cancer screening.¹⁸

3.7M

Americans who had a major depressive episode in 2016



\$147–\$210 billion
Cost of the obesity epidemic per year in the United States

8.5 to 1

benefit : cost for colorectal cancer screening program that targeted uninsured persons

Informational campaigns that notify people who have stable health care providers about the availability of screenings will encourage those individuals to connect with their provider and arrange a screening. Overall screening rates will increase. But this approach is unlikely to do much for marginalized populations who do not have regular care providers, thereby widening gaps between health haves and health have-nots.

By contrast, screening programs that focus on narrowing health gaps can indeed reduce these gaps. To shrink racial disparities in disease incidence and mortality in Delaware, the state government created a screening program available to the entire population (that is, a population-based intervention). Further, the program offered treatment at no cost for uninsured individuals who screened positive for colorectal cancer. In addition to increasing the overall screening rate, the Delaware program reduced mortality rates from colorectal cancer among African Americans by 51%, nearly eliminating the gap between them and Whites.¹⁹ Although this program cost the state \$1 million per year, as we note later, it was highly cost effective.

Massachusetts General Hospital Chelsea HealthCare Center, a community health center, adopted a different approach to colorectal cancer screening, reducing the screening gap between Latino patients and all patients visiting the center. The hospital provided outreach workers who matched patients both culturally and linguistically to help them navigate the health care system and tackle barriers to cancer care. Within four years, the program improved both the overall screening rates and health equity in vulnerable populations, especially when compared with the performance of other practices in the area.²⁰

Similar trends have been seen with both cervical and breast cancer screenings. A review of screening programs in 22 European countries found smaller differences in screening rates between lower socioeconomic and higher socioeconomic groups in countries that provided national screening programs for their entire population, as compared with countries

“screening programs that focus on narrowing health gaps can indeed reduce these gaps”

where screening is more dependent on an individual’s ability to access the health care system.²¹ Population-based approaches may, in the short run, be more difficult and costly to implement than education campaigns, but these European countries made a priority of improving health in disadvantaged groups.

The national colorectal cancer screening education program in the United States efficiently improved screening rates when the population is viewed as a whole but at the cost of increasing inequities within the population. Is this trade-off justifiable? This question is not a scientific issue but a values question, and it is one that can be answered only if policymakers are aware of the values they bring to their work. In some circumstances, they may consider a trade-off between efficiency and equity acceptable. For example, when an infectious disease epidemic is raging, achieving high rates of vaccination quickly is important, regardless of the cost or uneven distribution of services. At other times, making decisions without thought to the trade-offs and how to value them is indefensible. Conscious consideration of trade-offs between efficiency and equity should be front and center in behavioral science health policy discussions of both researchers and policymakers. There are no rules of thumb about what should be valued, but the very act of raising the notion that values dictate how people act can push policymakers to reckon with the trade-offs we are making implicitly, to the end of forcing us to be honest about why we choose to act in the way we do.

Principle 4: Evaluate Return on Investment

Prevention is the heart of population health thinking and public health practice. Most people



“Supporting public transportation would also help address the obesity epidemic”

would prefer not being sick in the first place to being treated for illness. When policymakers are setting priorities, they should consider another compelling argument for favoring programs that could prevent disease: such policies can yield a good return on investment, in terms of both improved population health and cost savings. Policymakers who want to improve public health should assess programs' potential return on investment as they consider which ones to implement.

The Denver program supporting housing stability mentioned earlier offers a case in point: it led to the city achieving a net cost savings of \$4,745 per participant by preventing unfavorable health outcomes.¹⁶ The colorectal screening program in Delaware cost the state \$1 million annually, but it led to \$8.5 million in annual savings from reductions in costs related to colorectal cancer.¹⁹

A return-on-investment approach examines the yield on a particular policy intervention. Potential interventions can be evaluated by considering the extent to which any particular approach is likely to yield returns in health, whether that return is worth the financial and other costs of a particular effort, and, most practically, how one intervention compares with another on those features. Metrics to measure return on investment in population health can be described in terms of actual health benefits, cost benefits, or many other parameters. For example, one metric by which one can assess the success of a subsidized gym membership program is the number of sick days taken during a time period. (Society benefits from having healthier workers who miss fewer days of work.) In addition to occurrences of a specific health event during a time period and all-cause or

disease-specific mortality, common metrics to measure return on investment include improvements in disability adjusted life years (DALYs) or quality adjusted life years (QALYs) gained through an intervention. Both measures assess the effects of interventions on years and quality of life, albeit in different ways.

Let's look at transportation investments for a fuller example of return-on-investment considerations. In a city of a million people, a 40% expansion of public transit systems delivers an annual health benefit worth more than \$200 million.²² This yield comes from spurring people to walk more and reducing pollution, among other benefits. This finding is a compelling argument for investing in transportation as a health policy.

Yet that is not the only argument for expanding public transportation. Supporting public transportation would also help address the obesity epidemic, which has real, crippling costs ranging from \$147 to \$210 billion per year in the United States.²³ Such an intervention can be a win-win for city planning, health system costs, and the health of populations alike.²⁴ The benefit of reducing obesity would extend even further, because of obesity's contribution to the burden of such chronic conditions as diabetes, heart disease, and cancer. Health care for people with multiple chronic conditions represented 71% of health care expenditures in the United States in 2010.²⁵ In 2012, the estimated costs of diagnosed cases of diabetes were \$245 billion.²⁶ A 10% reduction in mortality due to heart disease, cancer, and diabetes in the United States would generate a return on investment of \$10.9 trillion.²⁷ Viewed as a return-on-investment argument, investments in public transportation clearly have the potential to deliver enormous yields in population health.

Returns on early childhood education investments provide more support for this principle. One program showed, for example, that early childhood education provides a 5:1 return relative to costs, with positive outcomes taking the form of reductions in crime rates, child maltreatment, and teen pregnancy, as well as gains in academic achievement.²⁸ The Perry Preschool



Project, established in the 1960s, is also instructive. The school delivered high-quality education to 3- and 4-year-old African-American children living in poverty. Children attended daily educational sessions and received weekly home visits to involve their mothers in the educational process. Forty years later, 77% of those children had graduated from high school, compared with 60% of the children from the control group. Participants in the Perry Preschool Project were 20% more likely than those in the control group to earn more than \$20,000 a year, and they had lower crime rates.²⁹ The effects of early education extended to providing both direct and indirect health benefits. Early education predicts higher education attainment, which, in turn, predicts a better ability to make health-related decisions as well as higher income levels. All of those factors ultimately play roles in determining the health of an individual.

Beyond providing clarity to policymakers directly concerned with improving population

health, return-on-investment assessments for proposed recommendations can help sell those recommendations to leaders in the private sector, whose decisions inevitably influence how people behave and how healthy they are.

In Conclusion

Figuring out how best to enhance population health is a daunting undertaking, considering all the public health, social, and economic levers that can be pulled. The principles outlined in this article should help policymakers organize their thinking and establish policies and programs that will do the most good, maximally improving the health of the communities they serve.

author affiliation

Ettman: Boston University and Brown University.
Abdalla and Galea: Boston University. Corresponding author's e-mail: sgalea@bu.edu.



references

1. Keyes, K. M., & Galea, S. (2016). Setting the agenda for a new discipline: Population health science. *American Journal of Public Health, 106*, 633–634.
2. Kaplan, R. M. (2004). Shared medical decision making: A new tool for preventive medicine. *American Journal of Preventive Medicine, 26*, 81–83.
3. Keyes, K., & Galea, S. (2015). What matters most: Quantifying an epidemiology of consequence. *Annals of Epidemiology, 25*, 305–311. <https://doi.org/10.1016/j.annepidem.2015.01.016>
4. Keyes, K. M., & Galea, S. (2016). *Population health science*. New York, NY: Oxford University Press.
5. Rose, D., & Richards, R. (2014). Food store access and household fruit and vegetable use among participants in the US food stamp program. *Public Health Nutrition, 7*, 1081–1088. <https://doi.org/10.1079/PHN2004648>
6. Wrigley, N., Warm, D., & Margetts, B. (2003). Deprivation, diet, and food-retail access: Findings from the Leeds 'food deserts' study. *Environment and Planning A: Economy and Space, 35*, 151–188. <https://doi.org/10.1068/a351510>
7. World Health Organization. (2002). *Chapter 6: Strengthening risk prevention policies*. Retrieved from <http://www.who.int/whr/2002/en/Chapter6.pdf?ua=1>
8. Sweet success: Will sugar taxes improve health? [Editorial]. (2017). *The Lancet Diabetes & Endocrinology, 5*, 235. Retrieved from [https://doi.org/10.1016/S2213-8587\(17\)30070-0](https://doi.org/10.1016/S2213-8587(17)30070-0)
9. Irwin, A., Jozaghi, E., Weir, B. W., Allen, S. T., Lindsay, A., & Sherman S. G. (2017). Mitigating the heroin crisis in Baltimore, MD, USA: A cost-benefit analysis of a hypothetical supervised injection facility. *Harm Reduction Journal, 14*, 1–14. <https://doi.org/10.1186/s12954-017-0153-2>
10. Center for Behavioral Health Statistics and Quality. (2016). *Key substance use and mental health indicators in the United States: Results from the 2015 National Survey on Drug Use and Health* (HHS Publication No. SMA 16-4984, NSDUH Series H-51). Retrieved from [https://www.samhsa.gov/data/sites/default/files/NSDUH-FFR1-2015/NSDUH-FFR1-2015-NSDUH-FFR1-2015.pdf](https://www.samhsa.gov/data/sites/default/files/NSDUH-FFR1-2015/NSDUH-FFR1-2015/NSDUH-FFR1-2015-NSDUH-FFR1-2015.pdf)
11. Grant, B. F. (1995). Comorbidity between DSM-IV drug use disorders and major depression: Results of a national survey of adults. *Journal of Substance Abuse, 7*, 481–497. [https://doi.org/10.1016/0899-3289\(95\)90017-9](https://doi.org/10.1016/0899-3289(95)90017-9)
12. Nock, M. K., Hwang, I., Sampson, N. A., & Kessler, R. C. (2010). Mental disorders, comorbidity and suicidal behavior: Results from the National Comorbidity Survey Replication. *Molecular Psychiatry, 15*, 868–876. <https://doi.org/10.1038/mp.2009.29>
13. Black, M. M., Quigg, A. M., Cook, J., Casey, P. H., Cutts, D. B., Chilton, M., . . . Frank, D. A. (2012). WIC participation and attenuation of stress-related child health risks of household food insecurity and caregiver depressive symptoms. *Archives of Pediatric Adolescent Medicine, 166*, 444–451. <https://doi.org/10.1001/archpediatrics.2012.1>
14. Abt Associates. (n.d.). *Opioid use disorder (OUD), housing instability, and housing options for recovery*. Retrieved from <https://www.abtassociates.com/projects/opioid-use-disorder-oud-housing-instability-and-housing-options-for-recovery>
15. Perlman, J., & Parvensky, J. (2006). *Cost benefit analysis and program outcomes report*. Retrieved from https://shnny.org/uploads/Supportive_Housing_in_Denver.pdf
16. Leventhal, T., & Brooks-Gunn, J. (2003). Moving to opportunity: An experimental study of neighborhood effects on mental health. *American Journal of Public Health, 93*, 1576–1582. <https://doi.org/10.2105/AJPH.93.9.1576>
17. National Cancer Institute. (2017). *Colorectal cancer screening*. Retrieved from https://progressreport.cancer.gov/detection/colorectal_cancer
18. Cardarelli, R., & Thomas, J. E. (2009). Having a personal health care provider and receipt of colorectal cancer testing. *Annals of Family Medicine, 7*, 5–10. <https://doi.org/10.1370/afm.904>
19. Verma, M., Sarfaty, M., Brooks, D., & Wender, R. C. (2015). Population-based programs for increasing colorectal cancer screening in the United States. *CA: A Cancer Journal for Clinicians, 65*, 496–510. <https://doi.org/10.3322/caac.21295>
20. Percac-Lima, S., López, L., Ashburner, J. M., Green, A. R., & Atlas, S. J. (2014). The longitudinal impact of patient navigation on equity in colorectal cancer screening in a large primary care network. *Cancer, 120*, 2025–2031. <https://doi.org/10.1002/cncr.28682>
21. Palència, L., Espelt, A., Rodríguez-Sanz, M., Puigpinós, R., Pons-Vigués, M., Pasarin, M. I., . . . Borrell, C. (2010). Socio-economic inequalities in breast and cervical cancer screening practices in Europe: Influence of the type of screening program. *International Journal of Epidemiology, 39*, 757–765. <https://doi.org/10.1093/ije/dyq003>
22. Litman, T. (2010). *Evaluating public transportation health benefits*. Retrieved from https://www.apta.com/resources/reportsandpublications/Documents/APTA_Health_Benefits_Litman.pdf
23. Strategies to Overcome and Prevent Obesity Alliance & The George Washington University School of Public Health & Health Services. (2017). *Fast facts: The cost of obesity* [Fact sheet]. Retrieved from <http://stopobesityalliance.org/wp-content/themes/stopobesityalliance/pdfs/Fast%20Facts%20Cost%20of%20Obesity.pdf>
24. Cawley, J., & Meyerhoefer, C. (2012). The medical care costs of obesity: An instrumental variables approach. *Journal of Health Economics, 31*, 219–230. <https://doi.org/10.1016/j.jhealeco.2011.10.003>
25. Gerteis, J., Izrael, D., Deitz, D., LeRoy, L., Ricciardi, R., Miller, T., & Basu, J. (2014). *Multiple chronic conditions chartbook: 2010 Medical Expenditure Panel Survey data*. Retrieved from <https://www.ahrq.gov/sites/default/files/wysiwyg/professionals/prevention-chronic-care/decision/mcc/mccchartbook.pdf>
26. American Diabetes Association. (2018). *The cost of diabetes*. Retrieved from <http://www.diabetes.org/advocacy/news-events/cost-of-diabetes.html>
27. Harvard School of Public Health. (2012). *Infographic: The dollars and sense of chronic disease*. Retrieved from <https://www.hsph.harvard.edu/news/magazine/f12-infographic-chronic-disease/>
28. Halfon, N., & Hochstein, M. (2002). Life course health development: An integrated framework for developing health, policy, and research. *The Milbank Quarterly, 80*, 433–479. <https://doi.org/10.1111/1468-0009.00019>
29. Schweinhart, L. J., Montie, J., Xiang, Z., Barnett, W. S., Belfield, C. R., & Nores, M. (2005). *Lifetime effects: The High/Scope Perry Preschool study through age 40* (Monographs of the High/Scope Educational Research Foundation, No. 14). Ypsilanti, MI: High/Scope Press.

Reproduced with permission of copyright owner. Further reproduction prohibited without permission.