

Translating behavioral medicine evidence to public policy

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Abstract Behavioral medicine has made significant contributions to our understanding of how to prevent disease and improve health. However, social and environmental factors continue to have a major influence on health in ways that will be difficult to combat on a population level without concerted efforts to scale interventions and translate the evidence into public health policies. Now is also the right time to increase our efforts to produce policy relevant research and partnerships that will maximize the chances that our evidence is taken to scale in ways that can influence population health broadly, and perhaps contribute to the reduction of the recalcitrant health disparities that plague virtually every area of behavioral medicine focus. As a field we must take an active role in policy translation, learning from the public policy and political science disciplines, and our own pioneers in policy translation. This article discusses importance of accelerating evidence translation to policy, and suggests several factors that could enhance our translation efforts, including embracing policy translation as a key goal in behavioral medicine, increasing our understanding in variability of evidence-based policy adoption across and within states, improving our understanding of how to most effectively communicate our findings to policy makers, conducting research that is

responsive to policy makers' needs, and considering the important role of local policy partnerships.

Keywords Behavioral medicine · Policy · Prevention · Evidence-based practice and policy

Introduction

Behavioral medicine has a rich history of contributions to the prevention of disease morbidity and mortality, as well as chronic disease management. Examples range across the whole spectrum of health and disease including prevention of cardiovascular disease and management of hypertension and ischemic heart disease, and prevention and management of diabetes, most cancers, and asthma and chronic respiratory disease, to name a few (Fisher et al., 2011; Ockene & Orleans, 2010). Increasingly behavioral medicine methods and research is being applied to understanding the impact of social determinants, such as exposure to violence, on health outcomes (Christie & Matthews, in press; Coker et al., 2002; MacGregor et al., 2014; Maniglio, 2009). These contributions stem in part from behavioral medicine's broad perspective on disease causation that goes well beyond biomedical approaches. Behavioral medicine has contributed strong intervention research, theory development and testing, and population-based approaches that extend beyond high-risk approaches (Emmons, 2000, 2012). Much of the impact of behavioral medicine can be credited to its inter-disciplinary nature. By drawing from a range of disciplinary traditions and evidence bases, development of effective and innovative solutions are maximized.

Although the origins of behavioral medicine stem largely from psychology, medicine, and nursing, increasingly

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public health has become an integral component of the behavioral medicine field, particularly as the importance of population health approaches has been recognized. An emphasis on the importance of both internal *and* external validity and the role of practice-based evidence in enhancing evidence-based practice has significantly enabled our progress (Green et al., 2009; Green, 2008; Glasgow, 2008). Further, innovations in methodology and use of a much wider range of study designs has greatly expanded our ability to move evidence into practice, to understand the factors affecting implementation outcomes, and to begin to understand how to spread and scale evidence-based interventions (Brownson et al., 2017; Mercer et al., 2007]. Behavioral medicine has embraced and helped to develop implementation science, particularly in cancer and mental health, with a specific contribution to training the next generation in these critical methods (Padek et al., 2018; Tabak et al., 2017; Proctor et al., 2013; Meissner et al., 2013).

Behavioral medicine's contributions to addressing disease prevention and management

The field of behavioral medicine has led to many successes in disease prevention and management, several of which are briefly summarized here. For example, tobacco prevalence has been reduced from 42% in 1964 to 16.5% in 2016 (CDC, 2018). There were many contributing factors, but key was the development and spread of effective interventions, including pharmacotherapy and behavioral cessation treatments, and in conducting science on second-hand smoke that was a critical turning point in public opinion, and ultimately policy, related to tobacco control. However, even the significant success in tobacco control has not had a uniform impact across the population. Current smoking prevalence among lower income, less educated adults is 20–40%, compared with 4.5–7% among those with at least a college degree, as those with fewer resources have had significantly less benefit from tobacco control strategies to date.

There have also been significant contributions to understanding of weight management, and the origins of and response to the escalating prevalence of obesity in the US. In 1990, the average percentage of obese adults in the US was 11.1%. By 2014, nearly 38% of the US population was obese, with 8% falling into the extreme obesity category (Flegal et al., 2016). Behavioral medicine contributions have included development of evidence-based interventions for a range of settings and leadership in multi-sectoral partnerships focused on implementation of evidence-based interventions and policies. Obesity in adults has steadily increased over the past three decades,

although at a slower rate than had been predicted (Rehm et al., 2016), suggesting that the significant efforts among the scientific and policy communities to address obesity may have begun to have some impact. Obesity rates among children have risen at a slower rate than adults, plateauing between 2005–2006 and 2013–2014, but rising again in 2015–2016 (Hales et al., 2017, 2018). Of note among children has been the positive impact of obesity control efforts among lower income groups. Between 2010 and 2014, 31 states and three territories reported obesity rate declines among low income 2- to 4-year-old children receiving WIC benefits (Pan et al., 2016).

Dietary intake is also an important consideration in weight management. Interventions developed through behavioral medicine collaborations have targeted improvement of dietary quality through interventions for individuals, community and point of purchase settings, and food policy. Significant improvements in adult's diet quality at a population level have been noted in the past two decades, reflecting about a ten percent change (Rehm et al., 2016). These changes reflect improvements in consumption of whole grains, nuts/seeds, and fish, and decreases in consumption of sugar-sweetened beverages. Despite these improvements, 46% of US adults are considered to have poor diet quality, with significant declines in diet quality in non-Hispanic whites over time, only modest improvements among non-Hispanic blacks, and no improvement among Mexican–American adults (Rehm et al., 2016). Disparities appear to be worsening by income level, as there have been larger relative and absolute improvements among US adults with higher vs lower levels of income.

Physical activity is a key factor in weight control, and has been a focus of behavioral medicine interventions for some time, across settings and populations. Eighty percent of American adults do not meet the government's national physical activity recommendations for aerobic activity and muscle strengthening (CDC, 2017), and almost half of adults are not sufficiently active to achieve health benefits (<https://stateofobesity.org/>, accessed June 15, 2018). Time trends between 1990 and 2000 showed slight improvements for both men and women, but declines over time among those with lowest levels of education, revealing a significant education gradient (Brownson et al., 2005). There are also significant differences among racial and ethnic groups, with non-Hispanic Blacks and Hispanics least likely to meet recommended levels of physical activity.

Behavioral medicine has made significant contributions to the field of eating behavior and dietary intake, weight management and obesity prevention, including improving understanding the behavioral and psychological factors that influence weight (Pinto et al., 2007), the inter-generational

transmission of risk for obesity (Gillman & Ludwig, 2013), development of interventions for high-risk individuals (Muktabhant et al., 2015; CDC, 2018) and the spread and scale of effective interventions (Story et al., 2009; Masheb et al., 2017). Studies have focused on a range of settings (e.g. schools, workplaces, communities, health care), nutritional intake, policy and environmental factors and access to multi-level resources that promote healthy weight. Evidence of progress is emerging, but it will be critical to continue to develop the type of evidence needed to support appropriate policies and programmatic funding, and in particular to address recalcitrant disparities that in some aspects of weight management appear to be growing.

Another area in which the field of behavioral medicine has made significant progress has been in the prevention and management of diabetes, most notably with lifestyle intervention (e.g. Johnson & Marrero, 2016). In 2015, 30 million Americans, or 9.4% of the US population, had diabetes (American Diabetes Association, accessed 2018). An additional 84 million Americans age 18 and older had prediabetes and are at risk for developing diabetes, reflecting a very large current and future health burden. The Diabetes Prevention Program, which compared an intensive lifestyle intervention, metformin therapy, and placebo among participants with impaired glucose tolerance, demonstrated the superiority of the lifestyle intervention over drug and placebo treatment, with no differences in treatment response by race and ethnicity (Orchard et al., 2005). A 10 year follow-up found that diabetes incidence over the follow-up period was reduced by twice as much in the lifestyle group (34%) as in the metformin group (18%), when compared with placebo. Subsequent work has adapted the DPP lifestyle intervention for use in workplace, healthcare, and community settings (Weinhold et al., 2015; Hays et al., 2016). A systematic review and meta-analysis of twenty-eight US-based studies adapting DPP to real world settings concluded that these programs lead to clinically significant weight loss of about 4–5%, with loss maintained over 9 months of follow-up. Interventions that offered more core sessions and had greater attendance led to greater weight loss. A significant finding was that similar levels of weight loss were found when the program was delivered by lay educators and by medical and allied health personnel. A systematic review evaluating DPP adaptations specifically for African-Americans demonstrated less impact, although there were few higher-quality studies, indicating that further research is needed to determine the impact of community-based translations among African American adults (Samuel-Hodge et al., 2014).

Cancer screening is another area where behavioral medicine efforts have been focused, with an emphasis on knowledge, risk perception, and access, as well as the role

of providers and health systems factors in increasing screening. Screening rates for the major preventable and early detectable cancers have all increased significantly over the past two to three decades, although no cancer screening target has yet met the Healthy People 2020 goals (White et al., 2017). Mammography rates, at 71.5% of women ages 50–74, have remained largely stable since 2000. Significant variation by racial/ethnic group, immigration status, and insurance and health care access has been noted. Eighty-three percent of women report being up-to-date with cervical cancer screening, with similar disparities as those found with mammography, but also age (lower screening rates among younger women). Colorectal cancer screening rates have increased since 2000, to 62% of eligible adults. Disparities by social determinants have also been demonstrated. Work has begun to determine how to address multiple cancer screening targets simultaneously, in an effort to lower overall cancer burden (Emmons 2012; Mema et al., 2016).

There is a significant body of evidence about the impact of social determinants such as violence on health (e.g. AMA, 1992; Krug et al., 2002), including intimate partner violence, child maltreatment, and exposure to other violent crime. In the US, one in three women and one in four men have been victims of physical violence by an intimate partner within their lifetime (Black et al., 2011). One in five women and one in 71 men has been raped in their lifetime. One in 15 children is exposed to intimate partner violence each year, and 90% of these children are eye-witnesses to this violence. In 2017, the rate of stranger violence was higher than the rate of intimate partner violence (8.2 vs 2.2 per 1000). Violence has serious physical and mental health consequences, as well as devastating consequences for families and communities (Christie & Matthews, in press; Kitzman et al., 2003). There are long-term impacts on processes that contribute to disease (Christie and Matthews, in press), as well as on long-term risk for disease and poor health outcomes, such as cardiovascular disease (Suglia et al., 2015), mental health disorders and substance use (Anda et al., 2006; Norman et al., 2012), premature birth and low birthweight (Shah & Shah, 2010). Inter-personal violence is a very significant threat to health, and continued behavioral medicine research to understand the health impacts and to address it is critical. SBM has recently released a position statement on the pressing need for research on gun violence prevention (Behrman et al., 2018), which has been seriously hampered due to efforts to restrict federal funding for gun violence research.

These examples across a range of health topics illustrate the importance of behavioral medicine in understanding the drivers of disease, and developing effective strategies for reducing preventable morbidity and mortality. Although

the field has long recognized the importance of health disparities, there has been less systematic impact on reducing health inequities. The recent Burden of Diseases Study (Mokdad et al., 2018) in the US illustrates the health issues facing us going forward. This study noted that six risk factors each accounted for more than 5% of risk-attributable disability-adjusted life years, including tobacco use, high body mass index, poor diet, alcohol and drug use, high fasting plasma glucose, and high blood pressure. These are all preventable risk factors, yet they remain leading causes of morbidity and health inequities. The authors note that there are three key approaches needed for addressing this situation: (1) address key modifiable risk factors, through a range of approaches including policy strategies; (2) improve access to and quality of care; and (3) address social determinants of health. Thus, despite the many successes of our field, much remains to be done, and it is likely that new strategies, specifically focused on the translation of our evidence base to broad-reaching public health policies, will be critical to addressing the challenges before us.

The role of policy in expanding use of behavioral medicine evidence and reducing disparities

There is a growing recognition that the implementation and use of scientific evidence and its impact on population health is enhanced by use of evidence-based policies (Institute of Medicine, 1998; Koh et al., 2016; Koh & Parekh, 2018). Two exemplars to which behavioral medicine has significantly contributed are tobacco control and active living.

Policy approaches began to be used in tobacco control from the earliest days following publication of the seminal Surgeon General's report on smoking and health in 1964 (Public Health Service, 1964). Environmental and policy approaches that reduce uptake of tobacco products (e.g. taxation and restrictive policies), as well as increase access to treatment, are particularly important for tobacco control at the population level (Koh & Sebelius, 2012; CDC, 2014; Chaloupka et al., 2012). Policy approaches became particularly relevant in the late 1980s, when it became clear that second-hand smoke was harmful to nonsmokers. As a result, a new movement arose—a quest to protect the rights of nonsmokers—largely through public health policy approaches.

Warner and Tam (2012) reviewed the impact of tobacco control research on policy over the past two decades, comparing eleven areas of tobacco control in 1992 and 2011. They conclude that in half of the tobacco control areas, there has been very substantial impact of research on policy, particularly related to clean indoor air, taxation and cessation treatment policy. A robust example of the impact

of cessation treatment policy comes from Land et al., who evaluated the impact of the coverage of comprehensive tobacco treatment by the Massachusetts Medicaid program (Land et al., 2010a, 2010b). Within 2 years of coverage implementation, which included pharmacotherapy and behavioral counseling, 70,000 Medicaid smokers had utilized the benefit, and the smoking rate among Medicaid enrollees dropped to 28%, representing a decline of 26%, after years of flat smoking prevalence among this group. Further, substantial reductions in hospitalizations due to specific cardiovascular conditions were noted, and there was \$3.12 in medical cost savings for every dollar spent. Despite the substantial evidence of lives and health care costs saved, fewer than 25% of state Medicaid programs currently provide coverage for comprehensive tobacco control treatment (CDC, accessed 2018).

Active Living Research (ALR), a major initiative of the Robert Wood Johnson Foundation, represents an intentional national effort to increase the use of evidence in policy related to physical activity, such that being physically active is a part of daily life and normal routine for all populations (Active Living Research, 2015; Sallis et al., 2014). ALR has focused on promoting healthy living by identifying environmental factors and policies that can increase physical activity and by sharing this evidence with policymakers to help them create activity-friendly communities. ALR met its objectives through a three-part strategy that included: (1) building an evidence base of active living research that would be useful to policy-makers; (2) recruiting and nurturing a multidisciplinary and diverse cadre of active living researchers who are fluent in methods to create policy-relevant research; and (3) informing policy and practice through cross-sector partnerships. Most notable is the excellent blueprint that ALR provides to those seeking to increase uptake of evidence-based policies in a specific field. For example, ALR created Research and Policy Forum teleconferences of selected policymakers and researchers to gain input on research priorities for specific topics, thus opening a dialogue between researchers and policymakers on the latest findings and information gaps of special relevance to policy-makers. An external evaluation concluded that ALR largely met its goals, and has built a multi-disciplinary field that has and will likely continue to have impact on evidence translation to policy (Active Living Research, 2015).

SBM's efforts in promoting evidence-based policy translation

The Society of Behavioral Medicine (SBM) has for some time paid attention to health policy at the national level, starting with the formation of a health policy committee in

2004 (Estabrooks et al., 2011). This effort began with the development of policy briefs relevant to health and behavioral medicine, which led to growing interest among members in the development of a policy strategy and public policy agenda. In 2010, the strategy was articulated through work done by the Board, and included development of relationships with Congressional staffers and legislators, outreach to engage SBM members in policy-relevant activities, and the development of a rapid-response group, the Civic and Public Engagement Committee (CPEC) to respond to time-sensitive policy opportunities. The CPEC has been very effective in this capacity, drafting position statements with other partners and developing and publishing positions statements on critical health policy issues. It has also been active in educating SBM membership about how to increase the impact of health behavior research via public engagement, among other activities (Buscemi et al., 2017). In 2015, the SBM Board instituted a new Health Policy Council to expand the support for and integration of activities of the CPEC, its standing Health Policy Committee, and the policy Special Interest Group. A clear and distributed structure for policy activities throughout the Society has been developed, and activity continues on a number of fronts, including active development and dissemination of policy briefs and position papers covering a broad range of topics, including prevention of childhood obesity, screening and vaccination to prevent cancer, e-cigarette policies, gun violence prevention, and reimbursement for peer support in health care (<http://www.sbm.org/advocacy/policy-briefs>; accessed May 30, 2018). The active engagement of SBM leadership and members in policy translation is commendable, and no doubt has had an impact on the translation of our evidence-base. An area for continued focus is the development of a robust research effort focused on policy translation, and for engagement at the state and local levels. The final section of this paper focuses on potential policy translation issues that may further extend our impact.

Accelerating the impact of our evidence to policy translation

Despite the many successes noted above, as well as the growing efforts to translate evidence to policy, many gaps remain and can be seen across most areas where there is strong evidence for prevention and early detection. Simply put, as a nation we continue to under-invest in primary prevention and screening and fail to adopt evidence-based policies to ensure that all population groups equitably benefit from our knowledge (Emmons & Colditz, 2017; Colditz & Emmons, 2018). In the US we currently spend only 2.5% of our health care dollars on public health

programs, despite the large impact that prevention and public health have on morbidity and mortality (Koh & Parekh, 2018; Hartman et al., 2018). In the context of recent set-backs in federal efforts to provide health insurance and health care access to all Americans, we must look to leverage every other option for maximizing access to evidence-based prevention programs, and public health policy represents an excellent opportunity. There are several factors that could significantly improve our impact on translating this evidence base to policy.

Embrace policy translation as a key implementation goal in behavioral medicine

Although some of our colleagues have led the way in focusing attention on the importance of evidence-based policy implementation, as a field our work in this area has been limited. Brownson et al. (2009) provide a useful summary of evidence-based public health policy. There are three domains of evidence-based policy, including: (1) the policy process, which can influence the likelihood of policy adoption; (2) policy content, or identification of policy elements that are likely to be effective at achieving the target health outcomes; and (3) the policy outcome, which ideally include upstream factors (e.g. regulation, increased access economic incentives), midstream factors (e.g. school or workplace policy changes), and downstream factors (e.g. impact on health outcomes) (Brownson et al., 2010).

Kingdon's (1995) seminal Multiple Streams Framework details three streams of influence on the policy process. The Problem Stream reflects policymakers' attitudes about a specific health issue, and their perception of the issue as a problem they need solved. Personal experience with the issue can influence response, as well as sudden, focusing events (e.g. a death or community catastrophe resulting from the issue) that draw attention to the problem among constituents. The Policy Stream reflects the potential solutions to the problem. Kingdon identified factors that influence support for any given proposal, including: (1) value acceptability, or the extent to which the idea is consistent with existing value constraints; (2) technical feasibility, or the ability to actually create and/or implement the proposal; and (3) resource adequacy, or the ability to obtain the resources needed. Policy communities that are associated with the proposal and the integration of supporting networks are also key factors. Finally, the Political Stream is the institutional and cultural context in which the proposal is being put forward and outcomes identified. This stream reflects national mood related to the policy problem, the aggregate orientation of the political parties within relevant institutions, and the balance of interests among the policy-makers and other actors. When the three streams

align, there is a clear window of opportunity for policy-making. Considering policy implementation as a critical element within implementation science would extend our ability to address the many challenges in translating our evidence base to impact on population and community health (Nilsen et al., 2013).

Increase our understanding of variation in policy implementation

Significant geographic variation in adoption of evidence-based health policies is found in almost every area of health. For example, environmental and policy approaches are particularly important for tobacco control, as noted above. However, there is significant variation in implementation of the evidence base, which likely corresponds to the variation across states seen in the recent Burden of Health Study (Mokdad et al., 2018).

State tobacco taxes range from 17 cents to \$4.35 per pack of cigarettes (CDC, 2016). Raising cigarette excise taxes is considered a key policy strategy in reducing smoking prevalence in the US, yet almost one-third of states have not raised their taxes in 10 years. Despite compelling evidence about second-hand smoke's harmful effects for non-smokers, as of 2015 24 states did not have comprehensive smoke-free laws (Tynan et al., 2016). Fourteen states allowed smoking in indoor areas. Smoke-free laws, however, are a good example of where local policy action can overcome inaction at the state level. For example, although West Virginia does not have a statewide smoke-free law, 60% of West Virginia's population benefit from local laws that prohibit smoking in worksites, restaurants, and bars, as does 44% of Alaska's residents. Substantial variation across and within States indicates that there is much room for improvement in implementation of prevention-focused policies (Emmons & Colditz, 2017; Haire-Joshu et al., 2010).

Similar variation within state is seen in the implementation of obesity-related policies (Haire-Joshu et al., 2010). For many students, especially those living in communities with limited safe public space, school provides a critical opportunity to be physically active. Although every state has some physical education requirements, they are often limited to younger grade levels or not enforced, and many programs are inadequate. A national evaluation found that 83% of middle schools required physical education in 2010, as did only 35% of high schools (Johnston et al., 2012). Only about half of middle schools and about one-third of high schools had programs in place to support physical activity. Fewer than half of states specifically require schools to provide physical activity or recess during the school day (<https://stateofobesity.org/>, accessed June 15, 2018).

As the example of physical activity in schools illustrates, not all policy implementation reflects the best available evidence. Eyler (2008) identified four scientifically supported aspects of policy related to school-based physical education and then evaluated state legislation to determine the extent to which the laws enacted over a 6.5 year period were evidence-based. Only 28% of the laws included at least 1 evidence-based component, and less than 1% had all four elements. Hartsfield et al. (2007) identified over 100 public health laws that were recommended by at least one organization for adoption by government bodies or specified private entities. Only 6.5% of the laws included details showing its scientific basis.

Understanding the factors that influence adoption of evidence-based policy may help to accelerate its uptake. Policy-making is inherently steeped in local and regional context, and systematically studying how that context plays out in policy translation is an important goal. Although region and political affiliation likely influence interest in evidence-based prevention policy, these factors alone do not sufficiently describe the patterns of policy adoption seen in tobacco control, physical activity, or many other key public health areas (Ruetten et al., 2014). Policy-focused research that applies articulated policy frameworks, such as the Kingdon (1995) framework or others (Jones et al., 2016) across a range of prevention-focused policy topics may begin to help us better understand factors responsible for variations in policy translation, and to identify windows during which specific policies may be more likely to gain support.

Increase our understanding of how to communicate our evidence base to policy makers

Although there is a large body of evidence for strategies that could reduce the burden of preventable disease, there is a relatively small literature on how to disseminate information about the evidence base to influence policy decisions. Stamatakis et al. (2010) note that stories that are well-based in evidence can be used to help bridge the communication gap between the health research and policy worlds. Attributes of representative stories that may increase their effectiveness in persuasion include: (1) expression of an important theme arising from the research; (2) verifiability; (3) acknowledgement of uncertainties in the research findings; (4) having a basis in a compelling narrative; and (5) selection of a story protagonist who represents an important constituency that could benefit from the proposed policy change (Steiner, 2007). Brownson et al. (2016) also note the importance of how the communications are perceived (e.g. unbiased, credible), how they are delivered (e.g. appropriately packaged), the

timing of delivery (e.g. available when needed), and how relevant they are to policymakers' constituents.

Bou-Karroum et al. (2017) conducted a systematic review to determine the role that media interventions play in health policy-making. Only 10 studies that evaluated the effects of planned media interventions were eligible for inclusion, and all were found to be at high risk for bias. This review highlighted the important research gaps in the literature, and opportunity for further rigorous work, especially including social media interventions on policy-making. Viswanath and colleagues used local media training to change the public health agenda to support policies and programs to address health inequities (Wallington et al., 2010a, b; McCauley et al., 2013; Thompson et al., 2016). They used a "community reconnaissance method" to identify major actors in the community who were perceived to play an important role in addressing health, including the policy makers and the people who influence policy makers. This approach yielded a rich and detailed picture of leaders in different power positions in the community, and their views on health inequities and how to address them. This information was used to guide the development of the media intervention, which focused on changing the public health agenda by ensuring that greater attention was paid to the social determinants of health in news coverage.

Developing an evidence-base that is responsive to policy-makers' needs

Although most researchers do aspire to create evidence that ultimately has a broad impact on health, our studies are usually designed to answer *scientific questions*, rather than the very different, yet quite important *questions about the use of the scientific evidence* that policy-makers may have. A scoping review conducted by Tricco et al. (2018) found that knowledge users, including policy-makers, were primarily involved in the data synthesis and interpretation phases of knowledge synthesis, which may limit the value of their input. Ongoing engagement throughout the process may lead to more relevant and useful results. Further, this review found that knowledge synthesis was most commonly used at the level of national policies and healthcare systems, with much less emphasis on the state or local level.

Brownell and Roberto (2015) have advocated for the use of strategic science, or research that is designed to address gaps in knowledge important to policy decisions, derived from the reciprocal flow of information between researchers and policy makers. This approach not only helps to identify gaps in the scientific literature, but it also focuses on identifying and answering questions that could pose barriers to policy implementation (e.g. what is the cost-effectiveness of the strategy and the costs of imple-

mentation? How much public support is there for various policies?). Strategic science also requires careful consideration of how to communicate results of strategic experiments to policy-makers, using channels that are accessible and seen as credible. These steps constitute a feedback loop by which policy informs research and the research results inform the policy process, increasing the relevance and applicability of research to policy-making. Increased use of strategic science approaches will likely be critical if we are to increase translation of our evidence base to policy. This approach also emphasizes the importance of building relationships with policy makers and advocacy communities in order to maximize the policy relevance of our research.

Consider the importance of local policy partnerships

There is clearly a role for federal government in health-related policy, and creation of "feedback loops" can help to develop evidence where it is lacking based on national guidance, goals, and evidence summaries. The importance of local level policy has also been noted. Cities are increasingly becoming catalysts for policy change promoting health and well-being. Cities are home to more than half the world's population, and have demonstrated a capacity to innovate that national governments sometimes lack (Atkinson & Freudenberg, 2015). Indeed, local policy has been successfully used in cases where there has been industry resistance for national or state policies, such as the case in tobacco control, and increasingly in obesity prevention and control. Local partnerships with regional public health councils at the state and/or district levels can also be critical in pushing evidence-based policies and practice forward. An excellent example is the community organization "BOLD Teens", a youth tobacco control advocacy group in the Dorchester neighborhood of Boston. The group was started by a small group of teens who had been personally impacted by tobacco related illnesses within their families, and that wanted to focus on tobacco education and tobacco control policies. BOLD members were trained on tobacco control by the Massachusetts Tobacco Control Program. In 1998, their first campaign focused on convincing the Boston Globe to stop advertising tobacco products. After a petition was delivered with over 3000 signatures, meetings with the publisher, letters to the editor, and a planned press conference, the Boston Globe agreed to end the advertisement of tobacco products in the paper. In 2001, this group of teens went to the US Supreme Court in Washington DC to advocate for the Massachusetts effort to restrict tobacco advertisements within 1000 feet of schools and playgrounds. This same year BOLD also began its campaign to ban the sale of tobacco products in Boston pharmacies, for which regulation was eventually passed in

2008. Seventy-nine Massachusetts municipalities followed Boston's lead, and in 2014, CVS Pharmacy ended tobacco sales nationwide. This is an excellent example of partnerships with advocacy groups in which evidence-based strategies are carried forward in the public discourse in systematic, relentless, and effective ways, especially when the focus is in opposition to powerful industries, such as the tobacco industry.

Another excellent example of the critical role of community activism to move evidence-based policy forward in the context of powerful lobbying efforts is the Massachusetts Coalition to Prevent Gun Violence, which partnered with academics to learn about the evidence base on the effectiveness of gun control legislation on reducing morbidity and mortality from gun-related incidents. Their efforts led to then Governor Deval Patrick's 2014 signing of "An Act Relative to the Reduction of Gun Violence" that required background checks for all private gun sales, gave police chiefs discretion in issuing permits for rifles or shotguns, and collected trace data for guns used in crimes and suicides. Recent activity led to the passage of the Extreme Risk Protection Order in both the MA House and Senate to establish a civil procedure for temporarily removing guns from and revoking licenses for people who pose a significant danger of causing physical harm to themselves or others. The Order was signed by Governor Baker in 2018.

These examples underscore the importance of locally-based approaches. Recent work by Purtle et al. (2018) examined the opinions of US mayors and health commissioners related to health disparities and the role of city policies in addressing inequity. Only 58% of mayors believed that disparities existed in their city, and 30% did not believe that city policies could impact on health disparities. This study highlights the need for partnerships that can help elected local officials understand the health status of their constituents, and to understand the role that specific policy actions can have. Local politicians are also typically very responsive to their constituents, and thus partnerships with trusted and respected community organizations can provide an important bridge to policy-makers. Freudenberg and Atkinson (2015) studied the role of food policy in mayoral elections in New York and London. This work illustrated the importance of advocates coming together to form common alliances and place target issues higher on the municipal agenda, inserting the issue into the election dialogue. There is also a key need for rigorous studies to evaluate the comparative effectiveness of different strategies for engaging legislative partners in health-related policy development (Purtle et al., 2017).

Community-based participatory research and community-engaged research are also essential to building the types of partnerships that can facilitate evidence-based

policy adoption. Such approaches have been used in local tobacco control policy (Milam et al., 2012; Weber et al., 2012), environmental policy (Gonzalez et al., 2011), and in expanding efforts to increase uptake of evidence-based programs in community settings (Ramanadhan et al., 2017). In addition to ensuring that policy efforts support community needs and interests, engaging community members as key leaders and participants in policy development activities ensures that policy-makers see that the issue matters to their constituency, thus increasing relevance and urgency on the part of lawmakers.

Summary

Behavioral medicine has made significant contributions to our understanding of how to prevent disease and improve health. The field has recognized the importance of social and environmental context (Sorensen et al., 2003, 2004) and of social determinants of health, and has developed interventions to consider these key influences on health (Emmons et al., 2005; Sorensen et al., 2007), at least in part by embracing interdisciplinary theories, methods, and approaches. At the same time, social and environmental factors continue to have a major influence on health, in ways that will be difficult to combat on a population level without concerted efforts to scale interventions and translate the evidence into public health policies. SBM has long recognized the impact of health policy and has worked to increase our engagement in the policy sphere, and that work should continue. But now is also the right time to increase our efforts to produce policy relevant research and expand to include a focus on multi-sectoral partnerships at the local and state level that will maximize the chances that our evidence is taken to scale in ways that can influence population health broadly, and perhaps contribute to the reduction of the recalcitrant health disparities that plague virtually every area of behavioral medicine focus. We have seen too many times that if we build it, chances are they will not come. As a field we must take an active role in policy translation, learning from the public policy and political science disciplines, and our own pioneers in policy translation. We can't wait for others to pick up the evidence where we left off. Our scientific and community-partnered engagement in policy translation is essential. And the health of the nation depends on it.

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Compliance with ethical standards

Conflict of interest Karen M. Emmons and Ediss Gandelman declare that they have no conflicts of interest.

Human and animal rights and Informed consent All procedures were in accordance with the ethical standards of the institutional research committees and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This article does not contain any studies with human participants or animals performed by any of the authors.

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