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Behavior change, health, and health disparities: An introduction

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Abstract

This Special Issue of *Preventive Medicine* (PM) focuses on behavior change, health, and health disparities, topics of fundamental importance to improving population health in the U.S. and other industrialized countries. While the U.S. health care system and those of other industrialized countries were developed to manage infectious disease and acute illnesses, it is chronic health conditions that most need to be understood and managed in the 21st century. The evidence is clear that personal behavior patterns like cigarette smoking and physical inactivity/obesity are critically important proximal causes of chronic disease (cardiovascular disease, site-specific cancers, type-2 diabetes) and as such behavior change will need to be a key component of their management. As the outstanding contributions to this Special Issue illustrate, substantial headway is being made in advancing knowledge including developing effective prevention and treatment strategies, with cigarette smoking being an excellent example that change is possible. That said, cigarette smoking continues to be responsible for approximately 480,000 premature deaths annually in the U.S. alone and 5 million globally. So more needs to be done, especially in economically disadvantaged populations. The same certainly applies to the challenges of the obesity epidemic, which of course is a more recent problem and understandably efforts to curtail it are in earlier stages of development.

Introduction

This Special Issue of *Preventive Medicine* (*PM*) focuses on behavior change, health, and health disparities, topics of fundamental importance to improving population health in the U.S. and other industrialized countries. Each of the contributors to this Special Issue is an accomplished investigator in the area of health-related behavior change. We invited contributors with expertise in (a) basic behavioral science and related processes that underpin behavior change, (b) the development and testing of interventions to promote behavior change especially behavioral economic strategies, and (c) policy development to promote behavior change and protect the public health. Each contributor was a participant in the 1st Annual Conference on Behavior Change, Health, and Health Disparities that was held on September 26 & 27, 2013, at the Burlington Hilton, Burlington, VT. That conference was organized by the Vermont Center on Behavior and Health, a National Institutes of Health (NIH) supported research center located at the University of Vermont

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(http://www.uvm.edu/medicine/behaviorandhealth/). This select subset of conferees was invited to contribute to this Special Issue because of their exemplary records of scholarship and outstanding conference presentations. Each contribution underwent thorough peer-review overseen by the Editor-in-Chief, Eduardo L. Franco, DrPh, FRSC, FCAHS, in coordination with the Guest Editor. Below I outline the rationale for organizing a conference and Special Issue on this topic, while commenting briefly on how individual contributions help to advance knowledge in this important area of health research, clinical practice, and policymaking.

Behavior change, health, and health disparities

A seminal report on this topic by Steven Schroeder (2007) did an excellent job of characterizing this changing health care landscape, focusing on three points that provide an effective structure for organizing the issues addressed in this Special Issue. Those three points are that (a) the U.S. public health is in relatively poor standing compared to other industrialized countries, (2) unhealthy personal behavior is the primary contributor to the poor state of U.S. population health, and (3) these issues are directly related to socioeconomic disadvantage and impact health disparities. Importantly, these points are complemented and expanded upon in Kaplan's excellent contribution to this Special Issue (Kaplan, 2014–in this issue), views that are informed both by his many years of experience as an independent investigator in health outcomes research as well as through his service as prior Associate Director and Director of the NIH's Office of Behavioral and Social Sciences Research. Important to note is that while the originating conference and this Special Issue focus on U.S. population health, the challenges addressed are by no means unique to the U.S. and have implications for all industrialized countries wrestling with the enormous challenges of chronic health conditions. In future years we plan to expand the scope and breadth of the conference and related reports in *Preventive Medicine* and other outlets.

U.S. population health

Moving on to the first of Schroeder's three points, U.S. population health has fallen strikingly behind that of other industrialized countries despite outspending those other countries on health care by orders of magnitude. For example, compared to the 34 other countries in the Organization for Economic Cooperation and Development (OECD), the U.S. ranks 31st in infant mortality and 30th in longevity from birth (2011 statistics), two important metrics of population health (OECD, 2013). Kaplan underscores how the U.S. does especially poorly in years of life lost before age 50, a trend that is worsening over time especially among women, again underscoring how this state of affairs is occurring despite the U.S.'s relatively enormous spending on health care (see Figs. 2 & 3 in Kaplan, 2014–in this issue).

Personal behavior is the major determinant

Second, and most directly relevant to this Special Issue, analyses of the major determinants of population health (personal behavior, environmental exposures, genetic predisposition, health care, and social circumstances) show that personal behavior is the largest contributor

to the relatively poor health standings noted above, accounting for approximately 40% of annual premature deaths (McGinnis et al., 2002; Schroeder, 2007). Those same analyses indicate that health care accounts for only about 10% of the variance in premature death, anobservation that certainly clarifies how U.S. population health can be failing to keep pace with other developed countries despite allocating greater economic resources to health care. Kaplan develops this point further detailing how expectations for substantial improvements from advances in medical therapies for chronic diseases are not being met in numerous high profile NIH-supported clinical trials. Another complicating factor is that even in those instances where highly effective new medications are developed (e.g., statins) their impact is often greatly diminished by poor patient adherence (Bates et al., 2009).

In brief, the conventional biomedical paradigm that served so well in combating infectious disease is proving inadequate in efforts to combat chronic disease, at least in part for failing to adequately address the critically important role of behavior change in improving health. The evidence strongly suggests that advances in medical technologies will not have the same revolutionary impacts on these chronic health conditions that we have come to expect based on earlier accomplishments in combating infectious disease—we are not likely to medicate or inoculate our way out of these problems.

While the relative importance of personal behavior compared to health care and other determinants of population health might be surprising, the particular risk behaviors underpinning its impact are all too familiar: the two biggest killers are cigarette smoking and physical inactivity/obesity, which account for greater than 800 thousand premature deaths in the U.S. annually (Borrell and Samuel, 2014; U.S. Department of Health and Human Services, 2014) and approximately 8.4 million globally (World Health Organization, 2011, 2014). They also have enormous adverse economic impact. For example, cigarette smoking and obesity are estimated to increase U.S. direct medical care costs by approximately $250 billion annually (2009–12 and 2008 statistics for tobacco and obesity, respectively, Centers for Disease Control, Prevention, 2011; U.S. Department of Health and Human Services, 2014). It is no coincidence that the majority of contributions to this Special Issue focus on cigarette smoking or obesity and food choices.

An enormous amount of work remains to be done in reducing the adverse health impacts of cigarette smoking and obesity as is detailed in the individual contributions to this Special Issue. That point not with-standing, there has been tremendous success in reducing the prevalence of cigarette smoking, which serves as an excellent exemplar that behavior change and attendant improvements in population health are possible. Those successes, as well as the failures and remaining challenges in the world of tobacco control and regulatory science, are detailed in Henningfield's excellent commentary in this Special Issue (Henningfield, 2014–in this issue). Importantly, Henningfield underscores the central role that behavioral science has played and continues to play in these efforts.

No contribution was more important to the tobacco control effort than recognizing the role of the reinforcing effects of nicotine in maintaining cigarette smoking and producing addiction (U.S. Department of Health and Human Services, 1988). There is now broad scientific consensus within the tobacco field that the reinforcing effects of nicotine drive

chronic use and addiction, with the adverse health effects being side effects of chronic exposure to the toxins in tobacco, especially combusted tobacco. There is also compelling evidence that the same reinforcement process is at the core of the obesity problem, with enhanced relative reinforcing effects of food and sedentary activities promoting chronic behavior patterns that have the side effect of fat accumulation and attendant adverse health outcomes (Carr et al., 2011; Epstein et al., 2007). Unfortunately, there appears to be considerably less consensus in the obesity field around such a reinforcement analysis, which may be one important area where the successes of the former can inform the latter.

The Donny et al. (2014–in this issue) contribution to this Special Issue provides an outstanding example of how that same reinforcement and addiction analysis is now featuring prominently in tobacco regulatory science where these investigators are leading efforts to identify a nicotine content level in cigarettes that falls below the threshold necessary to produce reinforcement and associated addiction. The 2009 Family Smoking Prevention and Tobacco Control Act gave the U.S. Food and Drug Administration regulatory authority over tobacco products, including the authority to set nicotine levels in cigarettes. Further leveraging the utility of the reinforcement analysis, the Smith et al. (2014–in this issue) contribution to this Special Issue demonstrates how the effects of varying nicotine levels in cigarettes can be understood within a behavioral economic analysis of unit price, allowing for relatively precise quantification of those effects as well as a rich set of testable predictions on potential impacts.

Disproportionate impact on disadvantaged populations

Third, while these risk behaviors impact all socioeconomic strata, they disproportionately impact economically disadvantaged populations thereby worsening, although not fully accounting for, health disparities. For example, U.S. smoking prevalence rates are 41.9%, 24.7%, 23,1%, 9.1%, and 5.9% among those with graduate equivalence degrees, less than 12 years, 12 years, undergraduate degrees, and postgraduate college degrees, respectively (2012 statistics, Centers for Disease Control and Prevention, 2014a,b). A similar pattern is emerging for overweight and obesity, particularly among women (Ogden et al., 2010). While this pattern of overrepresentation among more disadvantaged populations is not uniform across developed countries, it is a common pattern (Mackenvach et al., 2008). This should not be surprising as humans are social primates and can be expected to be highly sensitive to social hierarchies in ways that adversely impact health (Sapolsky, 2005).

Social factors such as educational attainment have a substantial impact on health accounting for approximately 15% of the variance in premature death (Schroeder, 2007), but they are also complex and not yet well understood. There is little doubt that factors like stigma, stress, mate selection, constrained vocational and other economic opportunities, are important contributors (e.g., Adler et al., 1994; Currie and Moretti, 2003; Graham, 2009; Hatzenbuehler et al., 2013). Emerging knowledge on epigenetic influences and other biological changes whereby early life experiences influence later-in-life disease risk are providing insights into some of the physiological mechanisms involved (e.g., Santos and Joles, 2012; Szyf, 2013). In this Special Issue Bickel et al. (2014–in this issue) and Hall and Marteau (2014–in this issue) examine how impairments in neuropsychological self-

regulatory processes (i.e., executive functions) increase risk of disease and premature death, hypothesizing that they may mediate socioeconomic influences on health as well as Bayman et al. (2014); other individual differences. While acknowledging that this area of research is in its early stages and that the relationships in question are complex and multiply determined, both contributions offer the interesting and potentially important hypothesis that impairments in executive functions have a causal influence on health-related behavioral choice and attendant morbidity and mortality risk.

An effective behavioral economic strategy for promoting behavior change among disadvantaged populations is the systematic use of financial and other incentives to directly reinforce healthy behavioral choices. Indeed, use of this incentive-based strategy to promote health was the primary focus of an earlier Special Issue of *Preventive Medicine* (Higgins et al, 2012). These interventions explicitly leverage the same reinforcement process that drives unhealthy behavioral choices discussed above to systematically promote behavior change. In the current Special Issue, Higgins et al. (2014–in this issue) report the results of a randomized controlled clinical trial (RCT) providing further experimental evidence that financial incentives increase smoking abstinence and fetal growth among disadvantaged pregnant smokers, a highly vulnerable population for which effective treatments are sorely needed. Using data from this research effort on pregnant smokers, Heil et al. (2014–in this issue) provides novel evidence on the time-course of changes in smoking once a women learns of a pregnancy that draws attention to the potential for intervening even prior to the start of prenatal care using incentives or other behavior-change strategies. Holtyn et al. (2014–in this issue) report the results of a RCT on financial incentives in another vulnerable population, demonstrating how they can be used effectively to engage and increase abstinence among chronically unemployed, intravenous drug abusers. Harvey and Ogden (2014–in this issue) contribute a careful review of the literature on weight loss interventions in disadvantaged women demonstrating important gaps in meeting the needs of this vulnerable population, underscoring the potential utility of combining the financial incentives strategy discussed above with telecommunications strategies that Harvey and others have effectively utilized in weight loss interventions to meet that need.

While the use of incentives to promote health-related behavior change has extensive empirical support for its efficacy and is being used in the private and public sectors (Higgins et al., 2012; Mattke et al., 2013), it is certainly no silver bullet or without limitations. One common criticism is that treatment effects dissipate when the intervention is discontinued, something that is certainly not unique to incentive-based interventions but deserving of attention nevertheless. Bouton (2014–in this issue) provides a careful and insightful overview of how basic learning processes can undermine long-term behavior change. Importantly, he also discusses implications of that research for designing behavior-change interventions that produce sustained behavior change, emphasizing the need to program for generalization of healthy behavior across environmental contexts. This is an astute recommendation and one where investigators working on treatment development for health-related behavior change may benefit from referring back to early behavior modification research (e.g., Stokes and Baer, 1977). A complimentary approach to this same challenge of sustaining behavior change is outlined in the creative contribution of Jones et al. (2014–in

this issue), which is to devise low-cost incentive interventions that can remain in place longer-term. In this particular instance, the investigators examined a low-cost, game-based incentive strategy for reinforcing fruit and vegetable consumption in public elementary school lunch-rooms. The Jones et al effort is in its early stages, but the overarching concept of developing strategies to reinforce healthy behavior in an ongoing manner is critically important and one that healthcare policymakers would be wise to consider carefully (i.e., chronic therapeutic regimens for chronic conditions). Certainly that is part of the intent behind the growing use of employee wellness programs (Mattke et al., 2013).

Discerning future trends

Schroeder (2007) made effective use of health indicators from the OECD in sounding the alarm on the poor state of U.S. population health and the substantial contribution that personal behavior and associated chronic disease make to that situation. As such, it seems fitting to turn to that same source in trying to gain a glimpse into where things may be heading (OECD, 2013). As already noted above, more recent OECD metrics such as infant mortality and longevity from birth are not encouraging and as bad or worse than in Schroeder's report. However, there is positive information on smoking that should not be overlooked. The U.S. now ranks 2nd among the 34 OECD countries on youth and adult smoking prevalence, with <10% of those 15 years and younger reporting weekly or more frequent smoking (2009–10 statistics), and <15% of adults age 15 years or more reporting daily smoking (2011 statistics). That is a far cry from the 1960s when smoking prevalence in the U.S. exceeded rates in all western European countries (see Cutler and Glaeser, 2009). Consistent with the overview provided by Henningfield, efforts to reduce prevalence of cigarette smoking in the U.S. have seen considerable success, although clearly those efforts must be sustained and as was discussed above be better tailored to economically disadvantaged populations.

Unfortunately, that good news must be balanced against less encouraging news on obesity. The U.S. ranks 30th among the 34 OECD countries on prevalence of childhood overweight and obesity (2010 or latest year statistics) and dead last on prevalence among adults (2011 or nearest year statistics). Regarding daily fruit and vegetable consumption the picture is a bit more encouraging, among 15 year olds the U.S. ranks 16th and 12th, respectively, among 27 OECD countries reporting data (2009–10 statistics) and 25th and 9th among 28 countries reporting data for adults (2011 or nearest statistics). The data on physical activity are a bit more encouraging still, but also mixed. U.S. youth 11–15 year olds rank 5th among 27 OECD countries on the percent reporting moderate to vigorous daily exercise (2009–10 statistics), but the proportion who reported regular exercise was <25%. No physical activity data were reported for adults, although other sources indicate that less than half report meeting recommended weekly aerobic activity levels, less than one quarter meeting muscle strengthening levels, and only one fifth report meeting both (Centers for Disease Control and Prevention, 2014a,b). Clearly a great deal more will need to be done on reducing obesity in the general population as well as addressing gaps in reaching disadvantaged populations as underscored in Harvey and Ogden (2014–in this issue) in order to make the desired headway on improving U.S. population health, a challenge that will receive greater attention in our future conferences and associated publications.

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