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Incentives and health: An introduction

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Introduction

This Supplemental Issue of *Preventive Medicine* brings together contributions from an interdisciplinary group of nationally and internationally recognized scholars on various topics relevant to the effective use of financial incentives to improve health. These scholars discuss current knowledge across a wide range of topic areas, extending from basic aspects of neurobiology that may influence vulnerability to engaging in health-related risk behaviors and responsiveness to incentives to more philosophical issues of fairness and ethics regarding the use of incentives to improve health, with reviews and original studies on the empirical evidence for the effectiveness of incentives in promoting health-related behavior change taking center stage.

The idea for this Supplemental Issue, and a national conference on this same topic that preceded it, grew out of discussions between two of the Guest Editors (STH & NAN). Those discussions began at a two-day conference (January 6–7, 2009, Bethesda, MD) sponsored by the National Institute on Drug Abuse on substance abuse and related co-morbidities among returning combat veterans and their families. The potential for incentives to make a substantive contribution to the prevention and treatment of these substance abuse problems seemed clear based on the available evidence supporting their efficacy in the general population, but whether incentives could make an even broader contribution to improving military health is what quickly came to the forefront of those discussions. To explore that broader potential, the U.S. Navy's Bureau of Medicine and Surgery extended a call for

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proposals and eventually a contract to the University of Vermont to convene a conference of the leading scholars in the area of incentives and health to review current knowledge and future directions in this topic area and to also organize a publication that would place that information into the archival literature. Contributors were not requested to direct their presentations/articles specifically to the use of incentives in military settings. That topic was discussed in break-out sessions at the conference and in several commentaries in this Supplemental Issue (see Naito and Higgins, 2012-this issue; Sindelar and Torsiello, 2012-this issue). Instead, the goal was to more generally review and discuss the state of scientific knowledge in this growing area of health research.

The conference was successfully convened on February 23–24, 2011 at the Marriott Inn and Conference Center, University of Maryland, College Park, MD and this Supplemental Issue represents the planned publication. Contributors to this Supplemental Issue were invited based on their conference presentations with two exceptions. The contributions of Ranganathan and Lagarde (2012-this issue) reviewing the use of conditional cash transfer interventions for improving health in developing countries and Chien and colleagues (Chien et al., 2012-this issue) reporting outcomes from an original study of the effectiveness of provider incentives for improving outcomes in the treatment of diabetes were invited independent of the earlier conference. Each of those topics represents a critically important area of research on incentives and health that was important to include if this Supplemental Issue was to achieve its goal of providing a comprehensive overview of the topic of incentives and health.

All of the contributions to this Supplemental Issue except for this Introduction underwent thorough peer review. Each was assigned to one of the Guest Editors who selected reviewers and made recommendations to the Editor-in-Chief, Alfredo Morabia, MD, PhD, based on reviewer recommendations. We have more to say about the individual contributions below, but first want to provide some background information on the rationales behind the earlier conference and this Supplemental Issue.

Background and significance

As we settle into the 21st century, the main challenges to population health in the U.S. and other industrialized countries are in the form of chronic health conditions rather than infectious diseases. These chronic health conditions include coronary heart disease, various site-specific cancers, type 2 diabetes among others. A central contributor to these chronic health conditions is lifestyle: substance abuse, physical inactivity, unhealthy food choices, and non-adherence with medications and recommended disease prevention and treatment regimens. In the U.S., for example, unhealthy personal behaviors are estimated to contribute to 40% of all premature deaths annually, with cigarette smoking alone being responsible for greater than 440,000 deaths/year and physical inactivity and obesity contributing to another 365,000 deaths/year (Schroeder, 2007). Because the prevalence of these unhealthy behaviors is overrepresented among economically disadvantaged populations, they are also important contributors to the problems of health disparities (Cutler and Lleras-Muney, 2010; Higgins and Chilcoat, 2009; Isaacs and Schroeder, 2004; Kumanyika, 2012). In addition to undermining health, of course, these problems represent a staggering economic burden. In

the U.S., for example, the direct medical costs of cigarette smoking exceed \$90 billion annually, those of alcohol abuse approximately \$25 billion/year, and those for overweight and obesity approximately \$150 billion/year (Centers for Disease Control, Prevention, 2008, 2011; Finkelstein et al., 2009).

Perhaps not surprisingly, the health of the U.S. military and their families parallels that of the general population and thus these same problems are an equal and sometimes even greater burden on the military health care system. As of 2008, for example, 31% of those in the active U.S. military were current cigarette smokers, 20% problem drinkers, and 62% overweight or obese. Across the entire U.S. Military Health System, cost estimates as of 2006 were that the Department of Defense (DOD) was spending \$2.1 billion/year for medical care related to tobacco use, problem drinking, and excess weight and obesity (Dall et al., 2007).

Why prevention and why incentives?

There is growing recognition of the need for effective interventions to promote healthy behavior change among those who already engage in various risk behaviors as well as to prevent the acquisition of unhealthy behaviors among those who do not yet engage in them but are at risk for doing so. As just one example of this growing recognition, the NIH Institute Directors convened an NIH-wide meeting specifically on the topic of the science of behavior change in 2009 that was designed to harness energies across the institutes in an effort to advance knowledge in this area of common interest and need. Waiting to treat the adverse health outcomes associated with these modifiable risk behaviors has simply become too expensive in terms of the quality life years lost and direct health care costs for the status quo to continue. There is broad consensus that in order to bend the curve on spiraling health care costs, we need to improve our ability to prevent these problems using the science of behavior change in addition to improving medications and other more conventional medical interventions (National Institutes of Health, 2009).

While the track record on preventing health-related risk behaviors is less than stellar, there are certainly compelling examples illustrating that success is possible. As Ades and Gaalema (2012-this issue) outline quite effectively, for example, tremendous strides have been made nationally and internationally over the past several decades in reducing coronary heart disease through reductions in smoking prevalence and improvements in diet, as well as improved medications and other medical procedures. These provide a compelling illustration of the tangible health and economic benefits that can be realized through effective prevention. There is little question that these health-related risk behaviors can be effectively prevented and treated and that doing so saves lives and reduces direct health care costs.

In addressing the question of why look to incentives for this purpose, some discussion of the basic motivational processes involved in the acquisition and maintenance of health-related risk behaviors can be helpful. There is overwhelming scientific evidence that reinforcement and operant conditioning processes play a central role in the acquisition and maintenance of health-related risk behaviors (e.g., Bickel et al., 2011; Higgins et al., 2004). The substances that people abuse and the fatty and salty foods that are so often over-consumed, for example,

share a common effect of directly stimulating dopamine-based mesolimbic brain reward centers, which directly increases the likelihood that these same activities will be repeated in the future. That is, these risk behaviors are controlled to a considerable extent through the behavioral process of reinforcement. Considering that the reinforcement process and associated brain systems evolved to support the survival of the species under conditions of constraint, it should not be surprising that the behavioral effects that it produces can be strikingly robust and resilient. As we discuss below, incentive programs can be especially helpful if constructed appropriately because they leverage that very same reinforcement process that drives unhealthy risk behaviors to promote healthy behavior (Higgins et al., 2004). Indeed, financial incentives activate those very same dopamine-based, mesolimbic brain reward systems that drive repeated drug use, fatty food consumption, and other operant behavior (Knutson et al., 2001).

Three important and related aspects of existing scientific knowledge about these motivational systems are particularly relevant to understanding health-related risk behaviors and why incentives have an important role to play in efforts to change them. First, there is evidence from preclinical laboratory settings, clinical laboratory settings, treatment outcome research, and epidemiological studies supporting the position that impoverished environments where there are few competing sources of alternative reinforcement render responding that is maintained by drugs and other basic sources of reinforcement more resistant to change (e.g., Campbell and Carroll, 2000; Carroll, 1993; Higgins, 1997; Higgins et al., 2004). That certainly appears to be a substantive factor underpinning the overrepresentation of these risk behaviors and associated problems among economically disadvantaged populations (Higgins and Chilcoat, 2009).

Second, behavioral economic research has characterized some fundamental biases in the way that humans and other species make choices between different reinforcement options that increase vulnerability to these risk behaviors, with one such bias being what has come to be referred to as a bias for the present (Loewenstein et al., 2007). What that refers to is a tendency to prefer immediate over delayed reinforcement even when the amount of reward associated with the more immediate option is smaller, and to also prefer lower over higher initial costs even when the longer-term gain is greater in the option with a higher initial cost (Bickel and Marsch, 2001). It is not difficult to envision, for example, how this bias can factor into a pattern of repeatedly choosing the more immediate euphoria of drug use and abuse over the delayed health benefits of a drug-free lifestyle, the alluring taste of fatty foods over the blander tasting but healthier longer-term benefits of fruit and vegetable consumption, or the comfort, warmth, and relatively low effort of sedentary activities over the initially more demanding but healthier long-term effects of participating in regular exercise. Indeed, there is a growing literature demonstrating a relatively greater bias for the present among individuals with various addictions, obesity, and low compliance with disease prevention regimens relative to otherwise comparable individuals who are without those problems (e.g., Bickel et al., 2007; Bradford, 2010). Moreover, the degree of this bias is negatively associated with level of income or educational attainment, which likely also contributes to the overrepresentation of these risk behaviors and chronic health problems among disadvantaged populations (Green et al., 1996; Jaroni et al., 2004).

Third, an additional characteristic of human decision-making that merits mention in this context is a greater sensitivity to discrete and salient behavioral consequences over those that are more diffuse or subtle (Loewenstein et al., 2007). To grasp the potential impact of this characteristic on the matters under discussion here one need only contrast the readily discernible onset and salient tastes associated with the consumption of fatty and salty foods that contribute to hypertension compared to the relatively diffuse and largely imperceptible benefits of exercise-related reductions in blood pressure (Loewenstein et al., 2007).

Important advances are being made in understanding the neurobiology underpinning reinforcement and other motivational processes involved in vulnerability to these risk behaviors, the self-regulatory systems involved in making the type of health-related choices between immediate and longer-term gains and losses outlined above, and the role of development and experience in accounting for individual differences in behavioral choice and self-regulation. We included citations to published reviews of the behavioral science aspects of this knowledge base above so that interested readers could pursue more in-depth information. However, because we know of fewer such reviews of developments in neurobiology research relevant to understanding why incentives would have a potentially important role to play in promoting health we invited two reviews of work in this area (Garavan and Weierstall, 2012-this issue; Richards et al., 2012). Our goal is for these reviews to supplement the behavioral science information in providing an overarching scientific rationale behind the use of financial incentives to promote health-related behavior change.

The Richards et al. report reviews how adolescence and early adulthood is characterized by a maturational imbalance in brain development such that development in limbic-based systems underpinning reinforcement and related motivated behavior is accelerated relative to prefrontal cortical areas involved in self-regulatory processes. This maturational imbalance can leave young people, including those serving in the military, vulnerable to the acquisition of unhealthy behavior patterns such as substance abuse that so effectively activate those limbic-based systems. Consistent with the behavioral science rationales outlined above, the authors also note how incentives activate those same systems and thus can be used effectively to leverage these enhanced sensitivities for health promotion purposes. The Garavan and Weierstall report similarly discusses imbalances between mesolimbic brain areas associated with reinforcement and the self-regulatory processes that are based in the prefrontal cortex characterizing important differences in the balance between these systems among current drug users, those in recovery, and individuals without addiction histories. The competing brain systems models outlined in these reviews are consistent with the models offered by others (e.g., Bechara, 2005; Bickel et al., 2007). Importantly, Garavan and Weierstall review research demonstrating that in addition to activating basic brain reward areas, financial incentives also increase activity in prefrontal cortical systems that are involved in effective response inhibition, thereby providing an additional mechanism through which incentive-based interventions may act in promoting behavior change.

In summary, there are sound health and economic rationales for emphasizing behavior change in efforts to improve population health and more specifically for including the

systematic use of financial incentives in such efforts. Financial and other material incentives can effectively reinforce healthy choices and in doing so enlist the same powerful process of reinforcement and associated neurobiological processes that drives unhealthy behavior to promote health and prevent disease. Financial rewards can serve as healthy alternatives to those residing in relatively deprived environments and they can be delivered relatively immediately following healthy choices thereby accommodating and leveraging the bias for the present. They can also be readily scheduled and delivered in a manner that underscores their salience and activates important neurobiological self-regulatory systems.

Financial incentives in the promotion of health-related behavior change

Historical context

The use of financial incentives for changing health-related behavior dates back to the 1960s and the advent of behavior modification and behavior therapy. The approach is commonly referred to as contingency management, especially in the addictions field where the largest body of health-related incentives research has been conducted (Higgins et al., 2008; Lussier et al., 2006; Prendergast et al., 2006). Beginning in the 1960s and continuing through the 1970s, mostly case studies and a few experimental studies were reported suggesting that substance use and weight loss were sensitive to incentive-based interventions (e.g., Elliott and Tighe, 1968; Harris and Bruner, 1971; Miller, 1975; Stuart, 1967; Winett, 1973; see Sigmon and Patrick, 2012-this issue). In the substance abuse area, a programmatic series of studies by Stitzer and colleagues in the 1980s with opioid-dependent patients and cigarette smokers provided compelling evidence that substance use could be changed with incentives, including financial incentives (e.g., Stitzer and Bigelow, 1982, 1984; Stitzer et al., 1980). As is outlined in the review by Jeffery (2012-this issue), a comparable series of controlled studies in the late 1970s through the early 1990s conducted by Jeffery and colleagues established the same for weight loss. There were also studies reported during this period on the effective use of incentives for increasing medication adherence among substance abusers (see DeFulio and Silverman, 2012).

In the substance abuse area, two subsequent developments occurred in relation to the U.S. cocaine epidemic that fostered a striking upsurge in interest and research on the use of incentives. First, in a context in which virtually every other type of pharmacological and psychosocial intervention that was examined with cocaine-dependent outpatients was failing miserably, controlled clinical trials using financial incentives reliably retained cocaine dependent outpatients in treatment and increased cocaine abstinence levels several fold above control levels (e.g., Higgins et al., 1991, 1993, 1994; Silverman et al., 2006). Second, the efficacious incentive program that was working with these cocaine-dependent outpatients was a monetary-based incentive program (i.e., vouchers exchangeable for retail items) that was readily adaptable to a wide range of other types of substance abuse problems as well as other health problems (see Higgins et al., 2008; Lussier et al., 2006), whereas earlier incentive programs were often specific to a particular population (e.g., medication take-home privileges among methadone-maintained opioid-dependent outpatients, Stitzer et al., 1992). This upsurge in studies on incentives is reflected in the comprehensive review of incentives and cigarette smoking by Sigmon and Patrick (2012-this issue) as well as the

more focused reviews on smoking among pregnant women by Higgins et al. (2012-this issue) and those with serious mental illness by Tidey (2012-this issue). The overall efficacy outlined by Sigmon and Patrick for a problem that is currently responsible for the premature deaths of approximately 5 million people/year is quite encouraging. The review by Higgins et al. outlines how incentives are producing antepartum cessation rates and improvements in birth outcomes that are several folds greater than is typically seen in this vulnerable population while Tidey's review demonstrates progress in the use of incentives for helping those with serious mental illness to reduce or quit smoking, a population with whom little else has had any impact. Silverman et al.'s (2012-this issue) review describes a highly innovative and important program of research wherein voucher-based incentives are integrated with vocational training to produce long-term abstinence among inner-city, chronically addicted illicit drug abusers and homeless alcoholics, again populations for whom effective interventions are sorely needed.

The current obesity epidemic appears to be driving a similar quest for effective behavior change interventions that includes a resurgence of research activity on the use of financial incentives presumably connected to their earlier effectiveness in the area of weight loss and their effectiveness with various types of addictions. Whatever the reason, there has been a handful of rigorous randomized controlled clinical trials reported over the past few years (e.g., Finkelstein et al., 2008; Luley et al., 2010; Volpp et al., 2008). Only time will tell whether this epidemic-related upsurge in interest in the use of incentives for weight loss will grow in a manner comparable to what happened in the area of substance abuse, but the parallels across these areas of investigation are certainly interesting and encouraging. Included among these parallels is the quest to develop methods for achieving longer-term behavior change. As was noted above, Silverman et al. (2012-this issue) are examining methods designed to promote sustainable, long-term incentive-based interventions for severely addicted patients. John et al. (2012-this issue) review data from two controlled clinical trials investigating methods for promoting longer-term weight loss and suggest that there may be certain incentive structures that work better in that regard for certain socioeconomic groups.

Extending into other areas

The careful review by DeFulio and Silverman of studies on the use of incentives to increase adherence with medication regimens was mentioned above. As was already noted, the vast majority of these studies have been conducted with individuals with substance use disorders, such as naltrexone therapy with opioid-dependent patients, disulfiram therapy with alcoholics, and antiretroviral and TB medications among substance abusers infected with HIV or tuberculosis. There are a small handful of studies in other populations. Overall, the studies offer promise, especially when incentives of moderate or higher monetary value have been examined (\$100/month), although a great deal more research is needed in this important area. The available evidence suggests that it is unlikely that the carryover effects of incentives will be sufficient to sustain medication adherence in patients with conditions requiring chronic medication regimens. Important questions that remain to be answered include what value incentives are needed to achieve medically-meaningful improvements in adherence and whether the associated improvements in health outcomes and anticipated cost

offsets are sufficient to make the interventions cost effective. These are actually questions of importance to all of the areas of incentives research covered in this Supplemental Issue.

Without question the largest scale interventions involving the systematic use of incentives to improve health are the conditional cash transfer programs reviewed by Ranganathan and Lagarde (2012-this issue). These programs impact the lives of many millions of disadvantaged families in developing countries throughout most of Latin America and to a more limited extent and more recently in African and Asian countries. In the Latin American countries, the programs typically offered mothers an opportunity to earn additional public assistance conditional on them meeting particular targets around having their children immunized, participating in routine medical preventive care, and enrolling them in school. The interventions in African and Asian countries have been more focused on specific changes such as retrieving HIV test results or practicing safe sex/avoiding sexually transmitted diseases. Ranganathan and Lagarde provide a cautious review of 13 such CCT programs that have been empirically evaluated, concluding that there is evidence documenting improvements in the rate of preventive health care visits among children, nutritional status of newborns and infants, retrieving HIV test results, delivering babies in medical facilities rather than at home, and reducing risky sexual behavior. As would be expected considering the enormous scale of these interventions, there are discernible boundaries on some of these positive outcomes where, for example, an effect might be limited to rural as opposed to urban settings, but overall the results are quite encouraging and certainly set an example for the potential scalability of health-related incentive programs in industrialized countries, including large organizations such as military health systems. An important point noted in the Ranganathan and Lagarde review that merits underscoring is how the rigorous body of scientific evidence on the efficacy of incentives in the addictions field provided an empirical foundation for attempting this large-scale effort at using them to promote changes in behavior that are important to combating chronic poverty. As is discussed more below, the evidence on the efficacy of incentives for promoting health-related behavior change has catalyzed efforts to utilize them in a wide-range of novel and important public-health applications.

Heil et al. (2012-this issue) review research on incentives and family planning, mostly from efforts in developing countries but more recently in the U.S. as well, and point out how decades of research have shown that family planning is one of the most cost-effective health interventions in the developing world. Their review provides overwhelming evidence that family planning is sensitive to financial incentives, with empirical evidence supporting their utility promoting adoption and continuation of contraceptive methods, limiting family size, and promoting education designed to indirectly impact sexual behavior. All but one of nine studies reviewed reported positive outcomes and demonstrated clear effects of incentives on family planning behaviors.

Still other developments fueling rapid growth in the area of incentives and health are related to the Patient Protection and Affordable Health Care Act. That legislation allows private employers to use incentives to promote wellness at values up to 30% of the overall costs of the employee's health insurance coverage (Patient Protection and Affordable Care Act of, 2010). A recent estimate was that one-third of all large employers in the U.S. were using

financial incentives in their employee wellness programs (Mercer: Consulting, Outsourcing, Investments, 2011). The Patient Protection and Affordable Health Care Act also mandates the Center for Medicare and Medicaid Services (CMS) to allocate \$100 million in incentives to be allocated to 10 states to evaluate the use of Medicaid funds as incentives to increase participation in disease prevention programs (see <http://www.CMS.gov>, 2012).

As might be expected, this rapid growth and diversification in health-related incentive programs has appropriately increased concerns regarding ethics and fairness issues that can be complex and need to be considered carefully. Schmidt et al. (2012-this issue) provide an excellent introduction to the type of concerns that have arisen and how they can be thoughtfully and effectively examined, with a focus on reserving an important role for empirical evidence in such discussions.

Summary

Unhealthy personal risk behaviors including substance abuse, physical inactivity, unhealthy food choices, and failure to adhere to recommended preventive medical regimens are major causes of chronic disease, premature death, and spiraling health care costs in the U.S. and other developed countries. They are also major contributors to health disparities. Because the health of the U.S. military mirrors that of the general population, the military health care system is burdened by these same problems. This situation has stimulated interest in the development of effective interventions to prevent and treat these unhealthy behavior patterns. One approach that shows considerable promise in promoting health and wellness is the systematic use of financial incentives. There are sound scientific rationales for why incentives are effective in this regard and evidence from controlled clinical trials across a wide range of different applications supports their efficacy. Nevertheless, there are many important questions that remain to be answered regarding the use of incentives for health-related behavior change, including optimal incentive values, appropriate intervention durations for different problems and populations, and cost-effectiveness. This Supplemental Issue has the potential to bring further and much-needed attention to the challenges of personal behavior and health and to outline the important role that incentives can play in improving health in the general population as well the military health care system.

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