A Practical Framework for Incentive-Based Cancer Prevention

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Cost of Cancer Care

THE RECENT INSTITUTE OF MEDICINE report on the delivery of cancer care in the United States describes a system in crisis, suffering from growing demands for cancer care, increasing complexity of treatment, and rising costs.¹ It is well known that the cost of health care is rising in the United States and in other developed nations. A disproportionately large amount of this cost is attributable to cancer treatment. This is primarily because of the increasing incidence and prevalence of cancer in our aging population as well as concomitant rising costs of oncology treatments. It is estimated that there are almost 14 million people in the United States with a previous diagnosis of cancer, the highest number at any time in history, representing approximately 4% of the US population.² This is in part because of an increased incidence of cancer associated with an aging population, in addition to an increased prevalence of disease related to improvements in cancer treatment resulting in a growing number of cancer survivors.¹ According to a National Institutes of Health analysis, the cost of cancer care is estimated to reach \$158 billion by 2020, a 25% increase from \$124.6 billion in 2010.³ Together, these issues limit the ability to ensure access to high-quality cancer care for all patients, and also threaten the sustainability of the overall health care economy. In this context, cancer prevention represents an important “upstream” strategy to not only improve patient outcomes, but also to reduce costs and maintain the necessary resources required for high-quality cancer care delivery. Optimizing cancer prevention and cancer control are important components in population health management and represent an essential element of successful Accountable Care Organizations.⁴

Reports indicate that 30%–50% of all cancers can be avoided with proper exercise, improved diet, and avoidance of carcinogenic toxins.⁵ Furthermore, individual compliance with evidence-based screening recommenda-

tions, such as a screening colonoscopy, may shift the presentation of cancer toward earlier-stage disease that is more amenable to cost-effective treatment. Given these arguments, reducing the burden of cancer may depend as much on changing personal behaviors as it does on further scientific advances in oncology. The difficulty is in developing effective methods to promote healthy behaviors, as numerous patient education and motivational campaigns have had limited success producing lasting changes in at-risk patient populations. For example, the public is generally aware that smoking increases the risk of cancer and other health problems; however, although many smokers may report a desire to quit, relatively few are actually successful in their attempts. Awareness of the negative consequences of certain behaviors is often insufficient to change those unwanted behaviors. Research performed on the effectiveness of public health campaigns demonstrates that although many of these approaches elicit a fear response in patients, there are limitations to long-term effectiveness.⁶

The Role of Behavioral Economics

Efforts in cancer prevention may derive benefit from adopting economic behavioral theories. Behavioral economics acknowledges the fact that people have complex behaviors that develop over time and have the potential to become maladaptive. People do not always make decisions that are in their best interest, even when well informed. A number of human biases lead to behaviors and lifestyle choices that are detrimental to an individual's well-being. Biases such as hyperbolic or future discounting refer to the tendency to increasingly choose a smaller immediate reward over a larger delayed reward.⁷ This phenomenon explains why most people would prefer to receive \$100 today instead of \$150 in 1 year. The same principle explains how a person can adopt poor dietary habits today, despite being fully aware of the health consequences later in life. Behavioral

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TABLE 1. DESCRIPTION OF ECONOMIC BEHAVIORAL PRINCIPLES AND THEIR APPLICATIONS TO CANCER PREVENTION

<i>Principle</i>	<i>Definition</i>	<i>Clinical applications</i>
Discounting	The tendency to increasingly choose a smaller immediate reward over a larger delayed reward.	Closely time patient rewards, even minor ones, to the desired behavior. <i>Example:</i> Provide patients with a small financial reward each day for not smoking instead of a larger sum at the end of a month.
Loss aversion	The tendency to focus on losses more than gains.	Strategically use penalties to help motivate patient behavior. <i>Example:</i> Request that patients in a weight loss program place a certain amount of money in a health account that is at risk if they are not compliant with their exercise regimen.
Default	The tendency to make the default choice; to make the passive choice over the active alternative.	Ensure that the preferred behavior is the default choice. <i>Example:</i> High-risk breast cancer patients are automatically scheduled for and reminded about annual mammography.

economics also provides the basis for novel approaches to harness these biases in favor of positive changes that can have a significant impact on health. For example, a recent study investigating the effect of financial incentives applied to individuals enrolled in a smoking cessation program found that modest financial incentives were associated with significantly higher rates of smoking cessation compared to the control group.⁸ Behavioral incentives have the potential to be powerful “disruptive innovations” for improving cancer control within population health management programs. Table 1 lists a description of economic behavioral principles and their potential applications in cancer prevention. A handful of health care innovations have embraced the strategy of offering financial incentives to individuals to change their unhealthy behavior, such as promoting tobacco cessation.⁹ To date, these efforts have largely been conducted through a selection of academic initiatives focusing on circumventing human bias for the present and hefty discounting of behaviors that are linked to downstream states of disease. Results have been encouraging, but typically last only a short duration before patients relapse into former unhealthy patterns from which they started.

A New Paradigm for Behavioral Incentives

Most incentives programs to date have been static: A patient receives a reward contingent on a measurable behavioral change and can earn up to a total amount of the value of the incentive multiplied by the total iterations of the incentive if all required conditions are met. Studies have shown, however, that the human brain requires disruptive patterns of incentives in order to circumvent concomitant and long-adapted patterns of behaviors.¹⁰ A novel approach to incentives would involve modifying rewards based on individual preferences and monitoring these associations over time. This concept of “personalized incentives” acknowledges that different incentives may influence different people in different ways. It also recognizes that incentives may vary within a particular individual over time. One such endeavor is being undertaken as a joint collaboration between the Division of Surgical Oncology and the Global Health Economics Unit at the University of Vermont

Medical Center, and relies heavily on established clinical data sets and complex systems algorithm processing. The system begins with the identification of a target population, linking patient-reported outcomes data with external triggers, gathering data to allow the system to become smarter with time, and then designing and implementing appropriately personalized interventions that can foresee future behavioral choices. The system accomplishes machine learning using “big data” agent-based modeling. Initial planned applications include incentives to reduce postmenopausal obesity in breast cancer survivors (a known factor associated with an increased risk of recurrence), adherence to cancer screening recommendations in Vermont’s resettled refugee population, and access to cancer prevention services for rural patient populations, which comprise 61.1% of the state of Vermont.

Conclusions

There is a need for effective evidence-based policy to enhance efforts in behavior-based cancer prevention. Behavioral economics combined with complex systems analysis offer insights to help health care leaders achieve success in optimizing population health management. Strong evidence supports the use of financial incentives to increase preventive care behavior among high-risk patients. These techniques applied to onco-economics have the potential to improve value in cancer care, especially for vulnerable patient populations.

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