

Physical Activity Counseling in Primary Care: Insights from Public Health & Behavioral Economics

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Abstract

Physical inactivity has reached epidemic proportions in modern society. Abundant evidence points to a causal link between physical inactivity and increased risk for numerous non-communicable diseases, such as some types of cancer and heart disease, as well as premature mortality. Yet, despite this overwhelming evidence, many individuals do not meet the recommended amount of physical activity required to achieve maximum health benefits. Since primary care physicians' advice is highly regarded, clinicians have the unique opportunity to play an important role in enabling patients to modify their behavior at the point of care with the goal of guiding patients to adopt and maintain an active lifestyle. In the current study, we evaluate pertinent literature from the fields of medicine/public health and economics/psychology to suggest a comprehensive approach to physical activity counseling at the primary care level. We first examine the public health approach to physical activity counseling, and then proceed to offer insights from behavioral economics, an emerging field that combines principles from psychology and economics. The application of key behavioral economics tools (e.g. pre-commitment contracts, framing) to physical activity counseling in primary care is elaborated.

Introduction

The evidence on the beneficial effects of a physically active lifestyle have been known since the 1950s, and have been summarized into recommendations with the 1996 Surgeon General Report on Physical Activity & Health, the 2008 Physical Activity Guidelines for Americans, the Surgeon General Call for Action to Promote Walking and Walkable Communities (2015), and the National Physical Activity Plan.¹⁻⁶ Initial evidence was offered in a seminal study by Morris et al. (1953) that found the incidence of coronary heart disease to be markedly lower among active conductors on double deck buses in London than the bus drivers who had a sedentary occupation.^{7,8} Since then abundant evidence has accumulated linking physical inactivity to increased risk not only of coronary heart disease, but also for numerous other chronic conditions, such as some types of cancer, type 2 diabetes, metabolic syndrome, stroke, and depression.^{3,9,10} In fact, Lee et al. (2012), in an analysis of burden of disease worldwide, estimated that insufficient physical activity increases the risk for coronary heart disease by 33%, type 2 diabetes by 20%, and breast and colon cancer by 33% and 32%, respectively.⁹ In addition, Moore et al. (2016), examining prospective pooled data on 1.44 million adults, found that high levels of leisure time physical activity are associated with lower risk of incurring 13 types of cancer, such as 17% and 13% risk reductions for myeloma and rectal cancer, respectively.¹⁰ Moreover, among cancer survivors, physical activity has been associated with improved survival and has a positive impact on their physical function, fatigue, depression, and quality of life.^{11,12}

Despite this evidence, physical inactivity has become nearly ubiquitous, with an estimated 31% of the world not meeting the recommended levels of physical activity.¹ In the United States (US), 51.0% of adults do not meet aerobic physical activity guidelines (based on self-report), and ~96.5% of adults aged 20-59 years do not meet guidelines based on objective measurement (i.e.

accelerometry).^{13,14} Numerous strategies have been attempted to increase physical activity levels as a means of combating chronic disease, however, unlike the public health success of tobacco control in the US,⁷ physical activity rates have declined, particularly with regards to transportation, occupational, and household related activity.^{1,15} Leisure time physical activity, however, has remained relatively constant. To combat physical inactivity, an important avenue for research and practice has been physical activity promotion through primary care. Since primary care physicians' advice is highly regarded, they have the opportunity to motivate patients to change their behavior during the physician-patient encounters, which are frequent.^{16,17} Specifically, 83% of adults and 92.4% of children had contact with health care professionals in 2014.¹⁸ Yet numerous challenges affect clinicians' ability to provide physical activity counseling to their patients. Impediments include lack of training on the topic of physical activity counseling, lack of time during the clinical encounter, competing tasks and priorities, and insufficient organizational support and financial incentives to provide counseling.^{16,17,19}

While the field of public health offers a number of strategies and frameworks to facilitate lifestyle counseling to patients in primary care,²⁰ the primary focus is on cognitive behavioral approaches to behavior change following the belief that patients' decision making is guided by conscious factors. The field of behavioral economics (the integration of psychology and economics),²¹ has the potential to complement the public health perspective by acknowledging that decision making is influenced by both conscious and unconscious factors which affect choices. Moreover, behavioral economics allows for a closer assessment of the decision-making process that underlies observed individual physical activity levels. This assessment could potentially lead to a clearer understanding of the barriers that impede the decision to become more physically active and, in many cases, gives rise to tools that may be used to help overcome those barriers.²² It should

be noted, however, that while paradigms from public health have been utilized consistently to promote physical activity (with mixed success), the application of behavioral economics to the field of physical activity, though promising, is preliminary and the evidence is accumulating.^{23–25} Nonetheless, behavioral economics can offer insight not only into identifying barriers in the decision making process, but also into leveraging a more in-depth understanding of this process to aid in promoting physical activity. In the current study, we summarize pertinent literature from the fields of medicine/public health and economics/psychology to bring an integrated approach to physical activity counseling in primary care. We first examine the public health approach to physical activity counseling, and then proceed to offer insights from behavioral economics relevant to modifying lifestyle behavior. We conclude by presenting a practical approach to physical activity counseling integrating both approaches into the realities of primary care. This integrated approach warrants empirical examination in future research.

Physical Activity and Public Health

The evidence on the detrimental health effects of insufficient physical activity has accumulated over the past several decades and has culminated in guidelines underlining the importance of adults engaging in at least 150 minutes of moderate intensity physical activity and/or 75 minutes of vigorous intensity activity per week, or an equivalent combination.³ These guidelines also indicate that children and adolescents should engage in at least 60 minutes each day of moderate to vigorous intensity physical activity. Meeting physically activity guidelines is essential to promote health. Booth et al. (2002) indicate that from an evolutionary perspective, the human genome has been programed to be physically active, and deviating from an active lifestyle has led to the rise of

chronic diseases.²⁶ While hunter-gatherers spent most of the day moving about just to provide food and shelter, in modern society physical activity is not as necessary.^{26,27} This stems from modern society that has ‘engineered’ physical activity out of our daily lives due to increased automation at home and on the job.²⁸ In fact, when individuals aim to re-integrate activity into their daily routines, they encounter impediments on multiple levels. That is, there are barriers on the individual (e.g. lack of time), social (e.g. social support), environmental (exercise facilities), and policy levels (e.g. land use policies).²⁹ Intervention programs aimed at increasing the adoption and maintenance of physical activity have traditionally focused on the individual level, with mixed success.³⁰ To this end, the Guide to Community Preventive Services also recommends interventions that focus on enhancing the physical environment (e.g. connectivity of sidewalks) to be conducive for an active lifestyle.³¹ Policy and legislative changes (e.g. physical education requirement) have also been suggested as effective approaches to promote physical activity.³²

Physical Activity Counseling in Primary Care

The doctor-patient encounter is an important opportunity for lifestyle counseling as a preventive medicine measure.^{16,33} Several randomized controlled trials have examined the impact of primary care providers’ lifestyle counseling on their patients’ physical activity habits and health outcomes. For example, the PACE+ study found that primary care-based physical activity counseling (either over the phone or by mail) is a feasible means for increasing self-reported physical activity over the short term (4-month period) among adults.³⁴ The Green Prescription Program, where providers delivered physical activity counseling to their inactive patients during regular visits, found that leisure time physical activity increased by 9.7% among patients in the intervention group in

comparison to the control.³⁵ While the intervention was efficacious over a 12-month period in increasing both reported physical activity and quality of life, it did not affect patients' blood pressure or cardiovascular risk. Other interventions were not as fruitful, such as a study by Hillsdon et al. (2002) that found that advice to increase physical activity did not significantly increase study participants' energy expenditure over the follow-up period.³⁶

In fact, The US Preventive Services Task Force (USPSTF) states that based on the current evidence, providing patients (without prevalent chronic diseases) with behavioral counseling pertaining to increased physical activity in primary care will only result in a small benefit resulting in an evidence level of 'C'.³⁷ However, there is a higher level of evidence (level 'B') regarding the benefits of providing physical activity counseling (as well as dietary counseling) to patients with cardiovascular disease risk factors, obesity, and abnormal glucose levels.^{38,39} It should be noted, as of 2016, that the Patient Protection and Affordable Care Act requires coverage of USPSTF A and B rated preventive services with no cost sharing for eligible patients in non-grandfathered private plans, marketplace (exchange) plans, and expanded Medicaid.⁴⁰⁻⁴² In addition, Medicare Part B covers, without cost sharing, obesity screening and counseling to patients with a body mass index of 30 and above.⁴³

A number of organizations suggest incorporating physical activity counseling into primary care, irrespective of the existence of a chronic condition, due to the overwhelming evidence on the health benefits of physical activity, rather than the effectiveness of physical activity counseling by clinicians^{3,19}. The American College of Sports Medicine in collaboration with The American Medical Association have initiated Exercise is Medicine™,⁴⁴ emphasizing that physical inactivity should be considered a “vital sign” in primary care; that is, physical activity should be assessed in the clinic alongside other clinical measures, such as blood pressure and weight status.^{44,45} Hence,

clinicians should routinely assess physical activity in primary care and prescribe physical activity to reduce the incidence of chronic disease and/or as a way to manage chronic conditions (e.g. type 2 diabetes) and weight maintenance.⁴⁴ Similarly, in the UK, the National Institute for Health and Care Excellence (NICE), recommends that primary care providers identify patients who are not sufficiently active and subsequently provide physical activity counseling.⁴⁶ In addition, the Healthy People 2020 objectives include a goal of increasing the number of physician visits where physical activity counseling is provided to all patients, and also to those who are diagnosed with a chronic condition (e.g. diabetes).⁴⁷

Moreover, there have been calls in leading medical journals (e.g. JAMA) to incorporate physical activity counseling in primary care as a preventive medicine measure.^{48,49} They suggest, based on accumulating evidence, that merely advising patients to engage in physical activity is not sufficient to facilitate behavior change.^{20,33} The 5A framework (Assess, Advise, Agree, Assist, Arrange) has been suggested as an effective way to encourage patients to adopt physical activity. Specifically, Estabrooks et al. (2003) suggests that patients' levels of activity should be *assessed* in the waiting room by clinic staff.²⁰ This should be followed by the clinician *advising* the patient on the recommended amount, type, and intensity of the activity. Linking this physical activity advice to recent laboratory reports indicating the patients' risk for disease has been suggested, though this suggestion warrants further investigation.²⁰ Furthermore, the patients' readiness to change (e.g. stages of change) should be determined and a plan should be tailored to this his/her stage of change.⁵⁰ After this stage, both patient and clinician should *agree* upon an action plan and set attainable activity goals tailored to the patient. The *assist* phase includes identifying impediments to adopting the activity plan and addressing barriers on the personal (e.g. lack of time), social (e.g. assisting with social support), and community levels (community opportunities

for physical activity).^{20,29} The final stage of the 5A framework includes arranging follow-up visits and reminders with the ultimate goal of increasing adherence to the physical activity program.

The success of the Green Prescription program (previously described),³⁵ likely stems from the fact that many of the components of the 5A model were an integral part of the intervention.²⁰ For example, after the patients received the physical activity prescription, they discussed the plan with a primary care professional and jointly agreed on goals.³⁵ In addition, a copy of the activity plan was sent to a local sports organization that followed up with patients to encourage them to adhere to their program.³⁵ However, when attempting to implement the 5A approach in the context of a busy clinical setting, clinicians encountered some challenges, such as lack of time.⁵¹ More broadly, outside of the context of a clinical trial, physicians encounter numerous impediments when attempting to provide physical activity counseling. Barriers may include insufficient time during the patient-physician encounter, insufficient training in the field of physical activity, insufficient knowledge on how to counsel effectively, lack of perceived effectiveness of their counseling, organizational barriers, insufficient counseling protocols, and lack of reimbursement.^{17,19} Furthermore, research from the communication and linguistics literature suggests that individuals tend to resist (even well-intended) advice from the advice giver (e.g. clinician) because it is deemed as asymmetrical and paternalistic in nature.⁵²⁻⁵⁴ Finally, clinicians who are inactive themselves are less likely to provide physical activity counseling than their active counterparts.¹⁹

Indeed, national data from the US and Canada indicate that clinicians are insufficiently providing physical activity counseling. In the US, only 32.4% of patients seen by a clinician in 2010 received physical activity counseling that year.⁵⁵ The prevalence of physical activity counseling was higher for patients with chronic conditions or their risk factors. For example,

56.3% of diabetic patients received counseling, whereas 46.9% of obese patients were counseled on increasing activity.⁵⁵ In addition, a large Canadian study, examined the physical activity counseling habits of over 13,000 physicians. While they found that 85.2% of clinicians asked their patients about their physical activity habits, only 26.2% assessed their activity during a physical exam or fitness test, and a mere 10.9% refered their patients to others for additional assessments.³³ Thus while physical activity counseling is perceived to be important to clinicians,¹⁹ few provide comprehensive counseling to their patients.

Physical Activity and Behavioral Economics

While the public health viewpoint focuses on identification of actions that should be taken to reduce morbidity and increase longevity, the economic perspective focuses on the allocation of scarce resources to maximize welfare, of which health is only one potential component.⁵⁶ From an economic perspective, the decision to engage in physical activity can be viewed as a decision involving an inter-temporal tradeoff between current costs (e.g. time and energy expenditure) and future benefits (e.g. improved health).^{57,58} Physical activity can be regarded as an investment in health. Thus, physical activity is an important component of the production of health, which is consistent with Becker's seminal economic theory of investment in human capital and Grossman's adaptation of this model to health.^{56,58-61} These early traditional economic models assumed that individuals were rational decision makers, that individuals had consistent preferences over time, and that they made decisions to maximize their utility while having high computational abilities and possessing complete information to facilitate decision making.²¹ More recently, behavioral economists have expanded these early models by acknowledging many of these assumptions are

not always true. In particular, individuals frequently make inconsistent decisions over-time (e.g. ‘new year’s resolutions’); and rationality is bounded because humans have cognitive limitations and limited time to make decisions, which often leads to choices that are not always in their long-term self-interest.^{21,62–64}

The inter-temporal trade-off between the costs and benefits of physical activity is a primary area of focus for behavioral economists interested in understanding the decision to engage in physical activity. Individuals who are willing to ‘pay’ the immediate costs of physical activity to obtain health in the future are regarded as having patient time preferences. Having patient time preferences, reflective of the ability to delay immediate gratification, has been associated in the literature with higher education and income, more financial savings for retirement, better preventive health behaviors (e.g. exercising, healthful eating, and not smoking), and improved health outcomes (e.g. normal weight status).^{57,65–67} In general, most individuals possess impatient time preferences, but the degree of patience varies across individuals. It should be noted, that there is an inherent complexity when weighing the inter-temporal costs and benefits associated with physical activity. Some immediate costs of physical activity are salient and certain (e.g. ‘I will sweat and tire!’), but other costs occur with uncertain probability, such as the likelihood of exercise induced injury, which is often unknown. In comparison, the health benefits of physical activity are almost always probabilistic and documented in the literature (e.g. improved mental health).^{3,68} Furthermore, the decision to engage in physical activity has been associated with risk preferences.⁶⁹ As with time preferences, individuals vary in the degree to which they avoid (or seek out) risk, and their ability to accurately assess risk. Individuals who have a greater degree of tolerance for risk have been found to be more likely to engage in physical activity.⁶⁹

In summary, behavioral economists have identified some predictable decision biases,

which, once identified, may be leveraged to facilitate choices that will be beneficial instead of detrimental.^{70,71} Next we will describe pertinent sources of decision biases associated with engaging in physical activity. While a large set of cognitive biases have been discussed in the behavioral economics literature (e.g. probability matching bias), we focus here on two biases which seem especially relevant to the health care context: present-time bias and status quo bias. We will discuss strategies suggested by behavioral economics as potential solutions to these biases. Both general and specific strategies will be mentioned to facilitate effective physical activity counselling. The Table summarizes suggested strategies for each decision bias based on the 5A framework, previously described. This suggested integrative framework warrants examination in the context of the primary care setting in future research.

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Present Time Bias

Impatient time preferences result in individuals being overly focused on the here and now. In the case of physical activity, activity can be viewed as a tradeoff between ‘should’ behaviors (e.g. ‘I should be physically active to improve my health’), and ‘want’ behaviors (e.g. ‘I want to sit on the couch and watch TV’).^{57,58,72} Since the costs of physical activity are tangible at present (require time and energy expenditure) and the benefits are in the future and thus not salient, individuals, especially those with impatient time preferences, will tend not to be active.⁷³ While time preferences could be consistent over time, they often are not, particularly with respect to decisions pertaining to health. For example, an individual will plan to engage in physical activity tomorrow,

but when tomorrow arrives, the immediate gratification provided by watching TV instead will interfere with his/her plan.²² Individuals deviating from their time consistent plan, are regarded as being present time bias with self-control problems arising from temptations leading to immediate gratifying behavior. Specifically, self-control problems can be described as an inner struggle between two selves residing in one human being: a myopic self in conflict with a farsighted self, with the myopic self who cares about immediate gratification having the upper hand.^{22,74} This might happen daily when the myopic self is able to overcome the farsighted self.

To explore self-control problems, Ariely and Wertenbroch (2002) examined college students' performance in an academic course based exposure to internal or external restrictions.^{70,75} Specifically, in various sub-studies students were asked to submit class-assignments in three distinct ways: (1) Self-imposed deadlines; i.e. students selected the deadlines for the assignments themselves and receive a penalty if they did not meet the deadlines; (2) 'Laissez-faire' condition, i.e. students could submit assignments anytime they wanted until the last day of the semester; and (3) Externally imposed deadlines, i.e. the course instructor imposed the deadlines on students. Interestingly, the class with the externally imposed deadlines received the highest grades, followed by self-imposed deadlines, whereas the lowest grades were obtained by the group where no restrictions (either external or internal) were imposed.⁷⁰ Conclusions from this study are that external edicts from an authoritarian power (or figure) appear to be the most effective in solving self-control problem followed by the utilization of a pre-commitment tool to self-impose restriction to improve well-being, that is, grades in this case. When applying these findings to the physical activity realm it appears that most of the population is in the 'Laissez-faire' condition, that is, there are mostly no restrictions imposed on them. Therefore, increasing physical education and activity within schools, and setting active transport as the default option, for example, have

the potential to have the greatest impact on physical activity behavior. However, when setting physical activity as the default is not an option, pre-commitment devices to encourage physical activity have the potential to be a feasible and effective approach.

Pre-commitment Contracts

Pre-commitment contracts (or devices) consist of self-imposed present day costs or restrictions that are aimed at increasing one's welfare in the future.⁷⁶ An early example of this concept is from Greek Mythology, where Ulysses asked his crew to tie him to the mast of a sailing ship and pour wax in the crew's ears to resist being tempted by singing Sirens who had lured sailors to their death.⁷⁶⁻⁷⁸ A modern day application of this concept has been applied to monetary savings. For example, Ashraf, Karlan and Yin (2006), in a field experiment, examined how a commitment device aimed at restricting individuals access to saving funds impacted their overall savings.⁷⁶ Study results find that participants who used the commitment device increased their savings by 81% in comparison to the pre-intervention levels.⁷⁶ However, 28% of participants did not use the commitment device. Those willing to commit could be regarded as sophisticated (i.e. cognizant) regarding their self-control problems; that is, at present they are committing to help their future selves.⁷⁶ Thus it is important to increase the awareness of those who are naïve about being present-bias, in order to enable them to enhance their welfare through the opportunity of utilizing pre-commitment devices. An additional example comes from the realm of monetary savings: Thaler and Benartzi's (2004) saving program, Save More Tomorrow™, in which participants committed in advance to saving future raises in their salary towards retirement.⁶⁶ Indeed, study findings indicated that those who joined the plan increased their saving rates from 3.5% to 12.6% over a 40 month time period.⁶⁶

In addition, a pre-commitment contract could be applied by depositing a sum of money to a third party that would be lost or given to charity, if pre-determined goals are not met.⁷³ Since humans tend to be loss averse,⁷⁹ that is, they are more sensitive to losses than the prospect of gains,²¹ the thought of losing even a relatively small sum of money, will encourage adherence to the goals they aim to accomplish. This approach has been used successfully in weight loss interventions and in smoking cessation programs,^{80,81} and could be applied to encourage adherence to physical activity guidelines. For example, a study by Gine, Karlan and Zinman (2010), found that a voluntary commitment contract aimed to help smokers quit increased the likelihood of smoking cessation both at 6 and 12-month follow-up periods as measured by a urine test for both nicotine and cotinine.⁸² Similarly, Royer et al. (2015), in a large scale field experiment in a Fortune-500 company, found that pre-commitment contracts offered at the end of a brief incentive program aimed at increasing gym attendance, lead to sustained behavior change.²⁴

Financial Incentives

Providing financial incentives can aid in overcoming present-time bias by increasing the saliency of the future benefits of present day behaviors.⁵⁷ That is, providing financial incentives now for a desired behavior (e.g. physical activity) moves the benefits (e.g. improved health) from the future into the present via monetary incentives.⁵⁸ A systematic review by Mitchell et al. (2013) on the effects of financial incentives on physical activity, found that incentives not only positively impact behavior during the intervention period, but also remain after they subside.⁸³ Furthermore, Mitchell suggests that financial incentives are most successful when they are provided for objectively determined behavior, such as steps measured via pedometers or gym attendance measured electronically, that incentives are guaranteed (versus lottery), and that incentives are most effective for previously inactive adults.⁸³ Charness and Gneezy (2009), similarly found that financial

incentives significantly increased gym attendance for inactive adults; that is, incentives were helpful in habit formation, and once incentives were withdrawn, individuals continued to exercise.^{23,84} Loewenstein et al. (2016), found that short run and very modest incentives provided to children significantly increased their fruit and vegetable consumption, even after the end of the intervention.⁸⁵ However, it should be noted that the above mentioned incentives were provided as part of experiments. While clinicians cannot be expected to provide financial incentives to patients on a regular basis, some employers offer incentives. In addition, it is feasible for clinicians to provide symbolic encouragement to be physically active at each visit or suggest that patients reward themselves. Clinicians can also mention to patients that they could potentially receive incentives from their employers for healthy behaviors leading to improved health outcomes.^{86,87} Clinicians could also indicate to obese patients, for example, that they may be eligible for weight loss counseling including physical activity and dietary changes at no cost sharing (no copayment, co-insurance, or deductible) to them.⁸⁸

Strategies for Dealing with Present Time Bias in the Clinical Setting

Within the 5A model, when assessing patients' physical activity levels, clinicians could also inquire about patients' self-control problems (e.g. 'are you able to hold off on eating a tempting chocolate cake laying right in front of you?'), and later suggest strategies to overcome present time bias. For example, clinicians could suggest pre-commitment tools when jointly setting physical activity goals (i.e. 'Agree' phase) and when providing strategies to overcome barriers ('Assist' phase).²⁰ For example, Karlan, along with colleagues, developed a commercial application of pre-commitment contracts, StickK.com, where individuals can enter into a contract

and deposit money based on pre-determined goals, such as exercising regularly.⁸⁹ Clinicians (or supporting staff) can help patients set-up these tools in advance. A commitment contract can also be between friends or colleagues at work in the form of a binding social agreement to engage in physical activity daily, such as going for a walk daily during lunch time. In addition, for some patients the immediate gratification provided by high step counts from pedometers may offer a buffer against the immediate gratification offered by ‘want behaviors’, such as the TV. These step counts can be acquired either through walking up the stairs (instead of using the elevator), walking to talk to a colleague (instead of emailing), walking meetings, or simply walking for leisure. In addition, Milkman et al. (2014) suggested a method of ‘temptation bundling’ to overcome self-control problems.⁹⁰ Specifically, in a field experiment, they found that individuals that used ‘low brow’ audiobooks at the gym (i.e. a source of immediate gratification) significantly increased their attendance at the fitness center in comparison to control group participants who did not use audiobooks.^{72,90} Thus, this strategy could be suggested to patients to increase adherence to their physical activity plan.

In addition, some suggested ways of overcoming present time bias involve improving the saliency of future benefits and reducing present costs. For example, making patients aware of the direct link between sufficient physical activity and improved health outcomes, through relating their lab results to physical activity habits during the patient-doctor encounter;²⁰ this is important in making the benefits more salient. In addition, patients experiencing present time bias might intend to begin a physical activity program prescribed by their physician, but struggle with execution and follow-up. In the clinical setting, after the clinician collaboratively develops a physical activity plan with the patient, it is of importance for designated support staff to enroll patients in an activity of their choice (e.g. walking club, gym) rather than solely giving them

instructions. This is likely to help patients in general and with present time bias, in particular, since the costs associated with the time and energy required for registration fall under the purview of the clinic rather than the patient. Moreover, identifying opportunities for activity at home (e.g. yardwork), in the neighborhood (e.g. walking trails), or for active transport (e.g. cycling to work) based on the patient's preferences can increase the likelihood of adopting and maintaining this activity over time. In addition, identifying social support to regularly engage in the physical activity of choice is crucial since this could serve as a binding agreement, thereby increasing the likelihood of engaging in physical activity regularly. Furthermore, follow-up appointments should be set before the patient has left the clinic so that they are pre-committed to engage in a follow-up discussion about the status of their physical activity plan. Finally, clinicians should draw salient connections between patients' behavioral changes and health outcomes during the follow-up meetings. For example, clinicians should point out weight maintenance, improved cholesterol levels and better glycemic control when they are noted alongside increased physical activity rather than assuming patients will draw the cause-effect conclusions themselves.

Status-Quo bias

A key decision error is based on status quo bias, where individuals tend to take the 'path of least resistance'. Hence, individuals are often unable to make decisions that deviate from what they perceive as the status quo. This means that policies establishing default options are very influential in determining individual decisions because they effectively set the status quo. The case of organ donations, is a case in point, in which nations where the default option is to donate organs (with an opt out option) have markedly higher donation rates than countries where the default option is

not to donate organs (with an opt-in option). Specifically, Johnson and Goldstein (2003) found that in European countries that have the ‘opt in’ option for organ donation, the effective consent percentage is very low (e.g. Denmark: 4.25%), whereas in countries where with the ‘opt out’ option, such as Sweden (85.9%), rates are high.⁹¹ Government educational campaigns could potentially persuade individuals who live in an ‘opt in’ country to donate organs; however, this strategy would likely yield less effective results than setting the default as donating organs, while maintaining the ‘opt out’ option. This example is highly applicable to physical activity, since individuals often take cues for appropriate levels of activity from their family and peers. For example, in families where the norm is to be physically active, the entire family might engage in leisure time activity jointly (e.g. cycling), whereas an inactive lifestyle might be the norm in other families.⁹² Additionally, in countries (or cities) with policies and design strategies that promote or facilitate active transport (e.g. walking or cycling), transportation-related physical activity rates are markedly higher than countries that do not have the infrastructure conducive for active transport.^{93,94} Similarly, school classrooms or office workstations that have standing desks will encourage children and adults (respectively) to stand up and move about more, thus leading to increased energy expenditure and decreased sitting time.^{28,95} The evidence-based Guide to Community Preventive services recommends community-scale and street-scale urban design and land use policies and providing access to places for physical activity, combined with informational outreach, as strategies for increasing physical activity.⁹⁶ When policies and environments facilitate and encourage physical activity, people are more likely to be active. In contrast, where the path of least resistance is physical inactivity, the status quo in most communities, the population at large remains inactive, leading to numerous chronic diseases.^{3,14,29}

Asymmetric Paternalism

A policy approach suggested by behavioral economics to deal with self-harming behaviors is asymmetric paternalism.⁷¹ Asymmetric paternalism refers to an approach where individuals have the opportunity to select one out of a number of alternate options; however, one of the options (the one deemed beneficial), is made easier to choose than the others. This approach can help an individual achieve his/her own goals, without limiting freedom to choose.⁷¹ The asymmetric paternalistic approach suggests using choice architecture to facilitate healthy choices.⁹⁷ For example, placing healthy food items at eye level and unhealthy foods away from eyesight will encourage choosing healthier items.⁹⁷ Specifically, Wansink and Hanks (2013) observed that arranging healthier foods first at buffets can nudge individuals into selecting these items rather than unhealthful options placed further away.⁹⁸ With regard to physical activity, the asymmetric paternalistic approach is well-suited to facilitate physical activity change. A pertinent example is encouraging the use of stairwells, by making this option more visible and ‘attractive’ to use (e.g. via music or art work) instead of elevators or escalators. This can be conducted in a variety of settings, such as workplaces, hospitals, and malls. Signs placed near elevators (or even escalators) that nudge people to take the stairs instead of the unhealthy alternative (i.e. using the elevator or escalator) are referred to as point of decision prompts. These prompts, along with making stairwells more inviting, have been observed to significantly increase stair use in a systematic review.^{31,99} Moreover, schools and workplaces that set the default option as using standing desks or integrating physical activity into the course of the day, such as through promoting walking meetings or physical activity breaks, will make standing and moving about the norm rather than sedentary behavior.^{28,100,101}

Framing and Anchoring

The framing of choices has been found to have a paramount impact on decision-making,

particularly when making the intertemporal tradeoff between ‘should’ and ‘want’ behaviors.^{25,72} Highlighting the positive attributes of the ‘should behaviors’ (e.g. physical activity) rather than the negative ones are important factors which can change the current status quo.¹⁰² Thus the public health message delivered to patients encouraging them to engage in physical activity should be positive and simple.¹⁰² For example, First Lady Michelle Obama’s initiative to combat childhood obesity, ‘Let’s Move!’, was a good example of a positive and simple message.^{102,103} In addition, physical activity should be framed as a fun activity (e.g. “go out there, choose an activity you like, such as dancing or soccer, and have fun”) rather than an obligatory activity (e.g. “you need to meet guidelines because it’s important for improving your health”).²⁵ In addition, a recent study by Grinstein and Kronrod (2016) underscored the importance of not only what is said in the health message, but also how the message is conveyed.¹⁰⁴ Specifically, when encouraging a desired behavior (e.g. physical activity), praise can benefit from using an assertive tone, whereas scolding should be non-assertive. For example, when examining adherence to the physical activity plan in follow-up consultations, the clinician can encourage the patient by stating: “You are regularly active according to plan, excellent job!”. However, if the patient is not meeting the agreed upon goals, the clinician could state: “You are not meeting the goals you set; you might want to consider increasing the frequency of your activity sessions”. An additional factor that should be taken into account when providing physical activity counseling is anchoring. Anchoring is a form of priming whereby exposure to a reference point impacts subsequent judgment and decision making, often without the individual being aware of this effect.¹⁰⁵ Social norms can serve as an anchor, where both the proximal (e.g. close social network) and distal (e.g. societal norms) influence behavior.²⁵ In the case of physical activity, changing the norms among friends and family towards a more active lifestyle are important factors in behavior change. Additionally, using recent developments

in information technology to set a desirable anchor (e.g. the entire family strives to exceed 10,000 steps daily), can encourage an active lifestyle.¹⁰⁶

Strategies for Dealing with Status Quo Bias in the Clinical Setting

Clinicians should be aware of status quo bias and its potential impact on all stages of the 5A process. For example, inactive patients who believe the status quo is to be active regularly may exaggerate the degree to which they are active. This could impact accurate assessment of activity. In other stages of the 5As, clinicians may leverage status quo bias to encourage adherence to the physical activity plan by tailoring their advice. For example, rather than citing statistics about the degree to which the US population fails to adhere to physical activity guidelines, clinicians could mention success stories of individuals similar to them. Clinicians can also reinforce physical activity as a social norm when developing the physical activity plan by identifying specific elements of the plan that are commonly undertaken. For example, if a previously inactive individual is planning to begin exercising by gradually increasing the frequency and intensity of their sessions, the clinician can reinforce this practice by emphasizing that this practice is done by many others. For example, the following can be stated: “Did you know that most of my patients begin exercising gradually? You’re in good company.” Furthermore, clinicians can assist patients in executing physical activity plans by inquiring about their daily routine and helping patients to identify common daily opportunities for increased activity such as parks or fitness centers near their home, worksite wellness programs, stair usage, use of sit-stand workstations, or ways to integrate active transport into the daily routine. Finally, clinicians should be mindful to ensure that physical activity counseling is done routinely in their own practices. Having readily available

physical activity prescriptions, relevant handout material, trained support staff, knowledge of physical activity opportunities around them, and connections to physical activity programs and resources in the community are all paramount to providing meaningful physical activity counseling. In fact, some physicians have begun to create physical activity opportunities for their patients with the ‘Walk with a Doc’ initiative.¹⁰⁷ There are currently 250 chapters of ‘Walk with a Doc’, with 3000 clinicians and health professionals and approximately 200,000 members of the community who participate in these walking groups.

Limitations

While this study aims to summarize public health and behavioral economics approaches to promote physical activity in primary care, there are several limitations that should be acknowledged. While taking a comprehensive approach to reviewing pertinent literature, the current study should not be interpreted as a systematic review. Additionally, whereas constructs from public health have been applied extensively to physical activity promotion, less research is available examining the nexus of behavioral economics and physical activity. Therefore, the proposed framework linking the 5As with present time and status quo bias should be regarded as a suggestion that requires empirical examination in the primary care setting. Finally, although there are numerous cognitive biases identified by behavioral economists, the current study focuses on the two (present time bias and status quo bias) we deem most relevant to physical activity promotion in primary care.

Conclusion

Physical inactivity is prevalent in modern society. Since primary care physicians’ advice is respected and doctor-patient encounters are frequent, these meetings can be utilized to provide

physical activity counseling. Consistent and comprehensive physical activity counseling may be an important vehicle for reducing the risk of chronic diseases and premature death. Physical activity should be assessed in every clinic visit, a detailed physical activity plan should be jointly designed with the patient, and goals should be set and monitored. In addition, specific strategies should be provided to patients to overcome impediments to activity. While the 5A framework is a useful guide to providing effective counseling, behavioral economics might lead to a clearer understanding of impediments to physical activity since the decision to engage in physical activity is complex and influenced by both conscious and unconscious determinants. Common decision errors (i.e. present time bias, status quo bias) are highly relevant to physical activity, and pertinent strategies (e.g. pre-commitment contracts, temptation bundling) could be employed to overcome these errors. Future research should examine the efficacy and effectiveness of implementing these strategies in the context of the primary care setting. While the primary care setting is an important avenue to pursue physical activity promotion, it is not the only one. Policies aimed at changing the environment to one that is conducive to an active lifestyle are necessary to bring along a sustainable change.

Table. Physical activity counseling in primary care: 5As Framework* by decision biases

5A Component**	Present Time Bias***	Status-Quo Bias***
<p><u>Assess</u></p> <p>Assess physical activity levels at baseline and at each visit.</p>	<p>-Ask the patient about self-control problems; briefly explain this phenomenon and emphasize how common it is. Emphasize that strategies will be provided to help achieve activity goals.</p>	<p>-Be aware that patients’ perceptions of the status quo regarding physical activity could impact their reported activity.</p>
<p><u>Advise</u></p> <p>Advise on increasing physical activity levels. Relate patient’s lab results/ symptoms to physical inactivity.</p>	<p>-Increase patients’ awareness of the link between physical activity levels and improved health; relating lab results to health behavior increases the saliency of the benefits of activity.</p>	<p>-Use positive and simple language to deliver the public health message of physical activity; frame activity as fun.</p> <p>-Mention success stories of individuals similar to your patient.</p>
<p><u>Agree</u></p> <p>Agree on physical activity plan that is tailored to the patient’s interests and preferences; jointly set goals and milestones.</p> <p>Provide detailed counseling on the frequency, intensity and type of activity.</p>	<p>- Discuss the challenges often encountered when executing future plans.</p> <p>-Agree with patients that the future health benefits of physical activity are real and valuable.</p>	<p>-Reinforce that physical activity is the social norm; identify specific elements of the plan that are commonly undertaken by others.</p>
<p><u>Assist</u></p> <p>Provide pertinent strategies to overcome impediments to meeting physical activity goals.</p>	<p>-Encourage the use of pre-commitment contracts (e.g. pre-depositing money),**** and binding “contracts” with family/friends or personal trainer to engage in physical activity regularly.</p> <p>- Suggest using temptation bundling: combine ‘want’ behaviors (e.g. TV viewing</p>	<p>-Inquire about your patient’s daily routine and help them identify common opportunities for increased activity as the default option, such as worksite wellness programs, stair usage, the use of sit-stand workstations, and joining a physical activity program (e.g. ‘Walk with a Doc’).</p>

	<p>on iPad) with ‘should’ behaviors (e.g. walking on treadmill).</p> <ul style="list-style-type: none"> - Suggest the use of pedometers or other monitoring device (e.g. Fitbit) and set to a specific goal (e.g. 10,000 steps a day); this provides tangible feedback that may buffer the immediate gratification of “want” behaviors. - Actively enroll patients in an activity of their choice (e.g. walking club); this will reduce the ‘costs’, e.g. costs for the patient associated with registration. 	<ul style="list-style-type: none"> - Encourage lifestyle changes for the whole family; this will change the social norms and set the default as an active lifestyle. - Set activity monitors to meet a goal, such as setting prompts on the Fitbit for standing up and moving about every 30 min during a day at the office. This will facilitate changing the status quo from sedentary to more active.
<p>Arrange</p> <p>Arrange follow up visits and reminders.</p>	<ul style="list-style-type: none"> - Arrange follow-up meetings pertaining to meeting physical activity goals before patients leave the clinic; this will pre-commitment patients to come back. - Draw salient connections between patients’ behavioral changes and health outcomes (e.g. weight maintenance) during the follow-up meetings. 	<ul style="list-style-type: none"> - Establish that physical activity should be the status quo and maintain this “theme” throughout all follow-up visits. - Arrange to have reminders sent to patients to engage in activities with others that are physically active to reinforce that physical activity is the status quo.

* The 5As (Assess, Advise, Agree, Assist, Arrange) is a framework used to provide physical activity counseling.

** Based on Estabrooks et al. (2003).²⁰

*** Individuals deviating from their time consistent plan are regarded as being present time bias with self-control problems arising from temptations that result in immediate, gratifying behavior. Status quo bias is a decision error in which individuals tend to take the ‘path of least resistance’; that is, they are often unable to make decisions that deviate from what is the default option.

**** Pre-commitment contracts (or devices): consist of self-imposed present day costs or restrictions that are aimed at increasing one’s welfare in the future.

References

1. Kohl HW, Craig CL, Lambert EV, et al. The pandemic of physical inactivity: global action for public health. *Lancet*. 2012;380(9838):294-305.
2. U.S. Department of Health and Human Services. Nutrition, Physical Activity and Obesity: Data, Trends and Maps. https://nccd.cdc.gov/NPAO_DTM/.
3. Physical Activity Guidelines Advisory Committee. *Physical Activity Guidelines Advisory Committee Report, 2008*. Washington, DC; 2008.
4. The Surgeon General. *Step It Up! The Surgeon General's Call to Action to Promote Walking and Walkable Communities*. Washington, DC; 2015.
<http://www.surgeongeneral.gov/library/calls/walking-and-walkable-communities/>.
5. U.S. Department of Health and Human Services. *Physical Activity and Health: A Report of the Surgeon General*. Atlanta, GA; 1996.
6. National Coalition for Promoting Physical Activity. National Physical Activity Plan. <http://www.ncppa.org/national-physical-activity-plan>.
7. Cummings K. Smoking isn't cool anymore: The success and continuing challenge of public health efforts to reduce smoking. *J Public Heal Manag Pract*. 2016;22:5-8.
8. Paffenbarger RS, Blair SN, Lee I-M. A history of physical activity, cardiovascular health and longevity: the scientific contributions of Jeremy N Morris, DSc, DPH, FRCP. *Int J Epidemiol*. 2001;30:1184-1192.

9. Lee I-M, Shiroma EJ, Lobelo F, Puska P, Blair SN, Katzmarzyk PT. Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. *Lancet*. 2012;380(9838):219-229.
10. Moore SC, Lee I, Weiderpass E, et al. Association of Leisure-Time Physical Activity With Risk of 26 Types of Cancer in 1.44 Million Adults. *JAMA Intern Med*. 2016;176:816-825.
11. Kushi LH, Doyle C, McCullough M, et al. American Cancer Society Guidelines on Nutrition and Physical Activity for Cancer Prevention Reducing the Risk of Cancer With Healthy Food Choices and Physical Activity. *CA Cancer J Clin*. 2012;62:30-67.
12. Fong DYT, Ho JWC, Hui BPH. Physical activity for cancer survivors: meta-analysis of randomised controlled trials. *BMJ*. 2012;344:e70.
13. Centers for Disease Control and Prevention. Exercise or Physical Activity. <http://www.cdc.gov/nchs/fastats/exercise.htm>. Accessed August 7, 2016.
14. Troiano RP, Berrigan D, Dodd KW, Mâsse LC, Tilert T, McDowell M. Physical activity in the United States measured by accelerometer. *Med Sci Sports Exerc*. 2008;40(1):181-188.
15. Ng SW, Popkin BM. Time use and physical activity: a shift away from movement across the globe. *Obes Rev*. 2012;13(8):659-680.
16. Shuval K, DiPietro L, Skinner CS, et al. “Sedentary behaviour counselling”: the next step in lifestyle counselling in primary care; pilot findings from the Rapid Assessment Disuse Index (RADI) study. *Br J Sports Med*. 2014;48(19):1451-1455.

17. Katz DL, Shuval K, Comerford BP, Faridi Z, Njike VY. Impact of an educational intervention on internal medicine residents' physical activity counselling: the Pressure System Model. *J Eval Clin Pract.* 2008;14:294-299.
18. Centers for Disease Control and Prevention. Ambulatory Care Use and Physician office visits. <http://www.cdc.gov/nchs/fastats/physician-visits.htm>. Accessed November 5, 2016.
19. Hébert ET, Caughy MO, Shuval K. Primary care providers' perceptions of physical activity counselling in a clinical setting: a systematic review. *Br J Sports Med.* 2012;46:625-631.
20. Estabrooks PA, Glasgow RE, Dzewaltowski DA. Physical activity promotion through primary care. *JAMA J Am Med Assoc Estabrooks PA, Glas RE, Dzewaltowski DA Phys Act Promot through Prim care JAMA* 2003;289(22)2913-2916. 2003;289(22):2913-2916.
21. Thorgerirsson T, Kawachi I. Behavioral economics: Merging Psychology and Economics for Lifestyle Interventions. *Am J Prev Med.* 2013;44(2):185-189.
22. Roberto CA, Kawachi I, eds. *Behavioral Economics & Public Health*. 1st ed. Oxford, UK: Oxford University Press; 2016.
23. Charles G, Gneezy U. Incentives to Exercise. *Econometrica.* 2009;77(3):909-931.
24. Royer BH, Stehr M, Sydnor J. Incentives, Commitments, and Habit Formation in Exercise: Evidence from a Field Experiment with Workers at a Fortune-500 Company. *Am Econ J Appl Econ.* 2015;7(3):51-84.
25. Zimmerman FJ. Using behavioral economics to promote physical activity. *Prev Med (Baltim).* 2009;49(4):289-291.

26. Booth FW, Chakravarthy M, Spangenburg EE. Exercise and gene expression: physiological regulation of the human genome through physical activity. *J Physiol.* 2002;543(2):399-411.
27. Bey L, Hamilton MT. Suppression of skeletal muscle lipoprotein lipase activity during physical inactivity: a molecular reason to maintain daily low-intensity activity. *J Physiol.* 2003;551(Pt 2):673-682.
28. Shuval K, Barlow CE, Finley CE, Gabriel KP, Schmidt MD, Defina LF. Standing, Obesity, and Metabolic Syndrome: Findings from the Cooper Center Longitudinal Study. *Mayo Clin Proc.* 2015;90:1524–1532.
29. Sallis JF, Cervero RB, Ascher W, Henderson KA, Kraft MK, Kerr J. An ecological approach to creating active living communities. *Annu Rev Public Health.* 2006;27:297-322.
30. Faridi Z, Shuval K, Njike VY, et al. Partners reducing effects of diabetes (PREDICT): a diabetes prevention physical activity and dietary intervention through African-American churches. *Health Educ Res.* 2010;25(2):306-315.
31. The Guide to Community Preventive Services. Environmental and Policy Approaches to Increase Physical Activity: Community-Scale Urban Design Land Use Policies. <http://www.thecommunityguide.org/pa/environmental-policy/communitypolicies.html>.
32. Robertson-Wilson J, Dargavel M, Bryden P, Giles-Corti B. Physical activity policies and legislation in schools: a systematic review. *Am J Prev Med.* 2012;43(6):643-649.
33. Petrella RJ, Lattanzio CN, Overend TJ. Physical Activity Counseling and Prescription

- Among Canadian Primary Care Physicians. *Arch Intern Med.* 2007;167(16):1774-1781.
34. Calfas KJ, Sallis JF, Zabinski MF, et al. Preliminary Evaluation of a Multicomponent Program for Nutrition and Physical Activity Change in Primary Care : PACE+ for Adults. *Prev Med (Baltim).* 2002;161:153-161.
 35. Elley CR, Kerse N, Arroll B, Robinson E. Effectiveness of counselling patients on physical activity in general practice: cluster randomised controlled trial. *Br Med J.* 2003;326(793).
 36. Hillsdon M, Thorogood M, White I, Foster C. Advising people to take more exercise is ineffective: a randomized controlled trial of physical activity promotion in primary care. *Int J Epidemiol.* 2002;31:808-815.
 37. U.S. Preventive Service Task Force. Healthful Diet and Physical Activity for Cardiovascular Disease Prevention in Adults: Behavioral Counseling. <https://www.uspreventiveservicestaskforce.org/Page/Document/RecommendationStatementFinal/healthful-diet-and-physical-activity-for-cardiovascular-disease-prevention-in-adults-behavioral-counseling>.
 38. U.S. Preventive Service Task Force. Healthful Diet and Physical Activity for Cardiovascular Disease Prevention in Adults With Cardiovascular Risk Factors: Behavioral Counseling. <https://www.uspreventiveservicestaskforce.org/Page/Document/RecommendationStatementFinal/healthy-diet-and-physical-activity-counseling-adults-with-high-risk-of-cvd>.
 39. U.S. Preventive Service Task Force. USPSTF A and B Recommendations.

- <http://www.uspreventiveservicestaskforce.org/Page/Name/uspstf-a-and-b-recommendations/>. Published 2016. Accessed January 1, 2016.
40. U.S. Department of Labor. FAQs about Affordable Care Act Implementation (Part XXIX) and Mental Health Parity Implementation. <https://www.dol.gov/ebsa/faqs/faq-aca29.html>. Published 2015. Accessed January 1, 2016.
 41. Centers for Medicare & Medicaid Services. Reducing Obesity. <https://www.medicare.gov/medicaid-chip-program-information/by-topics/quality-of-care/reducing-obesity.html>. Accessed January 1, 2016.
 42. Public Law 111-148. Patient Protection and Affordable Care Act. <https://www.gpo.gov/fdsys/pkg/PLAW-111publ148/pdf/PLAW-111publ148.pdf>. Published 2010. Accessed January 9, 2016.
 43. Centers for Medicare & Medicaid Services. National Coverage Determination (NCD) for Intensive Behavioral Therapy for Obesity (210.12). <https://www.cms.gov/medicare-coverage-database/details/ncd-details.aspx?NCDId=353&ncdver=1&NCAId=253&ver=6&NcaName=Intensive+Behavioral+Therapy+for+Obesity&bc=AiAAAAAIAAA&>. Accessed June 10, 2016.
 44. American College of Sports Medicine. Exercise is Medicine. <http://www.exerciseismedicine.org/>.
 45. Coleman KJ, Ngor E, Reynolds K, et al. Initial Validation of an Exercise “Vital Sign” in Electronic Medical Records. *Med Sci Sport Exerc.* 2012;44(11):2071-2076.
 46. National Institute for Health and Care Excellence. Physical activity: brief advice for adults

- in primary care. <https://www.nice.org.uk/guidance/ph44>. Published 2013. Accessed July 5, 2016.
47. Office of Disease Prevention and Health Promotion. 2020 Topics and Objectives-Physical Activity. Health People.gov. <https://www.healthypeople.gov/2020/topics-objectives/topic/physical-activity>.
 48. Auyoung M, Linke SE, Pagoto S, et al. Integrating physical activity in primary care practice. *Am J Med*. 2016;129(10):1022-1029.
 49. Berra K, Rippe J, Manson JE. Making Physical Activity Counseling a Priority in Clinical Practice: The Time for Action Is Now. *JAMA J Am Med Assoc*. 2016;314(24):2617-2618.
 50. Garber CE, Allsworth JE, Marcus BH, Hesser J, Lapane KL. Correlates of the stages of change for physical activity in a population survey. *Am J Public Health*. 2008;98(5):897-904.
 51. Patel A, Schofield GM, Kolt GS, Keogh JWL. General practitioners' views and experiences of counselling for physical activity through the New Zealand Green Prescription program. *BMC Fam Pract*. 2011;12:119.
 52. Goldsmith DJ, MacGeorge EL. The Impact of Politeness and Relationship on Perceived Quality of Advice about A Problem. *Hum Commun Res*. 2000;26(2):234-263.
 53. Pilnick A, Dingwall R. On the Remarkable Persistence of Asymmetry in Doctor/Patient Interaction: A Critical Review. *Soc Sci Med*. 2011;72(8):1374-1382.
 54. Waring HZ. Peer Tutoring in a Graduate Writing Centre: Identity, Expertise, and Advice Resisting. *Appl Linguist*. 2005;26(2):141-168.

55. Centers for Disease Control and Prevention. Trends in Adults Receiving a Recommendation for Exercise or Other Physical Activity From a Physician or Other Health Professional. <http://www.cdc.gov/nchs/products/databriefs/db86.htm>.
56. Cawley J. An economic framework for understanding physical activity and eating behaviors. *AmJPrevMed*. 2004;27(0749-3797 (Print)):117-125.
57. Shuval K, Si X, Nguyen B, Leonard T. Utilizing Behavioral Economics to Understand Adherence to Physical Activity Guidelines Among a Low-Income Urban Community. *J Phys Act Health*. 2015;12:947-953.
58. Leonard T, Shuval K. Behavioral Economic Tools for Promotion of Physical Activity. In: Rice T, Hanoch Y, eds. *Behavioral Economics and Healthy Behaviors: Key Concepts and Current Research*. United Kingdom: Routledge – Abingdon.
59. Fuchs VR. *Economic Aspects of Health*. Vol I. National Bureau of Economic Research Conference Report; 1982.
60. Grossman M. The human capital model. *Handb Heal Econ*. 2000;1:347-408.
61. Becker GS. *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education, 2nd, Ed*. Vol I. National Bureau of Economic Research; 1975.
62. Dellavigna S. Psychology and Economics : Evidence from the Field. *J Econ Lit*. 2009;47(2):315-372.
63. Chiteji N. Time-preference, Non-cognitive Skills and Well-being across the Life Course: Do Non-cognitive Skills Encourage Healthy Behavior? *Am Econ Rev*. 2010;100(2):200-204.

64. Huston SJ, Finke MS. Diet Choice and the Role of Time Preference. *J Consum Aff.* 2003;37(1):143-160.
65. Shuval K, Leonard T, Nguyen B, Ngo TH, Yaroch AL. Behavioral Economics and Fruit & Vegetable Intake: The Fair Park Study. *Heal Behav Policy Rev.* 2015;2:92-99.
66. Thaler RH, Benartzi S. Save More Tomorrow: Using Behavioral Economics to Increase Employee Saving. *J Polit Econ.* 2004;112(1):S164-S187.
67. Huston SJ, Finke MS. Diet Choice and the Role of Time Preference. *J Consum Aff.* 2003;37(1):143-160.
68. Sin N, Moskowitz J, Whooley M. Positive Affect and Health Behaviors Across 5 Years in Patients With Coronary Heart Disease: The Heart and Soul Study. *Psychosom Med.* 2015;77(9):1058-1066.
69. Leonard T, Shuval K, de Oliveira A, Skinner CS, Eckel C, Murdoch JC. Health behavior and behavioral economics: economic preferences and physical activity stages of change in a low-income African-American community. *Am J Health Promot.* 2013;27(4):211-221.
70. Ariely D. *Predicatably Irrational.* New York: HarperCollins; 2008.
71. Loewenstein G, Brennan T, Volpp KG. Asymmetric paternalism to improve health behaviors. *JAMA.* 2007;298(20):2415-2417.
72. Milkman KL, Rogers T, Bazerman MH. Harnessing our inner angels and demons: What we have learned about want/should conflicts and how that knowledge can help us reduce short-sighted decision making. *Perspect Psychol Sci.* 2008;3(4):324-338.

73. Shuval K, Drope J, Stoklosa M, Yaroch AL, Pachucki M, Harding M. Time Preferences and Physical Activity: Insights from Behavioral Economics. *Heal Behav Policy Rev.* 2017;4:53-59.
74. Camerer CF, Loewenstein G, Rabin M, eds. *Advances in Behavioral Economics*. 1st ed. Princeton, NJ: Princeton University Press; 2004.
75. Ariely D, Wertenbroch K. Procrastination, deadlines, and performance: self-control by precommitment. *Psychol Sci.* 2002;13(3):219-224.
76. Ashraf N, Karlan D, Yin W. Tying Odysseus to the Mast: Evidence From a Commitment Savings Product in the Philippines. *Q J Econ.* 2006;121:635-672.
77. Soman D, Ainslie G, Frederick S, et al. The Psychology of Intertemporal Discounting: Why are Distant Events Valued Differently from Proximal Ones ? *Mark Lett.* 2005;16:347-360.
78. Liu PJ, Wisdom J, Roberto CA, Liu LJ, Ubel PA. Using Behavioral Economics to Design More Effective Food Policies to Address Obesity. *Appl Econ Perspect Policy.* 2014;36:6-24.
79. Kahneman D, Tversky A. Prospect Theory: An Analysis of Decision under Risk. *Econometrica.* 1979;47(2):263-292.
80. Halpern S, Asch D, Volpp K. Commitment contracts as a way to health. *BMJ.* 2012;522:e522.doi: 10.1136/bmj.e522.
81. Loewenstein G, Asch D a, Volpp KG. Behavioral economics holds potential to deliver better results for patients, insurers, and employers. *Health Aff (Millwood).*

2013;32(7):1244-1250. doi:10.1377/hlthaff.2012.1163.

82. Giné X, Karlan D, Zinman J. Put Your Money Where Your Butt Is: A Commitment Contract for Smoking Cessation. *Am Econ J Appl Econ*. 2010;2:213-235.
83. Mitchell MS, Goodman JM, Alter DA, et al. Financial Incentives for Exercise Adherence in Adults: Systematic Review and Meta-Analysis. *Am J Prev Med*. 2013;45(5):658-667.
84. Becker GS, Murphy KM. A theory of rational addiction. *J Polit Econ*. 1988;96:675-700.
85. Loewenstein G, Price J, Volpp K. Habit formation in children: Evidence from incentives for healthy eating. *J Health Econ*. 2016;45:47-54.
86. Volpp KG, Asch D a., Galvin R, Loewenstein G. Redesigning Employee Health Incentives — Lessons from Behavioral Economics. *N Engl J Med*. 2011;365(5):388-390.
87. Kullgren JT, Troxel AB, Loewenstein G, et al. Individual- versus group-based financial incentives for weight loss: a randomized, controlled trial. *Ann Intern Med*. 2013;158(7):505-514.
88. U.S. Centers for Medicare & Medicaid Services. Preventive health services. <https://www.healthcare.gov/coverage/preventive-care-benefits/>. Accessed January 1, 2016.
89. StickK: Set your goals and acheive them. <http://www.stickk.com/>.
90. Milkman KL, Minson JA, Volpp KG. Holding the Hunger Games Hostage at the Gym: An Evaluation of Temptation Bundling. *Manag Sci*. 2014;60(2):283-299.
91. Johnson EJ, Goldstein D. Do Defaults Save Lives? *Science (80-)*. 2003;302:1338-1339.

92. Shuval K, Chiu C-Y, Barlow CE, et al. Family history of chronic disease and meeting public health guidelines for physical activity: the cooper center longitudinal study. *Mayo Clin Proc.* 2013;88(6):588-592.
93. Fishman E, Schepers P, Kamphuis C. Dutch Cycling: Quantifying the Health and Related Economic Benefits. *Am J Public Health.* 2015;105(8):e13-5.
94. Fishman E, Böcker L, Helbich M. Adult Active Transport in the Netherlands: An Analysis of Its Contribution to Physical Activity Requirements. *PLoS One.* 2015;7:e0121871.
95. Benden ME, Blake JJ, Wendel ML, Huber JC. The impact of stand-biased desks in classrooms on calorie expenditure in children. *Am J Public Health.* 2011;101(8):1433-1436.
96. The Guide to Community Preventive Services. Environmental and Policy Approaches to Increase Physical Activity: Point-of-Decision Prompts to Encourage Use of Stairs. <http://www.thecommunityguide.org/pa/environmental-policy/podp.html>.
97. Thaler RH, Sunstein CR. *Nudge : Improving Decisions about Health, Wealth, and Happiness.* New Haven, Conn.: Yale University Press; 2008.
98. Wansink B, Hanks AS. Slim by Design: Serving Healthy Foods First in Buffet Lines Improves Overall Meal Selection. *PLoS One.* 2013;8(10):e77055.
99. Soler RE, Leeks KD, Buchanan LR, Brownson RC, Heath GW, Hopkins DH. Point-of-Decision Prompts to Increase Stair Use. *Am J Prev Med.* 2010;38:292-300.
100. Neuhaus M, Healy GN, Dunstan DW, Owen N, Eakin EG. Workplace sitting and height-adjustable workstations: a randomized controlled trial. *Am J Prev Med.* 2014;46(1):30-40.

101. Lynch BM, Owen N. Too Much Sitting and Chronic Disease Risk : Steps to Move the Science Forward. *Ann Intern Med.* 2015;162:146-147.
102. Roberto CA, Kawachi I. Use of psychology and behavioral economics to promote healthy eating. *Am J Prev Med.* 2014;47(6):832-837.
103. Let's Move! <http://www.letsmove.gov/>.
104. Grinstein A, Kronrod A. Does Sparing the Rod Spoil the Child? How Praising, Scolding, and Assertive Tone can Encourage Desired Behaviors. *J Mark Res.* 2016;53(3):433-441.
105. Samson A. The Behavioral Economics Guide 2015.
<http://www.behavioraleconomics.com>.
106. Kendzor DE, Shuval K, Gabriel KP, et al. Impact of a Mobile Phone Intervention to Reduce Sedentary Behavior in a Community Sample of Adults: A Quasi-Experimental Evaluation. *J Med Internet Res.* 2016;18:e19.
107. Abbasi J. As Walking Movement Grows, Neighborhood Walkability Gains Attention. *JAMA.* 2016;316:382-383.