



BLRI RESEARCH CATALOGUE

BLRi Research and Whitepapers

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Toronto Rehabilitation Institute (UHN) Exercise Tracker

Background:

Physical activity is an important contributor to fitness for patients with heart disease. Canadian guidelines recommend 30-60 minutes of moderate to vigorous physical activity on most, preferably, all days of the week. Participation in an outpatient cardiac rehab program is the usual first step toward developing an exercising lifestyle after a heart problem is diagnosed. Unfortunately, many patients stop attending cardiac rehab (about 500 'dropouts' per year at the Toronto Rehabilitation Institute) after enrollment. As well, many patients (about 400 each year) stop exercising after they complete cardiac rehab increasing the risk of another cardiac event.

Purpose:

The objective of this research study is to figure out if it is possible to recruit, randomize (i.e. split participants into 2 groups for the study – control and intervention groups) and study cardiac rehab patients using questionnaires and cardiopulmonary assessment (CPA) (CPA for graduates only; not for 'dropouts') in the context of a new financial incentive-based exercise self-monitoring program.

Design:

52-week, crossover, randomized control study. Intervention group to earn \$1/day for completing exercise prescription for 26 weeks. Control group to earn non-financial rewards (hearts) for completing exercise prescription for 26 weeks. Rolling sign-up for study participation, at 26 weeks participants switch groups to end of study.

Results

2018: Study in progress with targeted completion date of June 2018. Data analysis will commence in September 2018. Manuscript in preparation.

Hamilton Health Science (HHS) Steps Study

Background:

Low physical activity (PA) levels are a major public health concern. The workplace has been recognized as an important intervention target, given that employees are spending the majority of their time being sedentary. Moreover, compared to physically active employees, health care costs and utilization remain significantly higher among physically inactive and/or overweight and obese employees. The evidence shows that employees with a higher body mass index are more likely to have higher rates of medical claims and absenteeism compared to active employees. Therefore, it is critical to understand how best to get the workplace more physically active.

Purpose:

The purpose of this study is to examine whether a specially-designed program targeting employees will increase their number of daily steps to reach a target goal of 3,000 steps above their baseline step count.

Design:

24-week, parallel arm, pilot randomized control trial to begin to examine the impact of additional incentives (i.e. \$1/day for exceeding daily steps goal) on physical activity among *sedentary* HHS employees. Qualifying participants were given a blue-tooth enabled Piezo pedometer to track steps and were then randomized into control and increased incentive groups.

Results

2018: Study complete November 2017, data analysis will commence December 2017. Study results to be published in the winter of 2018. This protocol was designed to examine the impact of guaranteed rewards on physical activity maintenance in lower active hospital employees. Manuscript in preparation.

Examining Incentives to Promote Physical Activity Maintenance Among Hospital Employees Not Achieving 10,000 Daily Steps: A Web-Based Randomized Controlled Trial Protocol

Mitchell M, White L, Oh P, Kwan M, Gove P, Leahey T, Faulkner G. Examining incentives to promote physical activity maintenance among hospital employees not achieving 10,000 daily steps: A web-based randomized controlled trial protocol. *JMIR Res Protoc* 2016 Dec 12;5(4):e231.

Background:

The economic burden of physical inactivity in Canada is estimated at Can \$6.8 billion (US \$5 billion) per year. Employers bear a substantial proportion of the economic costs, as they pay more for inactive workers in health care and other organizational costs. In response, many Canadian employers offer wellness programs, though these are often underutilized. While financial health incentives have been proposed as one way of increasing participation, their longer term effects (ie postintervention effects) are not clear.

Objective:

The objective of this paper is to outline the methodology for a randomized control trial (RCT) examining the longer term impact of an existing physical activity promotion program that is enhanced by adding guaranteed rewards (Can \$1 [US \$0.74] per day step goal met) in a lower active hospital employee population (less than 10,000 steps per day).

Methods:

A 12-week, parallel-arm RCT (with a 12-week postintervention follow-up) will be employed. Employees using Change4Life (a fully automated, incentive-based wellness program) and accumulating fewer than 10,000 steps per day at baseline (weeks 1 to 2) will be randomly allocated (1:1) to standard care (wellness program, accelerometer) or an intervention group (standard care plus guaranteed incentives). All study participants will be asked to wear the accelerometer and synchronize it to Change4Life daily, although only intervention group participants will receive guaranteed incentives for reaching tailored daily step count goals (Can \$1 [US \$0.74] per day; weeks 3 to 12). The primary study outcome will be mean proportion of participant-days step goal reached during the postintervention follow-up period (week 24). Mean proportion of participant-days step goal reached during the intervention period (week 12) will be a secondary outcome.

Results:

Enrollment for the study will be completed in February 2017. Data analysis will commence in September 2017. Study results are to be published in the winter of 2018.

The Feasibility of Financial Incentives to Increase Exercise Among Canadian Cardiac Rehabilitation Patients

Mitchell MS, Goodman JM, Alter DA, Oh Pi, Leahey Tm, Faulkner GEJ. The feasibility of financial incentives to increase exercise among Canadian cardiac rehabilitation patients. *J Cardiopulm Rehabil Prev* 2015;35:1-5.

Background:

A growing body of scientific evidence, now including several systematic reviews of randomized trials, has shown that financial health incentives may assist with health behavior changes, such as increasing regular exercise. Since incentives offer a potentially effective and scalable method for promoting healthy behaviors, they have been widely implemented by governments and corporations to improve health outcomes. The cost-effectiveness of incentive interventions may be greatest when targeting preventive health behaviors in clinical populations.

Purpose:

This research aimed to examine the effectiveness of financial incentives for exercise self-monitoring in cardiac rehabilitation (CR)

Design:

12-week, 2 parallel-arm, single-blind feasibility study design. A volunteer sample of cardiac rehab program graduates was randomly assigned to an exercise self-monitoring intervention only, or an exercise self-monitoring plus incentives approach. The control group received a “home-based” exercise self-monitoring program following cardiac rehab completion. The incentive group participants received the “home-based” program, plus voucher-based incentives for exercise diary submissions.

Results:

Intervention acceptability was high with three-quarters of participants indicating they would likely sign up for an incentive program at baseline. Group differences in exercise self-monitoring (the incentive group) were not observed, modest but nonsignificant changes in aerobic fitness were noted with fitness increasing by $0.23 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ among incentive participants and decreasing by $0.68 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ in controls.

This study demonstrates the potential for incentives to be readily accepted in the broader context of the Canadian health care system.

The Economic Benefits of Risk Factor Reduction in Canada: Tobacco Smoking, Excess Weight and Physical Inactivity

Krueger H, Turner D, Krueger J, Ready E. The economic benefits of risk factor reduction in Canada: Tobacco smoking, excess weight and physical inactivity. *Can J Public Health* 2014;105(1):e69-e78.

Background:

Tobacco smoking, excess weight and physical inactivity contribute substantially to the preventable disease burden in Canada.

Purpose:

The purpose of this paper is to apply a recently developed approach in addressing the issue of double counting in estimating the combined current economic burden of these risk factors (RFs) and to estimate the economic benefits of long-term RF reduction in Canada.

Design:

used an approach based on population attributable fractions (PAF) to estimate the economic burden associated with the various RFs. Sex-specific relative risk and age-/sex-specific prevalence data were used in the modelling when available. Excess weight was modelled as a trichotomous exposure (normal weight, overweight, obese) while tobacco smoking was modelled as a tetrachotomous exposure (non-smoker, light, medium or heavy smoker). All costs are given in constant 2012 Canadian dollars.

Results:

The annual economic burden of the RFs of tobacco smoking, excess weight and physical inactivity in Canada are estimated at \$50.3 billion in 2012. Sensitivity analysis suggests a range for the economic burden of \$41.6 to \$58.7 billion. Of the \$50.3 billion, \$21.3 (\$20.0 to \$22.6) billion is attributable to tobacco smoking, \$19.0 (\$13.8 to \$24.0) billion to excess weight and \$10.0 (\$7.8 to \$12.0) billion to physical inactivity. A 1% relative annual reduction in each of the three RFs would result in an \$8.5 billion annual reduction in economic burden by 2031.

A modest annual 1% relative reduction in the RFs of tobacco smoking, excess weight and physical inactivity can have a substantial health and economic impact over time at the population level.

Variation Across Canada in the Economic Burden Attributable to Excess Weight, Tobacco Smoking and Physical Inactivity

Krueger H, Krueger J, Koot J. Variation across Canada in the economic burden attributable to excess weight, tobacco smoking and physical inactivity. *Can J Public Health* 2015;106(4):e171–e177.

Background:

Tobacco smoking, excess weight and physical inactivity contribute substantially to the preventable disease burden in Canada.

Purpose:

The purpose of this paper is to determine the potential reduction in economic burden if all provinces achieved prevalence rates of these three risk factors (RFs) equivalent to those of the province with the lowest rates, and to update and address a limitation noted in our previous model.

Design:

We used a previously developed approach based on population attributable fractions to estimate the economic burden associated with these RFs. Sex-specific relative risk and age-/sex-specific prevalence data were used in the modelling. The previous model was updated using the most current data for developing resource allocation weights.

Results:

In 2012, the prevalence of tobacco smoking, excess weight and physical inactivity was the lowest in British Columbia. If age- and sex-specific prevalence rates from BC were applied to populations living in the other provinces, the annual economic burden attributable to these three RFs would be reduced by \$5.3 billion. Updating the model resulted in a considerable shift in economic burden from smoking to

excess weight, with the estimated annual economic burden attributable to excess weight now 25% higher compared to that of tobacco smoking (\$23.3 vs. \$18.7 billion).

Achieving RF prevalence rates equivalent to those of the province with the lowest rates would result in a 10% reduction in economic burden attributable to excess weight, smoking and physical inactivity in Canada. This study shows that using current resource use data is important for this type of economic modelling.

Improved Estimation of the Health and Economic Burden of Chronic Disease Risk Factors in Manitoba

Krueger H, Williams D, Ready AE, Trenaman L, Turner D. Improved estimation of the health and economic burden of chronic disease risk factors in Manitoba. *Chronic Dis Inj Can* 2013;33(4):236-46.

Background:

There are analytic challenges involved with estimating the aggregate burden of multiple risk factors (RFs) in a population.

Purpose:

To describe a methodology to account for overlapping RFs in some sub-populations, a phenomenon that leads to “double-counting” the diseases and economic burden generated by those factors.

Design:

An efficient approach to accurately analyze the aggregate economic burden of chronic disease across a multifactorial system. In addition, it involves considering the effect of body weight as a continuous or polytomous exposure that ranges from no excess weight through overweight to obesity. We then apply this method to smoking, physical inactivity and overweight/obesity in Manitoba, a province of Canada.

Results:

The annual aggregate economic burden of the RFs in Manitoba in 2008 is about \$1.6 billion (\$557 million for smoking, \$299 million for physical inactivity and \$747 million for overweight/obesity). The total burden represents a 12.6% downward adjustment to account for the effect of multiple RFs in some individuals in the population.

An improved estimate of the aggregate economic burden of multiple RFs in a given population can assist in prioritizing and gaining support for primary prevention initiatives.

The Economic Burden of Cancers Attributable to Tobacco Smoking, Excess Weight, Alcohol Use, and Physical Inactivity in Canada

Krueger H, Andres EN, Koot JM, Reilly BD. The economic burden of cancers attributable to tobacco smoking, excess weight, alcohol use, and physical inactivity in Canada. *Curr Oncol* 2016;23(4):241-249.

Purpose:

The purpose of the present study was to calculate the proportion of cancers in Canada attributable to tobacco smoking (ts), alcohol use (au), excess weight (ew), and physical inactivity (pia); to explore variation in the proportions of those risk factors (rfs) over time by sex and province; to estimate the economic burden of cancer attributable to the 4 rfs; and to calculate the potential reduction in cancers and economic burden if all provinces achieved rf prevalence rates equivalent to the best in Canada.

Design:

We used a previously developed approach based on population-attributable fractions (pafs) to estimate the cancer-related economic burden associated with the four rfs. Sex-specific relative risk and age- and sex-specific prevalence data were used in the modelling. The economic burden was adjusted for potential double counting of cases and costs.

Results:

In Canada, 27.7% of incident cancer cases [95% confidence interval (ci): 22.6% to 32.9%] in 2013 [47,000 of 170,000 (95% ci:38,400–55,900)] were attributable to the four rfs: ts, 15.2% (95% ci: 13.7% to 16.9%); ew, 5.1% (95% ci: 3.8% to 6.4%); au, 3.9% (95% ci: 2.4% to 5.3%); and pia, 3.5% (95% ci: 2.7% to 4.3%). The annual economic burden attributable to the 47,000 total cancers was \$9.6 billion (95% ci: \$7.8 billion to \$11.3 billion): consisting of \$1.7 billion in direct and \$8.0 billion in indirect costs. Applying the lowest rf rates to each province would result in an annual reduction of 6204 cancers (13.2% of the potentially avoidable cancers) and a reduction in economic burden of \$1.2 billion.

Despite substantial reductions in the prevalence and intensity of ts, ts remains the dominant risk factor from the perspective of cancer prevention in Canada, although ew and au are becoming increasingly important rfs.

Regional Variations in the Economic Burden Attributable to Excess Weight, Physical Inactivity and Tobacco Smoking Across British Columbia

Krueger H, Koot JM, Rasali DP, Gustin SE, Pennock M. Regional variations in the economic burden attributable to excess weight, physical inactivity and tobacco smoking across British Columbia. *Health Promot Chronic Dis Prev Can* 2016; 36(4):76–86.

Background:

Prevalence rates of excess weight, tobacco smoking and physical inactivity vary substantially by geographical region within British Columbia (BC).

Purpose:

The purpose of this study is to determine the potential reduction in economic burden in B.C. if all regions in the province achieved prevalence rates of these three risk factors equivalent to those of the region with the lowest rates.

Design:

We used a previously developed approach based on population-attributable fractions to estimate the economic burden associated with the various risk factors. Sex-specific relative risk and age/sex-specific prevalence data was used in the modelling.

Results:

The annual economic burden attributable to the three risk factors in B.C. was about \$5.6 billion in 2013, with a higher proportion of this total attributable to excess weight (\$2.6 billion) than to tobacco smoking (\$2.0 billion). While B.C. has lower prevalence rates of the risk factors than any other Canadian province, there is significant variation within the province. If each region in the province were to achieve the best prevalence rates for the three risk factors, then \$1.4 billion (24% of the \$5.6 billion) in economic burden could be avoided annually.

Don't Change Much: The Economic Impact of Modest Health Behavior Changes in Middle-Aged Men

Krueger H, Goldenberg SL, Koot J, Andres E. Don't Change Much: The Economic Impact of Modest Health Behavior Changes in Middle-Aged Men. *Am J Mens Health* 2017;11(2):275-83.

Background:

Few studies have assessed differences in the prevalence of and economic burden attributable to tobacco smoking, excess weight, physical inactivity, and alcohol use by gender.

Purpose:

This article examines these gender differences in Canadians between the ages of 30 and 64 years. It also estimates the potential cost avoidance if the prevalence of the four risk factors (RFs) were reduced modestly in males.

Design:

A prevalence based cost-of-illness approach was used to estimate the economic burden associated with the four RFs.

Results:

Middle-aged Canadian males are more likely to smoke tobacco (26.4% vs. 20.2%), consume hazardous or harmful levels of alcohol (14.6% vs. 8.2%), and have excess weight (65.6% vs. 47.1%) than middle-aged Canadian females, resulting in an annual economic burden that is 27% higher in males than females. No significant differences were observed in the proportion of males who are physically inactive (48.4% vs. 49.4%). Modelling only a 1% annual relative reduction each year through to 2036 would result in a cumulative cost avoidance between 2013 and 2036 of \$50.7 billion. The differences in RF prevalence between middle-aged males and females have an important effect on the population's economic burden. A modest annual reduction in the four RFs in males can significantly affect population health and the economy over time.

The Economic Benefits of Fruit and Vegetable Consumption in Canada

Krueger H, Koot J, Andres E. The economic benefits of fruit and vegetable consumption in Canada. *Can J Public Health* 2017;108(2):e152–e161.

Purpose:

The objectives of this study were to determine the proportion of the population that meets or exceeds Canada's Food Guide (CFG) recommendations regarding the number of daily servings of fruits and vegetables (F/V), to assess trends in this proportion between 2000 and 2013, to estimate the annual economic burden attributable to inadequate F/V consumption within the context of other important risk factors, and to estimate the short- and long-term costs that could be avoided if modest improvements were made to F/V consumption in Canada.

Design:

We used a previously developed methodology based on population-attributable fractions and a prevalence-based cost-of-illness approach to estimate the economic burden associated with low F/V consumption.

Results:

Over three quarters of Canadians are not meeting CFG recommendations regarding the number of daily servings of F/V, leading to an annual economic burden of \$4.39 billion. If a 1% relative increase in F/V

consumption occurred annually between 2013 and 2036, the cumulative reduction in economic burden over the 23-year period would reach \$8.4 billion. Consumption levels of F/V, and the resulting economic burden, varied by sex, age and province.

A significant majority of Canadians are not consuming the recommended daily servings of F/V, with important consequences to their health and the Canadian economy. Programs and policies are required to encourage F/V consumption in Canada.

Redeeming Behaviours: The Influence of Incentive-Based Programs on Behaviour Change (Joan Warf Higgins – Whitepaper)

Purpose:

This paper updates an earlier 2012 version to describe the most recent and relevant evidence of incentive-based health promotion programs for behavior change.

Design:

To locate this evidence, a scoping review was conducted in both scholarly and grey literatures for research completed 2012-2016 in North America and the U.K. where incentives were offered for at least six months related to behaviours associated with chronic disease prevention, workplace wellness, mental health and medication compliance. The studies included reflect the use of financial and in-kind gifts or vouchers/discounts, as well as varying incentive schemes (e.g., lotteries, deposit contracts, immediate and delayed payments). As well, the paper includes data from systematic reviews and commentaries where appropriate. Most of the research obtained discusses the effectiveness of incentives integrated into workplace wellness initiatives for physical activity and weight loss. Smoking cessation is also well represented. There is much less information concerning mental health and medication compliance.

Results:

While the research methodologies and incentive schemes studied are scattered and diverse, a general narrative analysis of the findings suggest that success is more likely to be conferred when rewards are immediate, more visible, and escalate over the duration of the program. Personalized rewards that are earned for participation/engagement in the process and/or performance of behavior change, rather than solely for achieving health outcomes, appear to be more salient for individuals and more likely to sustain behavior change.

Does the World Really Need Another Health App? (Whitepaper)

Purpose:

The authors explore both the unique benefits and challenges of such technologies, examine the qualities of successful health behaviour change programs and make the argument that positive, long-term health behaviour change is best supported by comprehensive programs that take a more integrated approach and are personalized to the needs of their participants.

Results:

Recent technological advancements offer health behaviour change programs a wealth of new possibilities for both the Canadian government and employers. While we agree that incentives, apps and wearables are all powerful tools for health behaviour change, we strongly encourage their use as augment strategies within comprehensive, research-based health behaviour change programs rather than attempting to have them function on their own as standalone solutions.

Healthy Economics: Why Improving Workplace Wellness Helps Canadians and the Economy (Whitepaper)

Purpose:

The authors explore the economic impact of workplace wellness programs and make the argument that Canadian employers are increasingly well positioned to play a vital part, and in turn, benefit from lower health benefit costs and improved productivity.

Results:

Employee absenteeism, turnover and reduced productivity rates have huge financial implications for employers. The benefits of workplace wellness programs are increasingly well known, yet many employers have difficulty implementing such programs in effective, measurable ways. The newly launched healthy-economics.com tool provides employers with information that can be used to make the financial case for wellness programming in the workplace. It is time for government, employers and health behaviour change program providers to come together and take a coordinated approach to combating chronic diseases

5 Best Practices for Health and Wellness Program Data Security (Whitepaper)

Purpose:

the authors explore the importance of health data privacy, as well as the current guidelines and risks associated with the collection and management of health and wellness program user information. It also provides an overview of key best practices that can help support the development of effective health and wellness programs in the workplace and beyond.

Results:

While it's impossible to guarantee the protection of personally identifiable information and personal health information (there is always some risk that an unauthorized third party may find a way around our security systems or that transmissions of your information over the Internet may be intercepted), taking the steps above will help ensure you're as protected as possible. Trust is a central requirement for an effective wellness program, leading to better outcomes for all. The more people trust their privacy is protected, the more likely they'll engage in health and wellness initiatives and reap the benefits of these essential programs.

Wellness in the Workplace: Supporting Multiple Generational Needs (Whitepaper)

Purpose:

This article focuses on the importance of developing highly personalized workplace wellness plans that can be better tailored to our increasingly diverse workforce. It provides an overview of best practices that help support the development of effective health and wellness programs that resonate with employees across all generations.

Results:

While research suggests that each generation has distinct characteristics, it's important to remember not everyone within a generation will have the same attitudes and behaviours. Generational profiling is merely a helpful framework when looking at groups of individuals within an organization. The most successful workplace wellness programs will be the ones that recognize employee demographics are rapidly changing and embrace both the challenges and the opportunities of having such a diverse workforce. A personalized well-being program that recognizes both the differences and similarities between generations can allow companies to get the best out of its workers.