Occupational health promotion and cancer screening: Analyzing online-health methods for office workers in Germany and Prostate Specific Antigen screening in Canada for Disease Prevention Improvement

A Thesis Submitted to the
College of Graduate and Postdoctoral Studies
in Partial Fulfillment of the Requirements
for the degree of Master of Public Health
in the School of Public Health
University of Saskatchewan
Saskatoon

By
Devan Richard Tchir

Permission to Use

In presenting this thesis in partial fulfilment of the requirements for a Postgraduate degree from the University of Saskatchewan, I agree that the Libraries of this University may make it freely available for inspection. I further agree that permission for copying of this thesis in any manner, in whole or in part, for scholarly purposes may be granted by the professor or professors who supervised my thesis work or, in their absence, by the Head of the Department or the Dean of the College in which my thesis work was done. It is understood that any copying or publication or use of this thesis or parts thereof for financial gain shall not be allowed without my written permission. It is also understood that due recognition shall be given to me and to the University of Saskatchewan in any scholarly use which may be made of any material in my thesis.

Disclaimer

Reference in this thesis/dissertation to any specific commercial products, process, or service by trade name, trademark, manufacturer, or otherwise, does not constitute or imply its endorsement, recommendation, or favoring by the University of Saskatchewan. The views and opinions of the author expressed herein do not state or reflect those of the University of Saskatchewan, and shall not be used for advertising or product endorsement purposes.

Requests for permission to copy or to make other use of material in this thesis in whole or part should be addressed to:

Head of the School of Public Health
104 Clinic Place
University of Saskatchewan
Saskatoon, Saskatchewan S7N 2Z4 Canada

OR

Dean
College of Graduate and Postdoctoral Studies
University of Saskatchewan
116 Thorvaldson Building, 110 Science Place
Saskatoon, Saskatchewan S7N 5C9 Canada

Abstract

Background

Two ways to prevent diseases are through health promotion and screening. With respect to health promotion, this thesis investigated the impact an online-health promotion program had on the well-being of office workers. With respect to screening, this thesis identified characteristics of men who are undergoing prostate-specific antigen (PSA) screening for prostate cancer (PCa) despite mounting literature suggesting PSA screening is not beneficial, and in fact may cause more harm than it prevents. Our study objectives were to: 1) identify health issues faced by office workers and improve our understanding of online-health promotion in the context of office worker well-being, and 2) estimate recent PSA screening rates, compare these rates to past national data, and characterize the men who are screened.

Methods

Data for study objective 1 included a needs assessment, questionnaire(s), and activity log data of office workers undergoing online-health training. These data were provided by fitbase GmbH. Data for study objective 2 included the Canadian Community Health Surveys (CCHS) from 2009-2014, which had information related to PSA screening and the characteristics of a respondent. Needs assessment data were summarized to identify the perceived health issues of office workers for objective 1. Prevalence estimates with 95% confidence intervals were computed to determine recent PSA screening rates and to compare with past national rates for study objective 2. Logistic regression analysis (using the questionnaire and activity log data) was conducted to determine factors of the online-health promotion intervention associated with improved well-being for study objective 1. Logistic regression analysis using the CCHS data was conducted to determine the characteristics of Canadian men with increased odds of being screened with the PSA test for study objective 2.

Results

For study objective 1, about half of office workers frequently or constantly have issues with stress or back pain. Office workers who focused on completing practical exercises (guided, follow-along health activities) compared to information modules (reading health information) and who focused on completing back pain practical exercises compared to other

health categories had higher odds of having their well-being improved.

For study objective 2, we found that PSA screening rates have generally increased in eastern Canadian regions since 2000/2001. Physician-related factors were positively associated with having been screened, even among men who are not recommended to be screened (<50 years of age).

Conclusions

Health promotion and screening can help prevent health issues. Office workers in an online-health promotion intervention who chose to focus on completing practical exercises and to focus on back pain as a health issue they were experiencing had an increased odds of improved well-being. This information can help inform online-health interventions (that intend to prevent health issues) by maximizing one's well-being.

Despite controversy surrounding the PSA test, screening rates have generally increased since 2000/2001 in Canada. Physician-related factors play a role in screening for men at all ages. This work can help identify those who are currently being screened for PCa with the PSA test and to prevent the stress and complications that could result from a false positive.

Acknowledgements

I wish to acknowledge my supervisor, Dr. Michael Szafron, for his incredible guidance and mentorship. My parents, whom I owe most of my achievements because of their countless sacrifices. I also acknowledge all other family members and friends who have helped bring me to this point in my life, all of whom I could write another thesis about.

This thesis is dedicated to my dearest AD, for your unending support and so much more.

Contents

List of Tables

List of Figures

List of Abbreviations

ATL	Atlantic Canada
BC	British Columbia
BMI	Body mass index
CCHS	Canadian Community Health Survey
CI	Confidence interval
CRE	Colorectal exam
CTFPHC	Canadian Task Force on Preventive Health Care
CUA	Canadian Urological Association
DRE	Digital Rectal Exam
NL	Newfoundland
NS	Nova Scotia
ON	Ontario
OR	Odds ratio
PCa	Prostate cancer
PEI	Prince Edward Island
PSA	Prostate specific antigen
QC	Quebec
RSI	Repetitive strain injury
STHLM3	Stockholm 3 Model
US	United States of America
USPSTF	US Preventive Services Task Force
VIF	Variance Inflation Factor
WHO	World Health Organization

Chapter 1

Introduction

Public health can be defined as the efforts to keep people healthy, prevent injury, illness, and premature death [1]. The Public Health Agency of Canada Act defines public health as population-focused, including disease surveillance, disease and injury prevention, health protection, health emergency preparedness and response, health promotion, and relevant research undertakings [2]. Many of these public health objectives co-exist in practice (for instance, protecting health and health promotion play key-roles in disease and injury prevention). By addressing any one of these objectives, it is possible that others will also be impacted, with an overall improvement in general public health.

Prevention intends to optimize health, to prevent negative deviations of health, and to prevent the contraction of illness as well as the negative outcomes from that illness [3]. For any given illness, one undergoes a process of acquiring a given ailment and subsequent disease progression. Prevention is intended to avert the contraction of disease and/or to negate disease progression [3, 4]. Disease is an active process, meaning it actually begins before a host is directly affected [3]. For instance, one's unhealthy behaviours or inadequate environment can lead to disease susceptibility. Therefore, preventive interventions can be implemented prior to disease pathogenesis, or during pathogenesis [3, 4]. These interventions are respectively termed primary prevention (prior to disease pathogenesis) and secondary prevention (after onset but prior to detrimental progression) [3–5]. A major primary prevention method is health promotion [3, 4]. For example, health promotion programs aimed at educating the public about the dangers of smoking work to reduce smoking rates during the pre-pathogenesis phase of smoking-related diseases. A major secondary prevention method is screening [4]. For example, cancer screening aims to increase the likelihood that a person with cancer will have an early diagnosis, a timely treatment, and a better prognosis before a detrimental progression of the disease. Both health promotion and screening have been shown to be cost-effective [6, 7].

In this work, we focused on these two types of prevention: health promotion (section 1.1) and screening (section 1.2).

1.1 Health promotion

The WHO defines health promotion as the the process of enabling one to take control over their health and to improve their health [8]. Health promotion can be thought of as the combination of creating healthy behaviours, improving health services, and advocating for health [9]. Health promotion is the responsibility of many different groups, including (but not limited to) doctors, nurses, community workers, public health workers, and rehabilitation therapists [9]. Consequently, health promotion is a main component for Canadian public health [1] and has a role in the other objectives of public health (for instance, through disease prevention) [10].

Traditionally, health promotion deals with population health [4,11] and the health of any one individual can be thought of as ranging from ill-health to optimal [11]. According to the WHO, health is not solely the absence of disease, and is the collective physical, mental, and social well-being of an individual [12]; health promotion attempts to increase one's health status towards the optimal side of the health spectrum. Health promotion aims to empower individuals to shift their health to an optimal level [11].

The WHO states that 'health promotion is not just the responsibility of the health sector, but goes beyond healthy life-styles to well-being' [8, p.1]. Because a person spends significant time at work, because workplaces generally consist of a large number of people, and because there is a shift in employment to occupations confined to an office [13], the workplace is an especially important access point for health promotion efforts [14, 15].

Workplace health promotion can include varying degrees of educational and environmental interventions (i.e. health education, exercises and fitness classes, stress management, etc.) designed to bring about desired healthy behaviours [16, 17]. Workplace health promotion does not have to benefit the worker solely at work *per se*, but can improve the individual's general well-being overall [16, 18]. Health promotion not only benefits employees, but also the corporations for whom they work [16, 18, 19]. Workers experiencing poor well-being in the workplace may be less productive, prone to absenteeism, and increase health insurance costs for companies [16,19], illustrating potential benefits of workplace health promotion. Indeed, health promotion programs have been shown to improve the health of workers [17–19], reduce health risks [18, 20], and are financially favourable for companies [18, 20–22].

Workplace health promotion includes interventions intended to change workers' behaviours in a healthy direction [17, 23]. The delivery methods of workplace health promotion have varied, and can include the dissemination of print materials, health risk appraisals, intensive disease management programs, information classes, counseling, seminars, and other methods [24, 25].

Recently, workplace health promotion has begun to shift towards computerized methods [26, 27], commonly defined as eHealth or web-based health promotion, which is defined as online-health training in this work. Some evidence exists that web-based health promotion is superior to non-web-based interventions for beneficial behavioural health changes [24, 28]. It has been effective in decreasing chronic pain in the general population [29] and back pain among office workers [30]. Many web-based interventions for workers also focus on mental processes [31], such as stress management [32,33] mindfulness [34,35] and resilience [36], and are also effective. There is evidence that web-based health interventions targeting mental processes can improve psychological well-being in the general working population [37]. Given this up-and-coming method for workplace health promotion, we were interested in analyzing the efficacy of an online-health promotion intervention on the well-being of employees, and parsing out which components of online-health training are beneficial.

A useful framework for online-health promotion's impact on workers can be adapted from Danna and Griffin [16]. They propose that certain antecedents, such as work settings (including health hazards), occupational stress (such as role requirements), and intrinsic qualities (such as locus of control) can affect a workers well-being, which can have individual and organizational consequences [16]. Online-health promotion can target these factors, thereby reducing (e.g. stress) or promoting (e.g. resilience) for the optimization of a worker's well-being.

There is a dearth of literature describing the efficacy of online-health promotion activities with respect to improving an individual's perceived health. Given that the literature documenting the effects of web-based health interventions on self-reported well-being for office workers goes largely unreported, in this thesis we asked: *Does web-based health promotion improve office worker self-perceived well-being, and which components of online-health training better predict improved well-being?*

We then wanted to identify these health-associated factors potentially impacting office workers: *What health issues primarily affect office workers?* Lastly, this work combined the question regarding the workplace-associated health issues office workers face, and the question related to web-based health promotion improving well-being: *How does addressing the different health issues identified by office workers impact their well-being?* In other words, this work examined whether there are differences in self-reported well-being among office workers focused upon different health issues. In Chapter 3, we explore these three research questions.

1.2 Screening

A second prevention strategy of interest in this work was screening. Screening is used to 'discover those among the apparently well who are in fact suffering from disease' [38, p.7]. In other words, screening aims to identify asymptomatic individuals with a high likelihood of illness. While health promotion aims largely to allow people to take control of and improve their well-being and to prevent the contraction of diseases, screening aims to detect early signs of disease in order to prevent harmful progression, and can be thought of as a form of disease prevention [4].

Screening can be used to detect many different health issues. Some of these issues include mental health problems [39], tuberculosis [40], pregnancy issues [41], and cardiovascular disease [42]. Screening can also be used to detect cancers. For example, mammography is commonly used to detect early breast cancer [43]; colorectal screening methods such as fecal occult blood tests are used to detect early colorectal cancer [44]; human papillomavirus and Papanicolaou testing are used to detect cervical cancer [45]; and computerized tomography is used to detect lung cancer [46]. There are also screening methods to detect prostate cancer (PCa).

Although the efficacy of the screening methods for breast, colorectal, and cervical cancer are fairly well established and recommended in Canada [47–49], recommendations for PCa screening (which is widely done with the digital rectal exam [DRE] and prostate-specific antigen [PSA] test [50]) are somewhat mixed. PSA test benefits for all-cause and cancer-specific mortality are limited [51] and most men with elevated PSA levels do not have PCa [52]. Furthermore, false positives resulting in psychological distress, and biopsy complications are common [51, 53–56]. Recent randomized trials suggest approximately 3 of 1000 men screened will be protected from the development of metastatic PCa and screening might prevent 1.3 deaths among 1000 men [57–59]. The PSA test might also lack cost-effectiveness [60]. Consequently, recommendations for cancer screening using a PSA test in Canada are conflicting [61, 62].

While the Canadian Task Force on Preventive Health Care has recommended against PSA screening for all ages [61], the US Preventive Services Task Force marginally recommends shared decision-making screening in American men aged 55 to 69 years of age [56].

On the other hand, some evidence exists that men have reassurance from using the PSA test [63, 64] and there can be benefits through shared decision-making between a patient and their clinician [62]. The test is also readily available, and Canadian men perceive the test generally positively [65].

The PSA test remains widely used in Canada despite mixed recommendations and the lack of evidence that the benefits outweigh the risks. The most current Canadian guidelines suggest PSA testing at 50 years of age, 45 years of age for men at an increased risk (specifically for those men with family history), and in men with a life expectancy greater than 10 years [62]. The Canadian Urological Association (CUA) recommends men with PSA levels <1 ng/mL to repeat PSA testing every four years, men with PSA levels from 1–3 ng/mL to repeat PSA testing every two years, and men with PSA levels >3 ng/mL to consider frequent PSA testing intervals or other strategies [62].

Currently, best practice probably includes informing a patient that PSA screening is ultimately his choice, and that the decision to screen should weigh the risks and benefits of the PSA test while taking into account how the patient personally views the risks and benefits [66, 67].

National screening rates and predictors for PSA screening for 2000/2001 were identified after Canadian guidelines recommending against PSA screening were released [69]. Beaulac et al. [69] found that almost half of Canadian men over 50 years of age have had a lifetime PSA screening test and that having a family doctor was positively associated with having been screened. Some other factors frequently identified as being positively associated with PSA screening in Canada are: increasing age [68–70], high educational attainment [68, 69], high income [68–70], caucasian ethnicity [69], having a colorectal exam [70], non-smoking status [69, 70], speaking English or French [69], and excellent perceived health [70]. A more detailed list of variables can be found in Chapter 4.

The controversy surrounding PSA testing continues to the present day. Because there is continued doubt surrounding the PSA test efficacy for screening PCa, in this work we aimed to improve our understanding of PSA screening utilization in Canada, and which men are prone to PSA screening. It is important to see whether this continued doubt has impacted the 2000/2001 rates, if at all. It is also important to identify the demographics associated with having a PSA screening test. Thus, the questions this research asked were: *What are the most recent rates of PSA screening in Canada? How do these rates compare to past national rates?* and *What are the properties of Canadian men that are associated with PSA screening?* This work acknowledges that screening is very individualized, and thus many men who are at high-risk for PCa should still discuss screening options with their physicians.

1.3 Research objectives

This thesis contains work related to two prevention strategies: health promotion and screening. We studied an office online-health promotion intervention and PSA screening rates and factors associated with PSA screening in Canada.

For office workplace online-health promotion, we asked: *What health issues primarily affect office workers?* The corresponding research objective was to identify the health-associated workplace issues affecting office workers. We hypothesized that office workers would perceive stress as a persistent health issue, given that office workers commonly face stressors [71–73]. A detailed discussion can be found in Chapter 3.

We next asked: *Does web-based health promotion improve office worker self-perceived well-being, and which components of online-health training better predict improved well-being?* Our research objective was to identify the mode of delivery for an online-health intervention that could improve well-being. Specifically, workers could read information modules and/or complete practical exercises. We hypothesized that practical exercises would work better for improving well-being than the information modules, because the former is an active approach compared to a more passive approach. A detailed discussion can be found in Chapter 3.

Our final health promotion question was: *How does addressing the different health issues identified by office workers impact their well-being?* Our objective was to determine on which health issues to focus for a maximal gain in well-being. It was hypothesized that because office workers often face stress in the workplace [71–73] and that web-based health promotion interventions targeting stress have been successful [74], that focusing upon stress would benefit office worker well-being to the greatest extent.

For PSA screening in Canadian men, this work asked: *What are the most recent rates of PSA screening in Canada?* and *How do these rates compare to past national rates?* Our objective was to estimate current screening rates in Canada with the most current available data, and to see if these rates have increased since 2000/2001. Because no major change in Canadian PSA screening recommendations occurred between 2001-2009, we expected these rates to remain relatively stable. For a full discussion, refer to Chapter 4.

Our second research question was: *What are the properties of Canadian men that predict PSA screening?* Our objective was to characterize Canadian men who have had a lifetime PSA screening test. We hypothesized that physician-related variables would be positively associated with PSA screening. Refer to Chapter 4 for a complete discussion.

A summary of the objectives of this research with respect to office worker health promotion which we explore in Chapter 3 are to:

- Objective 1: Identify the health-associated workplace issues affecting office workers.
- Objective 2: Identify the mode of delivery for an online-health intervention that could improve well-being, namely practical exercises or information modules.
- Objective 3: Discern on which health issues an office worker should focus for a maximal gain in well-being.

In Figure 1.1, we present a framework connecting our research Objectives 1-3.

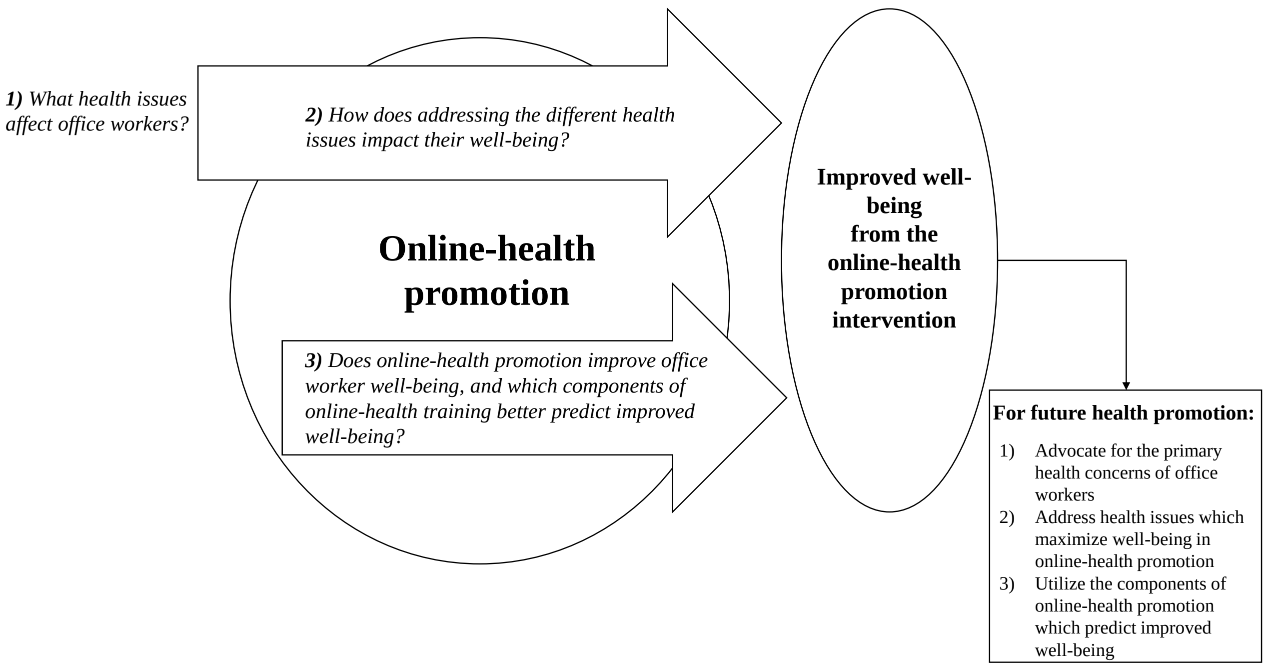

Figure 1.1: Framework for office worker well-being undergoing online-health promotion. 1) Office workers may have varying perceptions of health issues (i.e. back pain, or poor stress management) which influence their well-being. 2) Online-health promotion might work better for certain health issues when measuring one's improved well-being as an outcome. 3) Certain modes of online-health promotion delivery might predict improved well-being better than other modes of delivery.

A summary of the objectives of this research regarding PSA screening in Canada which we explore found in Chapter 4 are to:

- Objective 4: Estimate recent screening rates in Canada with the most current available data, and to see if estimates have increased since 2000/2001.
- Objective 5: Characterize Canadian men who have had a lifetime PSA screening test.

The general format for the remainder of this thesis is as follows. In Chapter 2, we discuss the methodologies used for each research objective. In Chapter 3, we examine the effect that an online-health promotion intervention in an office workplace has on worker well-being. In Chapter 4, we analyze Canadian data to determine PSA screening rates from 2009-2014, compare to 2000/2001 rates, and identify characteristics in men which are associated with PSA screening. In Chapter 5, we summarize the key-findings from this work, we discuss the implications of our findings with respect to health promotion, screening, and prevention, and discuss future research directions.

Chapter 2

Methodologies

This chapter presents the methodologies used to address the research objectives found in section 1.3. In section 2.1, we describe the data and the methodologies used to study research Objectives 1-3. In section 2.2, we describe the data and the methodologies used to study research Objectives 4 and 5.

2.1 The office worker health promotion intervention

The practicum completed as part of the MPH degree requirements was conducted at fitbase GmbH, a company based in Hamburg, Germany. The online-health promotion intervention studied in this thesis is a program offered by fitbase. fitbase (lower case 'f' left intentionally, as is the company's name) specializes in web-based health promotion, which they define as "online-health training". The goal of this online-health training is to promote healthy behaviours for companies and individuals. fibase's online-health training consists of health categories in RSI (repetitive strain injury, defined by fitbase as having upper limb pain associated with computer work and has been referenced in the literature [75]), back care, eye health, nutrition, stress management, mindfulness, and resilience. The online-health training was delivered via reading online information modules (about improving health), and/or completing web-based practical exercises (which are guided, follow-along activities encouraging healthy behaviours).

2.1.1 Data

The data collected from fitbase GmbH included the logs of the voluntary completion of practical exercises and information modules of insurance company workers undergoing fitbase's online-health training, and the voluntary responses to a needs assessment and questionnaire(s). fitbase collected usage data from the insurance companies workers over the period of February 2016 to May 2017. Demographic data was not collected for purposes of confidentiality.

The needs assessment included the questions/statements: "After intensive PC work, I feel pain, tingling or numbness in my hands or arms"; "I have upper and lower back pain"; "My eyes hurt after work"; "I crave fast food"; "I feel tense or irritated"; "I notice that I'm lost in thought about the future or the past"; and "I assume I can overcome difficulties in life" which are related to RSI, back pain, eye issues, nutrition, stress, mindfulness, and resilience, respectively. Workers responded with 'never', 'rarely', 'sometimes', 'frequently', or 'constantly' and served as our needs assessment sample (n=3354).

The questionnaire was administered three times to office workers at roughly three, six, and nine weeks after the initiation of the online-health training. We used the last questionnaire completed to best capture an individual's perception at the end of training. Office workers who completed at least one questionnaire, read at least 2 information modules, and completed at least 2 practical exercises (n=779) were used as our sample for logistic regression analysis (Figure 2.1).

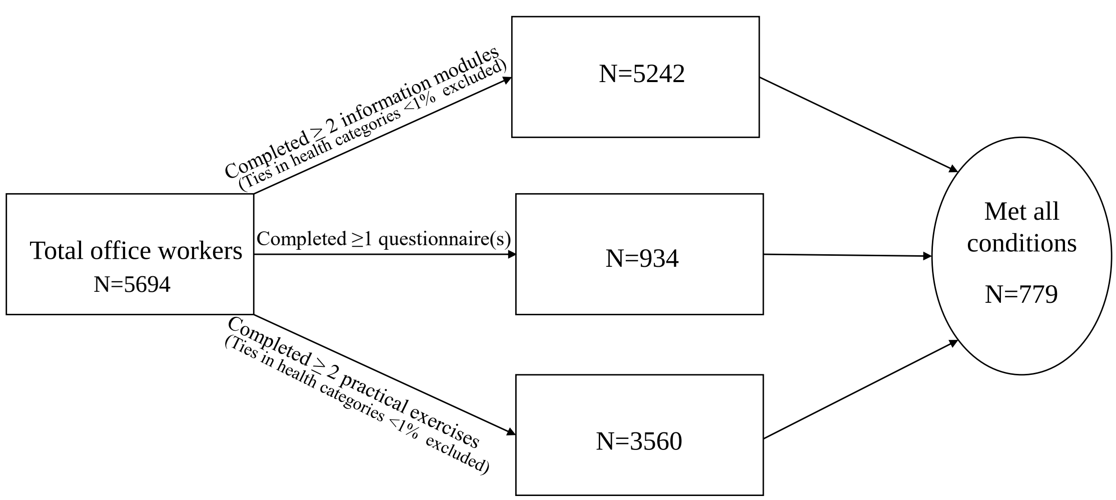

Figure 2.1: Inclusion criteria for logistic regression analysis of whether online-health training improved office worker well-being.

Outcome variable

From the questionnaire, we utilized the response to the statement "Online-health training improves my well-being", with which office workers strongly disagreed, disagreed, agreed, or strongly agreed. We derived an outcome variable called *Improved well-being* as follows. 'Strongly disagree'/'disagree' were coded as 'no', and 'strongly agree'/'agree' were coded as 'yes'. This response served as the outcome variable for our work with respect to research Objectives 2 and 3.

Independent variables

Information health focus: From the information module logs of the workers, we had records of which information modules were read. The individual information modules that were read were tabulated under the health categories: RSI, back pain, eye health, nutrition, stress management, mindfulness, and resilience, so we could identify how often a worker focused on a specific health category. Based on this tabulation, we derived an *information health focus* variable. One's *information health focus* was recorded as the health category in which the individual read the most information modules. For example, a worker who read most information modules under stress management had an *information health focus* of 'Stress management'. If two or more health categories appeared most frequently, then the focus was recorded as a combination of these health categories. For example, if an individual read an equal number of stress management and RSI modules, then the individual's *information health focus* was coded as 'Stress management/RSI'.

Exercise health focus: From the practical exercise logs of the workers, we had records of which practical exercises were completed. The individual practical exercises that were completed were tabulated under the health categories: RSI, back pain, eye health, stress management, and mindfulness, so we could identify how often a worker focused on a specific health category. We then derived an *exercise health focus* similarly to how we derived an *information health focus*. If two or more health categories appeared most frequently, then the focus was recorded as a combination of these health categories. For example, if an individual completed the most practical exercises related to stress management and RSI, then the individual's *exercise health focus* was coded as 'Stress management/RSI'.

Preferred type of intervention: This variable was derived as follows. We computed the total number of practical exercises completed and information modules read for each worker. Those who completed statistically more practical exercises than information modules were classified as having an 'exercise' preference, those who completed statistically more information modules than practical exercises were classified as having an 'information' preference, and those with no statistical difference in the total number of information modules and practical exercises completed were classified as having 'no preference'.

2.1.2 Analysis plan

For research Objective 1, we aimed to identify the health-associated workplace issues affecting office workers. To do so, we summarized the needs assessment data. The frequencies of the employees' responses to the questions related to RSI, back pain, eye issues, nutrition, stress, mindfulness, and resilience were tabulated (using PROC FREQ and PROC SUMMARY, and graphically displayed using PROC SGPLOT in SAS).

Objective 2 was to identify the mode of delivery that could improve well-being in this online-health promotion intervention (namely practical exercises vs. information modules), and Objective 3 was to identify which health-associated workplace issues focused on, within web-based health promotion, maximize well-being. Logistic regression was utilized to address these two research objectives. The eligibility criteria for the logistic regression analysis can be found in Figure 2.1. We used the derived *improved well-being* outcome to build a logistic regression model. The independent variables in this model were the derived *preferred type of intervention*, and the derived *exercise health focus* and *information health focus*. The resulting model was used to address Objectives 2 and 3.

A chi-square test was used to determine whether the proportion of workers who reported improved well-being was greater than the proportion of workers who reported no improvement. We utilized the PROC FREQ CHISQ statement in SAS to test this.

A bivariate analysis of each independent variable with the outcome variable was completed using PROC LOGISTIC. Variables with $P < 0.20$ were to be included in the final model. All subsequent analyses were considered significant with $P < 0.05$. PROC LOGIS-

TIC with the ODDSRATIO statement was used to fit our final model. For the derived *exercise health focus* and *information health focus* variables, any ties in health categories which constituted $<1\%$ of workers were to be excluded. For example, if the total number of workers who focused on 'Stress management/RSI' was less than 1% then these workers were removed. Variance Inflation Factor (VIF) scores were used to determine the influence of multicollinearity. The absence of perfect separation was checked via scatterplots with PROC SGPLOT, using the outcome variable and each of the independent variables. The independence of error terms was tested using the durbin-watson test (PROC AUTOREG with DW DWPROB statement). Interaction terms were not considered due to the small sample size. All analyses were completed using SAS v9.4. In Chapter 3, we employ these methods to address the aforementioned research Objectives 1-3 found in section 1.3.

2.2 PSA screening in Canadian men

PSA screening can be used to detect early PCa in men. In order to estimate the screening rates and the associations that certain factors have with PSA screening, we used data from the Canadian Community Health Survey (CCHS), which is 'a cross-sectional survey that collects information related to health status, health care utilization and health determinants for the Canadian population' [76, p.4]. It surveys persons 12 years and over living in private dwellings in all Canadian provinces and territories via computer assisted in-person and computer assisted telephone interviews. Exceptions include 'individuals living on Indian Reserves and on Crown Lands, institutional residents, full-time members of the Canadian Forces, and residents of certain remote regions' [76, p.4]. The CCHS assigns weights in the sample, so that a sample is representative of the Canadian population [76].

The CCHS includes Canadian men and has PSA relevant questions. These questions include whether a man has had a PSA test and his reasons for having a PSA test. We utilized the relevant PSA questions to formulate the outcome variable needed to address both Objectives 4 and 5.

2.2.1 Data

The CCHS questions related to PSA testing were limited to certain Canadian regions during particular cycles: Regions used were Atlantic (ATL) provinces (Newfoundland [NL], Prince Edward Island [PEI], Nova Scotia [NS]) in 2009/2010, Ontario (ON) in 2011/2012, and Quebec (QC) in 2013/2014. We combined these datasets and standardized the associated weights according to Statistics Canada specifications [77]. The sample size of this combined dataset was 22 515 men: 1087 men from Newfoundland (NL), 532 men from Prince Edward Island (PEI), and 1435 men from Nova Scotia (NS) (2009/2010), 12 508 men from Ontario (ON) (2011/2012), and 6953 men from Quebec (QC) (2013/2014). This sample included men aged 35 years and older.

Men who answered the question "Have you ever had a prostate specific antigen test for prostate cancer, that is, a PSA blood test?" were used. Men were determined to have been screened with the PSA test as depicted in Figure 2.2.

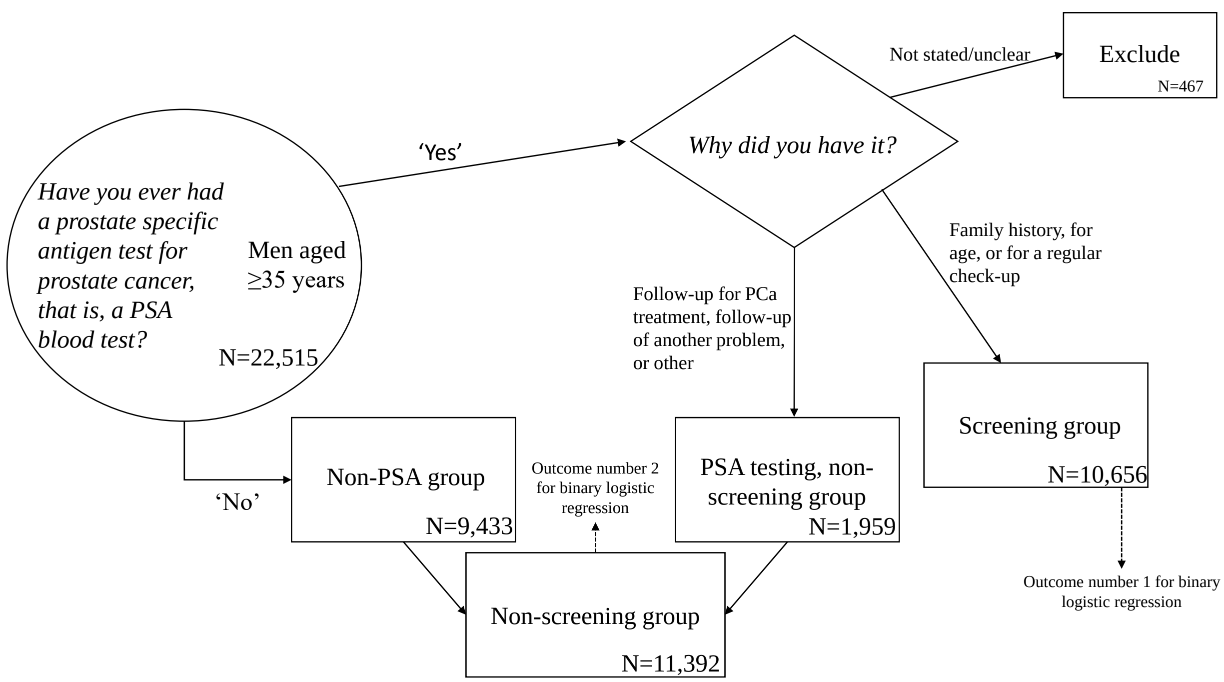

Figure 2.2: Inclusion criteria for PSA screening behaviour of Canadian men.

Outcome variable

A *Lifetime PSA screening* variable was derived where men, who had a PSA test for screening purposes, were coded as 'yes' and men who have not had a PSA test for screening purposes as 'no'. Note that individuals coded as 'no' were men who did not have a PSA screening test, or only had it as a result of preexisting health conditions. These 'yes' men form the 'screening group' and 'no' men form the 'non-screening' group in Figure 2.2.

Independent variables

Physician related variables: We considered physician-related variables to be variables in the CCHS that implied direct contact with a physician. These included *has a regular doctor*, *had a colorectal exam (CRE)*, and *had a digital rectal exam (DRE)*. The *had a CRE* variable was derived as men indicating 'yes' if they indicated having a fecal occult blood test, sigmoidoscopy, or colonoscopy and 'no' if they did not. *Has a regular doctor* and *had a DRE* were coded as indicated on the CCHS ('yes'/'no'). Having a regular doctor [78] and colorectal examinations [79] are associated with doctor visitations, and physicians often use the PSA test along with the DRE [80] in Canada.

Lifestyle-related variables: Included *alcohol consumption in the last 12 months*, *BMI*, *daily consumption of fruits and vegetables*, *perceived health*, *physical activity*, and *type of smoker*. *Alcohol consumption in the last 12 months* was dichotomized as 'yes' or 'no', *daily consumption of fruits and vegetables* had three responses including '<5', '5-10', or '>10' times per day, and *physical activity* was coded as 'inactive', 'moderately active' and 'active' as defined by the physical activity index on the CCHS. All three variables were unmodified from the CCHS. Our derived *BMI* variable included 'underweight/normal weight' men (<25 BMI), 'overweight' men (25-29.9 BMI), and 'obese' men ($\geq$30 BMI). *Perceived health* was derived as men reporting 'poor', 'fair', 'good', or 'very good/better' health. *Smoking status* was derived as men being 'smokers' (current) and 'non-smokers' (former/never).

Other social and health-related variables: Included *needs help with daily activities*, *marital status*, *urinary incontinence*, *number of chronic health conditions*, *country of birth*, and *spoken language*. *Urinary incontinence* ('yes' or 'no') and *country of birth* ('Canada' or ‘other’) were unmodified. We derived a *needs help with daily activities* as men who needed help (‘yes’) with any of the following as indicated on the CCHS: preparing meals, getting to appointments, doing housework, personal care, moving inside the house, or looking after finances. Men who indicated not needing help with any of the listed activities were coded as ‘no’. Chronic health conditions on the CCHS included having asthma, fibromyalgia, high blood pressure, migraines, chronic obstructive pulmonary disorders, diabetes, heart disease, cancer, intestinal/stomach ulcers, ailments from stroke, bowel disorder, bowel disease, mood disorders, and anxiety disorders; we coded men with none, one, or two or more of the listed conditions as having ‘0’, ‘1’, or ‘≥2’ chronic conditions. We derived our *martial status* variable as whether a man indicated being married or common law (‘married or equivalent’) or never married/widowed/separated (‘single’). Our *spoken language* variable was derived based on what language a man indicated speaking at home. For those in ATL and ON, a man who spoke English or both English and French at home were coded as ‘native’, whereas those in QC who spoke French or both English and French at home were coded as ‘native’. Men in ATL and ON who spoke French at home were coded as ‘non-native’, and men from QC who spoke English at home were coded as ‘non-native’. Men who indicated speaking a language other than the national languages at home were coded as ‘other’.

Control variables: Included *age*, *household income*, *educational attainment*, *ethnicity*, and *region*.

We classified *age* four different ways. The first was taken directly from the CCHS and included men aged ‘35-39’, ‘40-44, ‘45-49’, ‘35-39’, ‘40-44, ‘45-49’, ‘50-59’, ‘60-69’, ‘70-74’, ‘75-79’, and ‘≥80’ and was used to determine PSA screening rates in all age groups for our study population. The second *age* variable included men aged ‘40-49’, ‘50-59’, ‘60-69’, ‘≥70’, ‘≥50’, and ‘≥40’ which was used to compare our rates to those found in 2000/2001 [69]. Our third *age* variable consisted of men aged ‘35-39’, ‘40-44’, and ‘45-49’ for the logistic regression model which addressed men aged <50 years of age. Our fourth *age* variable consisted of men aged ‘50-59’, ‘60-69’, and ‘≥70’ for the logistic regression model which addressed men aged ≥ 50 years of age.

The *household income* variable was used as categorized in the CCHS (‘No income or <$20,000’, ‘$20,000-$39,999’, ‘$40,000-$59,999’, ‘$60,000-$79,999’, ‘$80,000 or more’). We derived *educational attainment* as a man with 'low' education (some post-secondary education or less) or 'high' education (post secondary certificate attained). The *ethnicity* variable used for this work was unmodified from the CCHS ('white' or 'visible-minority'). A derived variable *region* to control for province/survey was created, consisting of respondents from ATL (2009/2010), ON (2011/2012), and QC (2013/2014).

2.2.2 Analysis plan

For Objective 4, which was to estimate the recent screening rates in Canada and to see if these estimates have increased since 2000/2001, we analyzed each CCHS dataset (i.e. 2009/2010, 2011/2012, and 2013/2014). We constructed prevalence estimates with 95% confidence intervals (CIs) on the weighted data using PROC SURVEYFREQ for men aged 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74, 75-79, and ≥80. In order to compare our estimates to those found in 2000/2001 [69], we also constructed prevalence estimates using PROC SURVEYFREQ for men aged 40-49, 50-59, 60-69, ≥70, ≥50 and ≥40 with 95% CIs.

For Objective 5, which was to characterize men prone to PSA screening, logistic regression was used. Variables in the literature, as described in section 2.2.1 and to be discussed in Chapter 4, were identified as being associated with PSA screening behaviour and modified as needed from the CCHS for the logistic regression analyses.

We followed a similar statistical analysis plan as found in section 2.1.2 (i.e. significance values, verification of assumptions), although PROC SURVEYLOGISTIC with a WEIGHT statement was used given that the CCHS deals with weighted data. All assumptions were met. Given the potential for different regions of Canada influencing the independent variables effect on the outcome variable, interaction terms of all variables by *region* were created. Interaction terms with $P > 0.05$ were to be removed, and the logistic regression models re-fit. Men with missing data for any given variable were deleted case-wise. Any non-control variable with greater than 5% missing data were to be removed. In the ≥50 years old model, *daily fruit and vegetable consumption* was not considered due to too many missing observations (>5% of men). Potential outliers were identified with the use of covariate patterns, standardized residuals greater than 2.58 in magnitude, confidence interval displacement diagnostics (c diagnostic), and DFbeta diagnostics. C diagnostics provide the magnitude of influence an observation has on estimates, and a DFbeta diagnostic is the standardized difference of a parameter estimate from the omission of each individual observation [81]. Covariate patterns (i.e. men sharing the same levels across all variables) were determined to identify any distinct populations within the data, which would potentially validate the removal of outliers if certain covariate patterns were over-represented in the outliers. These statistics were calculated using PROC LOGISTIC with a WEIGHT and OUTPUT C DFBETA statement.

For each model, influential data points were determined using the c diagnostic and DFbeta diagnostics, given that these are useful tools for weighted, complex survey data as found in the CCHS [81,82]. Such influential observations are those that greatly impact the fit of the model. This work considered any c diagnostic greater than one, or any DFbeta statistic with a value greater than 1.96 to be an influential observation, requiring closer inspection. Any such influential observations would be deleted and models re-fit. If a majority of parameter estimates changed by over 10%, these observations would remain excluded [81]. No DFbeta statistics revealed influential observations, while c diagnostics yielded 23 and 16 influential observations in the $<$50 years old model and the $\geq$50 years old model, respectively, and were removed because a majority of the parameter estimates changed by greater than 10% upon removal. These observations were excluded from subsequent logistic regression analyses. For all of our analyses, we used SAS v9.4. In Chapter 4, we use these methods to study our research Objectives 4 and 5 stated in section 1.3.

In section 2.1, we described the data and the analysis plan used to address research Objectives 1-3, which are discussed in detail in Chapter 3. In section 2.2, we described the data and the analysis plan used to address research Objectives 4 and 5, which are discussed in detail in Chapter 4. The research Objectives can be found previously in section 1.3. The next Chapter aims to address research Objectives 1-3. We examine a web-based health promotion intervention which targeted office workers.

Abstract: Chapter 3

Objectives

Office workers face many health issues including stress, back pain, and others. These health issues have considerable costs to businesses and healthcare systems. Workplace health promotion attempts to prevent these health issues. There is little literature regarding web-based health promotion (online-health), office workers, and well-being. Our objectives were: i) identify health-associated issues affecting office workers; ii) discern whether focusing on different health issues when undergoing online-health differentially impacts a worker's well-being; iii) identify which modes of delivery of online-health improve one's well-being.

Methods

The data included the logs of completed practical exercises (guided, follow-along health activities), read information modules (modules which provide education regading health), and responses to a needs assessment and questionnaire(s) by office workers undergoing online-health training. fitbase GmbH provided this online-health training and collected the data. Responses to the needs assessment were summarized to identify health-associated issues. Logistic regression was used with the logs and questionnaire data to address whether different health issues focused upon, and whether practical exercises or information modules are more effective modes of delivery, for improving one's well-being.

Results

We found that almost half of the workers frequently or constantly experienced back pain and stress. Workers who focused on practical exercises related to back pain had higher odds of improved well-being than almost all other health issues. Office workers who completed more practical exercises than information modules had better odds of having their well-being improved.

Conclusion

Back pain and stress were persistent health issues for the office workers. An office worker who focused generally on practical exercises, or who focused on back pain practical exercises, had increased odds of improved well-being from the online-health training. These findings suggest the need to employ practical exercises in online-health promotion interventions, and that back pain interventions are needed in the office.

Chapter 3

Occupational health needs and predicted well-being in office workers undergoing online-health promotion training: Findings from needs assessment, questionnaire, and activity data

As discussed in Chapter 1, the goal of this thesis was to improve general public health by improving prevention efforts. The method of prevention explored in this Chapter is health promotion.

In this work, we examined a web-based health promotion intervention which targeted: RSI, back pain, eye issues, nutrition, stress, mindfulness, and resilience in office workers. As noted previously and stated by the WHO, health promotion is not solely the promotion of a healthy life-style but goes beyond to well-being [12]. We were thus interested in how this intervention and the associated health issues impact one's well-being.

Repetitive movements and computer work are likely antecedent health issues in the office; they are associated with upper limb pain [83], back pain [84] and eye issues [85] all of which are negatively associated with well-being [86–88]. Poor nutritional habits common in office workers can also act as an antecedent to chronic diseases [89, 90] and can negatively impact one's well-being [91]. Stress is common in office workers [71–73], and is detrimental to one's well-being [92]. Finally, intrinsic qualities of an office worker, including mindfulness and resilience, can strengthen or act as a buffer for one's well-being. Mindfulness can be defined as the state of being attentive and aware to what is presently taking place [93], is positively associated with many beneficial personality traits [94], is positively associated with well-being [93], and can be strengthened [95]. Resilience in the workplace can be thought of as an individuals sense of control, ability to rise and meet challenges, and having a commitment to action, and is associated with well-being specific to work [96, 97] and in general [98, 99]. These two qualities might not only be directly influencing well-being, but also regulating other listed health issues that office workers face, including stress [100, 101] and pain [102, 103]. The health issues described (namely upper limb, back, and eye pain, nutrition, stress, mindfulness, and resilience) are not exhaustive in office workers, but were the focus of the work in this thesis. In this work, these health issues were addressed with an online-health intervention. Note that these health issues are the 'Office worker health issues' in our earlier framework and negatively or positively influence an office worker's well-being (Figure 1.1). The online-health intervention addressed these health issues by conveying healthy information (i.e. information modules) and by providing follow-along, guided activities which encourage a healthy behaviour (practical exercises) as modes of delivery. Note that these modes of delivery are the 'components of online-health training' in our earlier framework intended to prevent health issues and improve well-being (Figure 1.1).

In an attempt to maximize prevention efforts in the online-health promotion context, it was of interest to identify perceived health issues of office workers and components of the online-health training that predicted improved well-being. The answer to these questions can potentially help direct health promotion efforts towards certain areas of concern for the office working population, and improve online-health strategies. Additionally, conveying this information is a form of advocacy on behalf of office worker health, a key component of health promotion [9, 104].

3.1 Introduction

Office workers face a multitude of health issues including back pain [84, 105–107], stress [71–73], eye problems [85, 108, 109], and upper limb pain [84, 105, 107, 110, 111]. Internationally, costs from back pain [112, 113] and stress in the workplace [114] are extensive. Eye problems decrease productivity of office workers [115, 116], and upper extremity injuries result in long absences from work and are a financial burden to businesses [117]. All of these health afflictions can have a significant financial toll through loss of work and healthcare expenses.

Workplace health promotion can be used to prevent many occupation-related health concerns and can include a range of information delivery systems. These systems include intervention programs, disease management programs, print materials, health education classes, fitness facilities on worksites, health fairs, and interventions for diet and fitness, among other methods [24]. Web-based eHealth interventions (online-health) are also available. Addressing health issues via online-health techniques is favorable given that they can be personalized, highly structured, visually stimulating, and readily available to workers [118, 119]. Online-health interventions have been shown to decrease back pain [30, 120], help manage stress [24, 74, 121], provide improvements to nutritional and physical activity habits [24, 122], and increase energy expenditure and decrease blood pressure [123, 124]. Furthermore, internet based interventions have been shown to dramatically restore work capacity [125, 126], and have more favorable changes in health behaviour and knowledge compared to non-web-based interventions [28].

Self-reported well-being and self-reported health have been beneficial predictors for decreased sick days, decreased costs to the health care system, and increased productivity [16, 127–130]. There is also evidence that well-being is negatively associated with spinal pain [87], stress [131], eye problems [88], and mortality [132]. Thus, self-reported well-being as an outcome of online-health training can be an important measure. Whether a worker's reported well-being differs with respect to a health concern (such as stress management or back pain) is an important question. However, we found little literature documenting the effect of web-based health interventions on self-reported well-being in office workers.

Web-based health promotion interventions primarily aim to change health behaviours through education and may involve the worker passively reading or listening to health information without engaging workers in practical, hands-on exercises designed to improve health. The effectiveness of practical, hands-on exercises (as opposed to simply reading information modules)in web-based interventions is undocumented in the literature to the best of our knowledge. Also, information on self-perceived health issues (related to back pain, stress, etc.) for office workers goes largely unreported.

Our study was designed to address these two gaps in the literature. This study has the following goals: i) identify the extent to which office workers have health issues related to repetitive strain injury (RSI, i.e. upper limb pain associated with personal computer [PC] work), back pain, resilience, mindfulness, nutrition, stress, and eye health; ii) to assess whether office workers who differ in their health focus also differ in their self-reported well-being; and iii) evaluate whether practical exercises influence self-reported well-being of office workers more than information modules.

3.2 Methodology

fitbase GmbH is a German company based out of Hamburg, Germany, that specializes in online-health training for companies and individuals. fitbase conducts research for the improvement of worker health using technology. Their online-health training consists of reading educational information modules (with health categories in back pain, stress management, nutrition, mindfulness, eye health, RSI, and resilience), and practical exercises (with health categories in back pain, stress management, mindfulness, eye health, and RSI). The information modules educate workers on maintaining a healthy life-style, and the practical exercises are guided health-tutorials for activities related to a healthy behaviour that workers complete.

fitbase collected data for the period of February 2016 to May 2017 from health insurance employees undergoing online-health training in Hamburg, Germany. The data included responses to a needs assessment, a questionnaire, and practical exercise and information module logs of the employees. Demographic information of the office workers was not collected for purposes of confidentiality. The needs assessment was administered prior to beginning the online-health training. Questionnaires regarding perceptions of the online-health training were administered while training at roughly three, six, and nine weeks, and were completed voluntarily. The last questionnaire completed was used for all analyses to best capture an individual's perception at the end of training. Those who responded 'strongly disagree' or 'disagree' to the statement on the questionnaire "Online training improves my well-being" were coded as 'disagree', and those who responded 'agree' or 'strongly agree' were coded as 'agree', creating a binary variable. Which practical exercises completed and which information modules read throughout the course of the online-health training were logged per user. Based on these logs, we computed the total numbers of practical exercises completed and information modules read per health category. From these totals, we computed per individual the grand total of practical exercises completed and the grand total of the information modules read. We then defined a user's *preferred type of intervention* as the intervention associated with the greater of these two grand totals; if these grand totals were not statistically different, the workers *preferred type of intervention* was set to be 'no preference'. A user's *exercise health focus* was defined to be the exercise health category associated with the maximum total of the the exercise-related health categories. A user's *information health focus* was derived similarly. If two health categories were completed most frequently, a tie was assigned to the worker. The number of ties was negligible (each combination <1%) except for workers completing both stress and mindfulness, and both back pain and RSI practical exercises. Consequently, we respectively labeled their *exercise health focus* as 'stress/mindfulness' and 'back/RSI', and we excluded the data for individuals with all other ties.

To address our first goal, we summarized the frequencies of the needs assessment data. Employees responded as 'never', 'rarely', 'sometimes', 'frequently', and 'constantly' to the following questions/statements: 1) "After intensive PC work, I feel pain, tingling or numbness in my hands or arms" (n=3354); 2) "I have upper and lower back pain" (n=3354); 3) "I basically assume that I can overcome difficulties in life" (n=3348); 4) "I notice that I'm lost in thought about the future or the past" (n=3354); 5) "I crave fast food" (n=3354); 6) "I feel tense or irritated" (n=3348); and 7) "My eyes hurt after work" (n=3348).

To address our second and third goals, we developed a logistic regression model that predicted the well-being of workers from the online-health training (n=766). Those who completed at least two exercises, two information modules, and a questionnaire were included for the logistic regression analysis. The response to the statement "Online training improves my well-being" was used as the outcome variable. Independent variables included the derived variables *exercise health focus*, *information health focus*, and *preferred type of intervention.* Office workers with a RSI *information health focus* (n=7) and with a Back/RSI *exercise health focus* (n=6) were removed due to the extremely small sample size. Due to insufficient sample size, interactions between variables were not considered in the model.

Bivariate analyses of the independent variables with the outcome variable having $P < 0.20$ were to be included in the model, and all subsequent analyses were completed at the α=0.05 level. All variance inflation factor (VIF) scores were below 1.7, indicating a negligible influence of multicollinearity. All statistical analyses were conducted using SAS v9.4. The University of Saskatchewan Research Ethics Board waived the need for ethics approval on the basis of secondary analyses of the data.

3.3 Results

Distributions of the responses to the needs assessment questions are illustrated in Figure 3.1.

Of the 3354 office workers who completed the needs assessment, over 40% never felt pain, tingling or numbness in their hands or arms after intensive PC work. Nearly half of the office workers chronically had back pain. About three-fourths believed they can consistently overcome difficulties in life. Half of the office workers felt chronically tense or irritated. About one-fifth of office workers had eye pain after work frequently or more often.

Of the workers who completed a questionnaire, 765 (82%) indicated that the online-health training improved their well-being while 169 (18%) indicated the online-health training had not improved their well-being ($P < 0.001$).

Of the workers who completed two or more practical exercises, 30% focused on back pain, 22% focused on stress management, 19% focused on mindfulness, 14% focused on stress and mindfulness equally, 11% focused on eye health, and 3% focused on RSI (Table 3.1). Of the workers who completed two or more information modules, 46% focused on back pain, 18% focused on stress management, 18% focused on nutrition, 7% focused on mindfulness, 5% focused on eye health, 3% focused on RSI, and 2% focused on resilience (Table 3.2).

Of the workers who completed two or more information modules, 46% focused on back pain, 18% focused on stress management, 18% focused on nutrition, 7% focused on mindfulness, 5% focused on eye health, 3% focused on RSI, and 2% focused on resilience (Table 3.2).

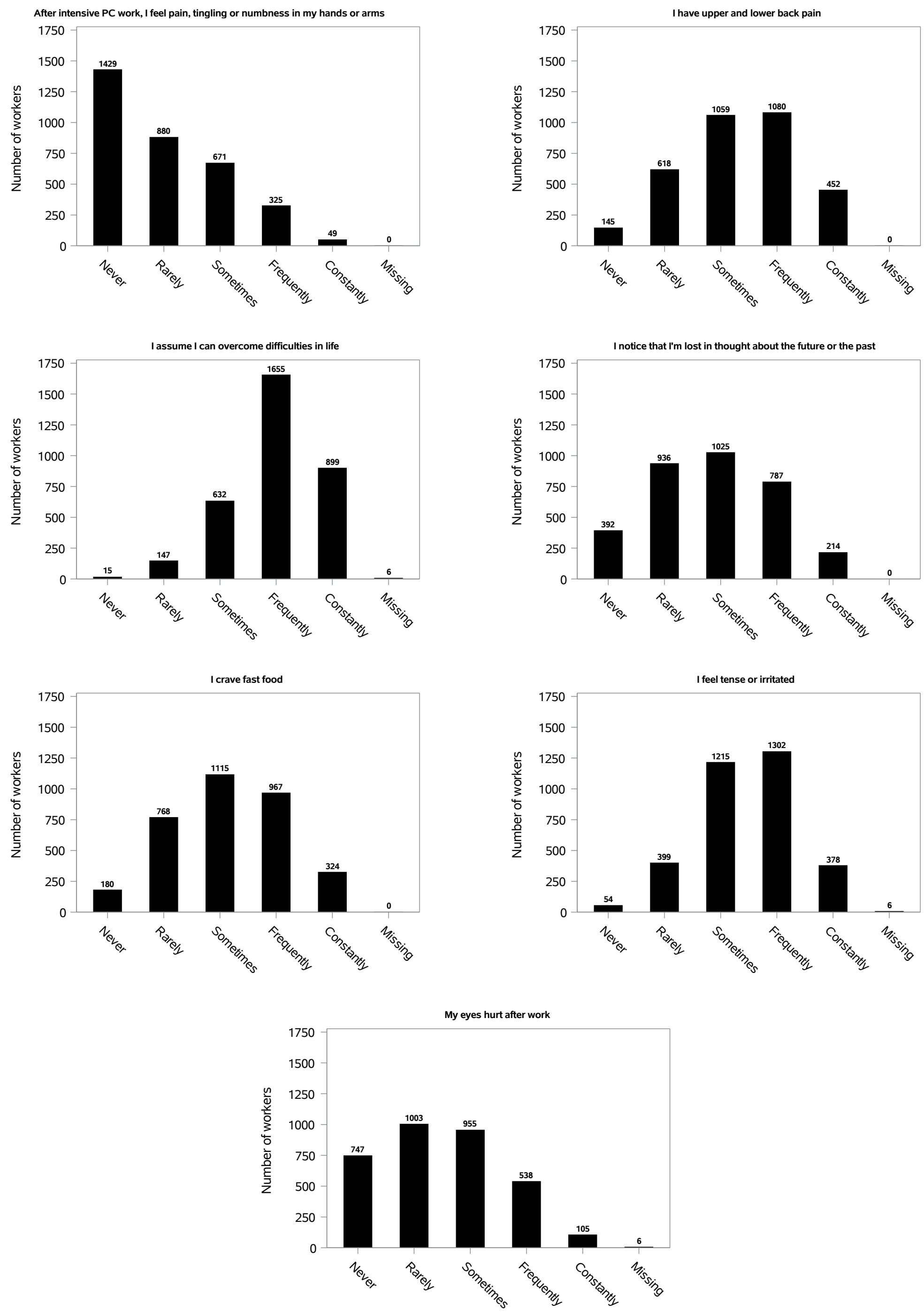

Figure 3.1: Needs assessment frequency data of office workers in Germany (n=3354).

Table 3.1: a) Number of office workers categorized in each *exercise health focus* who completed exercises. b) Number of office workers categorized in each *exercise health focus* who completed exercises, information modules, and a questionnaire.

Health focus	**a) No. of workers (%)**	**b) No. of workers (%)**
Back pain	1057 (29.69)	226 (29.01)
Stress management	781 (21.94)	213 (27.34)
Mindfulness	674 (18.93)	162 (20.80)
Stress/Mindfulness	494 (13.88)	76 (9.76)
Eye health	385 (10.81)	73 (9.37)
RSI	96 (2.70)	23 (2.95)
Back/RSI	73 (2.05)	6 (0.77)
Total	3560 (100)	779 (100)

Table 3.2: a) Number of office workers categorized in each *information health focus* who completed information modules. b) Number of office workers categorized in each *information health focus* who completed information modules, exercises, and a questionnaire.

Health focus	**a) No. of workers (%)**	**b) No. of workers (%)**
Back pain	2415 (46.07)	345 (44.29)
Stress management	965 (18.41)	234 (30.04)
Nutrition	938 (17.89)	96 (12.32)
Mindfulness	385 (7.34)	51 (6.55)
Eye health	279 (5.32)	24 (3.08)
RSI	137 (2.61)	7 (0.90)
Resilience	123 (2.35)	22 (2.82)
Total	5242 (100)	779 (100)

Among the workers who completed a questionnaire and did two or more information and exercise units, 645 (84%) reported that the online training had improved their well-being ($P < 0.001$). All independent variables were included in the final model after bivariate analyses with whether the online-health training had improved a worker's well-being ($P < 0.20$). Descriptive statistics of the variables along with bivariate analyses with a worker's reported well-being can be found in Table 3.3.

Table 3.3: Descriptive statistics of the variables considered for the logistic regression model and bivariate analyses of the independent variables with the outcome variable "online training improves my well-being".

Independent variable	No. of workers	*P*-value
Exercise health focus		0.0028
Back pain	224	
Stress management	211	
Mindfulness	162	
Stress/Mindfulness	76	
Eye health	72	
RSI	21	
Information health focus		0.1204
Back pain	344	
Stress management	233	
Mindfulness	51	
Nutrition	92	
Eye health	24	
Resilience	22	
Preferred type of intervention		0.0023
Exercises	208	
Information modules	351	
No preference	207	

Outcome variable	No. of workers
The online-health training improves well-being	
Yes	645
No	121
Total	766

The results of the logistic regression model, including *P*-values, ORs and 95% CIs can be found in Table 3.4. One's *exercise health focus* and *preferred type of intervention* were both statistically significant with a worker's improved well-being from the online-health training (P=0.0127, P=0.0349, respectively). Compared to workers focused on back pain exercises, workers focused on eye health, mindfulness, stress management, and stress/mindfulness statistically differed ($P < 0.05$). Those workers with a focus in back exercises had 3.1 times the odds greater than those focused on stress management (P=0.0008), 2.3 times the odds greater than those focused on mindfulness (P=0.0235), 3.1 times the odds greater than those focused on stress/mindfulness (P=0.0051), and 3.4 times the odds greater than those focused in eye health exercises (P=0.0025) of having their well-being improved. Among office workers whose preferred intervention was practical exercises, the odds were 2.2 times greater to report improved well-being from the online-health training than those who preferred information modules (P=0.0115).

Table 3.4: Logistic regression model results for office workers in Germany undergoing online-health training (n=766).

Variable	OR	1/OR	95% CI of OR	P-value
Exercise health focus*				
Back pain†				
Stress management	0.322	3.105	[0.166-0.623]	0.0008
Mindfulness	0.439	2.280	[0.215-0.895]	0.0235
Stress/Mindfulness	0.319	3.135	[0.143-0.710]	0.0051
Eye health	0.291	3.436	[0.131-0.648]	0.0025
RSI	0.548	1.825	[0.142-2.124]	0.3844
Preferred type of intervention*				
Information modules†				
Exercises	2.218	0.451	[1.196-4.112]	0.0115
No preference	1.083	0.923	[0.671-1.749]	0.7446
Information health focus				
Back pain†				
Stress management	1.097	0.912	[0.652-1.848]	0.7267
Mindfulness	0.704	1.420	[0.295-1.684]	0.4304
Nutrition	0.643	1.555	[0.354-1.168]	0.1467
Eye health	1.574	0.635	[0.411-6.029]	0.5080
Resilience	1.979	0.505	[0.419-9.359]	0.3891

*$P < 0.05$
†Reference category

We summarize our findings from this work in Figure 3.2.

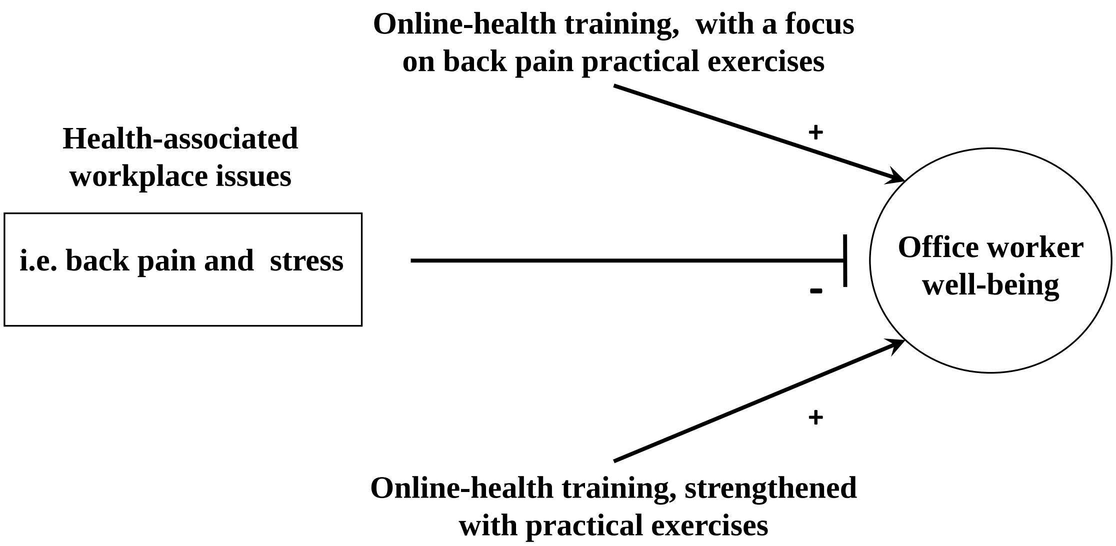

Figure 3.2: Schematic of the results from online-health training as an intervention to increase well-being. Those who focused on back pain exercises and those who focused on practical exercises had improved well-being. (+) promotes. (-) inhibits.

3.4 Discussion

This study sought to examine the level of importance in which office workers perceived health issues, and examined possible differences in improved well-being from online-health training. We were interested in whether there are differences in the well-being of workers based on specific health categories and whether completing guided practical exercises or reading educational information modules had a different impact on improving an office workers well-being.

In our exploration of office worker health issues, back pain and stress management were most important; mindfulness and nutrition were moderately important; and RSI, resiliency, and eye health were of least concern to office workers. Back pain and stressful demands from work are common among office workers [133] and interventions for both exist [134,135]. This aligns with the popularity of the two foci in our study, as they were the most popular exercises and information modules completed by workers. Studies have reported a wide range of back pain prevalences ranging from 23-56% in office workers [84, 106, 136–139]. This is consistent with our finding that workers frequently focused on back pain when completing both practical exercises and information modules (29.69% and 46.07%, respectively).

It is well known that office workers suffer from stress [71–73], and our study cohort was no different. Half of the office workers in this study felt chronically tense or irritated. There is an apparent dichotomy between a worker experiencing stress and their resilience. Over three quarters of office workers in this study stated they frequently or constantly could overcome life difficulties, suggesting our study participants are intrinsically confident in their abilities to overcome stressors.

It is well known that office workers suffer from stress [71,73], and our study cohort was no different. Half of the office workers in this study felt chronically tense or irritated. However, over three quarters of office workers in our study stated they frequently or constantly could overcome life difficulties, suggesting our study participants are intrinsically confident in their abilities to overcome stressors. This indicates an apparent dichotomy between a worker experiencing stress and their resilience.

Oha et al. [137] found that 7% of computer workers reported frequent wrist/hand or shoulder pain. Other studies report varying results; prevalences of upper limb symptoms as low as 10% and as high as 52% have been documented in office workers [83, 84, 107, 136–138, 140, 141]. Our findings support that workers experience varying degrees of pain after PC work while most studies simply report whether workers experience upper limb pain in a dichotomous fashion [84,107,136,138,140–142]. In fact, those responding 'constantly feeling pain after PC' work might have disabling pain or worse [143]. In our study, 11% of workers chronically felt pain after PC work in their hands or arms, compared to 69% of workers reporting rarely or never. These estimates are considerably different from the literature, which estimates a higher prevalence for RSI pain [136]. Only 19% of our office workers reported routinely feeling eye pain after work. Another study identifying health issues in data processing office workers report a 26% prevalence of sore eyes from work [138].

Our logistic regression model yielded that well-being was influenced by different health categories and different interventions (i.e. exercises vs. information). With respect to those who completed information modules, there were no differences in the reported well-being of office workers across health categories; however, office workers who completed more exercises than information modules in general had higher odds of having their well-being improved. Our findings could suggest a need for hands-on, instructional, do-it-yourself exercises in online-health promotion for the workplace. Also, workers focusing on back pain had higher odds of improved well-being. Available literature shows exercise driven back pain interventions can decrease pain and improve back function [144,145]. Our study suggests back health might be in greatest demand by office workers; this makes sense, given that many different occupations are linked with back pain [146].

Furthermore, participation rates in web-based workplace health promotion activities are typically low and hence a concern [26]. Evidence suggests that guided web-based health programs promote worker retention [37]. Our finding that office workers have increased odds of improved well-being when utilizing guided, follow-along exercises might reflect this. More specifically, workers focused on back pain exercises in this workplace online-health promotion intervention had higher odds of having their well-being improved. When considering the future of workplace online-health promotion programs, our work could help steer the so-called "life cycle" of a health promotion program in a more efficient direction. Jimenez and Bregenzer [26] have proposed an altered version of the WHO model for workplace health promotion, offering the benefits of Internet based methods at each step in the cycle. The findings from our work can be implemented in the proposed stages of the workplace health promotion life cycle proposed by Jimenez and Bregenzer [26]. Table 3.5 provides a summary of these seven stages.

Table 3.5: Life cycle model of workplace health promotion and descriptions of stages as described by Jimenez and Bregenzer [26]. Each stage can be strengthened with the use of eHealth tools.

Stages	**Description**
Concept adaptation	The workplace health promotion project, including duration and content, available resources, and objectives are outlined.
Information	Information flow between management, employees and other key stakeholders. The intervention information is conveyed to all parties.
Assessment analysis	Assess the current state of the organization or company, with respect to the objectives outlined in the concept adaptation for efficient implementation. This can be done through questionnaires, needs assessments, and behavioural analyses.
Dashboard feedback	Convey results from the assessment analysis stage to management, employees and other key stakeholders.
Health circles/participatory planning	Include employees in subsequent decision making processes in order to increase intervention acceptance and program uptake. "Health circle" discussion groups can be used.
Interventions	Health promotion interventions, as planned in the previous steps, are developed and implemented.
Evaluation	Evaluating the implementation process and the intervention outcomes. Can evaluate short, medium or long-term outcomes.

Figure 3.3 demonstrates how we can implement our findings in the life cycle of a workplace health promotion program. Note that health promoters can convey the importance of back health and practical exercises during the 'dashboard feedback' stage of a life cycle when addressing office workers.

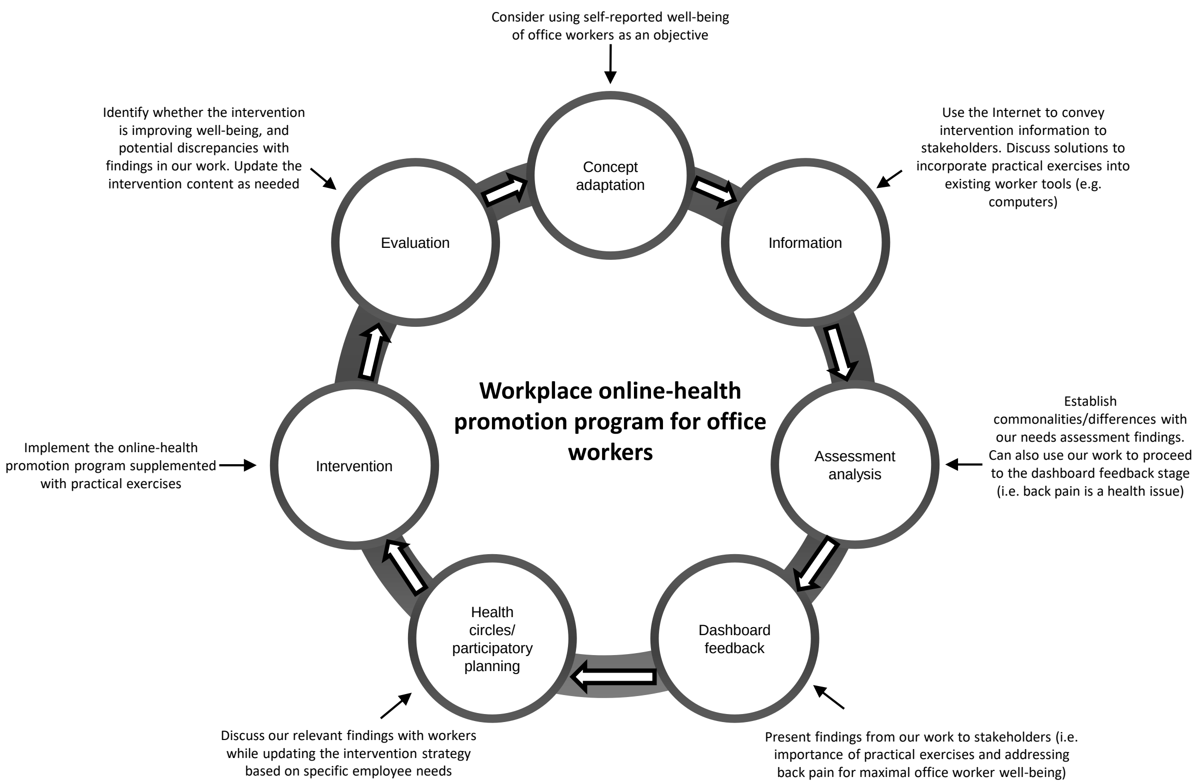

Figure 3.3: Examples of where our findings can help inform the life cycle of a workplace health promotion intervention, specifically for office workers. Based on the life cycle from Jimenez and Bregenzer [26].

To the best of our knowledge, our findings are the first demonstrating that completing online-health training translates to improved well-being in office workers, and that completing practical exercises rather than simply receiving online-health information improves well-being. Our work supports that practical exercises for online-health interventions are beneficial to online-health promotion as a whole, regardless of a specific health focus, in office workers. Specifically, our work shows the importance of back health. Our data suggests that online-health interventions for an office-workplace should tailor resources towards promoting back health and in general, exercise-intensive health promotion strategies. This customized approach may help retention and uptake of office workers for future programs.

Given the potential cost benefits of reported well-being, employers and health insurers could benefit from incorporating practical back health exercises into online-health promotion efforts. Because there is a shift in employment to many sedentary and office-confined occupations [13] and the Internet is widely used globally [147] and in Canada [148], our findings could possibly apply to a wider spectrum of occupations.

3.5 Limitations

Because only those who completed a questionnaire, exercises, and information modules were included in our logistic regression modeling, there is potential selection bias. The absence of demographic information on the office workers prevented us from controlling for socio-demographic confounding factors. The findings were centered on German office workers, and therefore may not generalize to other countries and other types of workers. Health categories, from which workers chose, were not exhaustive; there are likely other important concerns that were not included in this study, such as physical activity [25] or smoking cessation [149]. Future studies should identify objective measures (blood pressure, cortisol levels, etc.) and a way to compare the perceived quality of the practical exercises to information modules.

3.6 Conclusions

This study examined needs assessment data, questionnaire data, and activity data (including practical exercises and information modules), to determine the degree office workers perceive health issues and to identify which components of online-health training predict improved well-being. Office workers reported back pain and stress most frequently as persistent health issues. Office workers who focused on guided practical exercises had better odds of improving their well-being compared to office workers who focused on information. Those who focused on back pain exercises had greater odds of having their well-being improved than those who focused on other health domains. As technology becomes more mainstream in the workforce and jobs continue to shift towards seated computer work, online-health promotion will become increasingly more important. On the basis of our study, we recommend future online-health promotion workplace interventions to focus on back pain and to incorporate guided exercises for office workers who are wanting to improve their health.

Abstract: Chapter 4

Objectives

The prostate-specific antigen (PSA) test is widely used in Canada to detect Prostate Cancer (PCa) despite mixed recommendations. After PSA test screening, psychological distress from false positives and complications from biopsies are common, posing as a cancer-screening concern. National data of PSA screening rates and the characteristics of men who are prone to PSA screening are from 2000/2001. This work attempted to provide recent rates of PSA screening, compare rates to past national data, and identify men prone to PSA screening.

Methods

The Canadian Community Health Survey (CCHS) from 2009/10 (Atlantic Canada; ATL), 2011/2012 (Ontario; ON) and 2013/2014 (Quebec; QC) were used for all analyses. Lifetime PSA screening estimates with 95% confidence intervals were constructed to estimate PSA screening in ATL, ON, and QC. Two logistic regression models, one for men <50 years of age and one for men ≥50 years of age, were utilized to determine associations between factors and lifetime PSA test screening.

Results

Since 2000/2001, PSA screening rates have increased in ATL, ON, and QC excepting in men aged 40-49 from Newfoundland (NL) and men aged 40-59 from QC. Factors positively associated with lifetime PSA screening in men of all ages was ever having a digital rectal exam, having a regular doctor, and ever having a colorectal exam. Among men aged <50 years of age, daily consumption of fruits and vegetables and non-smoking status were positively associated with lifetime PSA screening. Among men aged ≥50 years of age, high income and the presence of chronic health conditions were positively associated with lifetime PSA screening.

Conclusion

Despite the controversy surrounding the PSA test, screening rates have generally increased since 2000/2001 in eastern Canadian regions. Physician-related factors play a role in men at all ages. Men <50 years of age are being screened despite no recommendations for screening in men in this demographic (excepting men with an increased risk of PCa).

Chapter 4

PSA screening rates and factors associated with screening in Canadian men: Findings from cross-sectional survey data

Thus far, this work has discussed disease prevention through the lens of health promotion. This Chapter focuses on disease prevention through the lens of screening.

The goals of this work were to improve our understanding of screening utilization in Canada, and to establish which factors are associated with being screened. The PSA screening test, as outlined in section 1.2, is currently met with mixed recommendations and has several negative implications for men in Canada (including psychological distress from false positives and complications from unnecessary biopsies). PSA screening is a current Canadian public health concern related to PCa prevention. In this Chapter, we establish the most recent rates of PSA screening and factors associated with PSA screening.

4.1 Introduction

Prostate cancer (PCa) is the most common cancer malignancy and a main cause of cancer death (accounting for 21%) in Canadian men [150,151]. It is characterized as the development of cancer in the prostate, a gland in the male-reproductive tract, composed of smooth muscle and epithelial cells partly responsible for alkaline fluid secretion and ejaculation [152, 153]. A protein that is transcribed from prostatic epithelial cells is the prostate-specific antigen (PSA) [52]. When the prostate structure is disrupted (for example with PCa), PSA proteins normally confined within the gland can leak into the circulatory system and be detected in the blood. PSA blood tests are utilized to detect PCa, but most men with elevated blood PSA levels do not have PCa [52]. Therefore, recommendations for PSA screening in Canada are currently mixed [61, 62].

Problems with the PSA test include limited benefits for all-cause and cancer-specific mortality, psychological distress from false positives, and complications from biopsies upon diagnoses [51,54,55,154,155]. Some evidence suggests only 1 in 1000 men screened with PSA testing might prevent PCa [51] while more recent evidence suggests 3 of 1000 men screened will be protected from metastatic PCa [57–59]. Despite the limitations with PSA testing, it remains a default screening method for PCa in Canada and might be growing in usage for men under 50 years of age [68]. Thus, pending definitive evidence of test benefits, it is important to establish the most recent screening rates in Canada and to determine factors associated with men being screened with the PSA test.

Where (+) indicates a positive association and (-) indicates a negative association, known factors associated with having a PSA test in western countries outside of Canada include age (+), physician interaction (+), urinary tract symptoms (+), good perceived health (+), high educational attainment (+), high income (+), non-smoking status (+), being married or equivalent (+), screening for colorectal cancer (+), regular physical activity (+), independence (+), alcohol use (+), obesity (+), and chronic health conditions (+) [156–166].

To the best of our knowledge, Canadian literature documenting PSA screening rates and factors associated with having a PSA test is either over a decade old for national data [69] or limited to Alberta [68,70]. Age (+), having a family doctor (+), being married or equivalent (+), high educational attainment (+), high income (+), being born in Canada (+), non-smoking status (+), excellent perceived health (+), speaking English or French (+), chronic health conditions (+), colorectal cancer screening (+), and caucasian and asian ethnicity (+) are associated with having a PSA test [68–70].

Because factors for other cancer screening methods may infer the uptake of PSA screening, it is of interest to identify these factors for other cancer screening methods. Educational attainment (+), increasing income (+), age (+), physician referral (+), fruit and vegetable consumption (+), and physical activity (+) are associated with colorectal cancer screening [167–174]. Educational attainment (+), increasing income (+), age (+), physician referral (+), and social support (+) are associated with breast cancer screening [175–179]. For cervical, breast, and colorectal screening, smoking (-) [180] overweight/obesity in women (-) [181–183] and overweight/obesity in men (+) [181] are associated with screening.

Based on the factors associated with PSA screening and other cancer screening methods, we hypothesized that having a regular doctor; a digital rectal exam (DRE); a colorectal exam (CRE); independence in activities; urinary incontinence; obesity status; good perceived health; physical activity; fruits and vegetable consumption; alcohol use; chronic health conditions; married/equivalent status; non-smoking status; been born in Canada; and a English/French spoken language at home would be positively associated with having a PSA test while controlling for age, income, education, ethnicity, and regional differences. We sought to update the current understanding of factors associated with having a PSA test while adding to the Canadian literature, namely by examining the association between lifestyle-related factors such as fruit and vegetable intake, alcohol use, and level of physical activity; physician-related factors such as having a DRE, CRE and a regular doctor; and health and social-related factors including needing help with daily activities, having urinary tract problems, and whether these variables differed by Canadian region. Also, given that recent Canadian guidelines recommend men electing to be tested to begin screening at 50 years of age [62, 184], and that PCa detected in men younger than 50 years of age often have better outcomes and lower stage disease [185–187], we were interested in determining screening rates and factors associated with the PSA test in men younger, and older than, 50 years of age.

4.2 Methodology

Secondary data analyses were completed using data from the 2009/2010, 2011/2012, and 2013/2014 cycles of the Canadian Community Health Survey (CCHS) [188]. The CCHS is an annual, cross-sectional, population-based survey, intended to inform health policy for Canadian communities. The last CCHS cycle to include PSA relevant questions was the 2013/2014 cycle and limited to men 35 years and older from Quebec (QC). For this reason, we also included the 2009/2010 and 2011/2012 CCHSs, because the 2009/2010 CCHS has PSA related questions for men 35 years and older from Newfoundland (NL), Prince Edward Island (PEI), and Nova Scotia (NS), hereafter referred to as Atlantic Canada (ATL), and the 2011/2012 CCHS because it has PSA relevant questions and men 35 years and older from Ontario (ON), to be more representative of Canada. No recent data was available for the other provinces/territories. Prevalence estimates of lifetime PSA screening with 95% confidence intervals (CIs) were calculated for each survey. The three datasets were combined and weights standardized for the combined dataset for regression analyses. In order to compare screening rates with national data from 2000/2001 [69], we also constructed 95% CIs for the weighted prevalences of men 40-49, 50-59, 60-69, ≥ 70, ≥ 50 and ≥ 40 years of age.

The outcome variable used for the logistic regression analyses was a binary variable coded as whether a man has ever had a PSA screening test in his life (yes/no). Lifestyle-related variables included in the analyses are alcohol consumption [161] in the last 12 months, BMI [156, 158], daily consumption of fruits and vegetables [167], type of smoker [69], self-perceived health [163], and physical activity [161]. Having a regular doctor [69], ever having a DRE, and receiving a CRE [70, 161] were physician-related factors included in the analyses. Other social and health-related independent variables considered were needing help with daily activities [161], marital status [69], urinary incontinence (a potential urinary tract problem) [162, 189], the number of chronic health conditions [70], country of birth [69], and spoken language [69]. Control variables used were age, ethnicity, household income, and education [69, 70]. We derived an *age* variable to categorize men aged 35-39, 40-44, 45-49, 50-59, 60-69, and $\geq$70 years. We derived the *BMI* variable to be either under weight or normal weight (BMI $<$25), overweight (BMI 25-30) and obese (BMI $\geq$30) individuals. The derived *type of smoker* variable categorized men as either individuals who currently smoke or individuals who do not. The derived *perceived health* variable was categorized as poor, fair, good, and very good or better. The *had a CRE* variable was derived as men who have had a fecal occult blood test, sigmoidoscopy, or colonoscopy ('yes') or none ('no'). The *needs help with daily activities* variable was derived based on whether an individual needs help with any of the following, and coded as 'yes' or 'no': preparing meals, making appointments, doing house work, personal care, moving within the house, or personal finances. *Marital status* was derived as an individual who is either married/common law or never married/widowed/separated. A *number of chronic health conditions* variable was derived from the number of conditions an individual had from those listed in the CCHS (which were defined as having asthma, fibromyalgia, high blood pressure, migraines, chronic obstructive pulmonary disorders, diabetes, heart disease, cancer, intestinal/stomach ulcers, ailments from stroke, bowel disorder, bowel disease, mood disorders, and anxiety disorders) and coded as 0, 1, or 2 or more. A *spoken language* variable was coded as whether a respondent spoke their provincial language at home (French in QC and English in ATL and ON; denoted as 'native'), whether a respondent spoke a national Canadian language but not the provincial language at home (English in QC and French in ATL and ON, denoted as 'non-native') or some other language spoken at home (not French nor English in QC, ATL, and ON; denoted as 'other'). Lastly, a derived variable *region* for the province/survey of a respondent was created, consisting of men from ATL (2009/2010), ON (2011/2012), and QC (2013/2014). All other variables were included as answered on the CCHS. Interaction terms for these variables and the *region* of respondent (ON, ATL, QC) were included, given that the region of the respondent might differentially influence the independent variables on the outcome variable.

Descriptive statistics and regression modeling were performed on the weighted data with SAS v9.4. We formed one logistic model for men aged <50 years of age and another model for men ≥ 50 years of age. To determine which variables were associated with the outcome variable, bivariate logistic regression analyses of each independent variable with the outcome variable were completed first. Those pairs with $P < 0.20$ were to be included in the logistic regression model. All variance inflation factor (VIF) scores were below 2.5, indicating a negligible influence of multicollinearity. Influential points were removed as described by Ryan et al. [81]. Binary logistic regression was used to build our final models for the combined 2009/2010, 2011/2012, 2013/2014 CCHS data with a 0.05 significance level. Individuals with missing data were deleted case-wise; variables with greater than 5% missing data were excluded. *Daily consumption of fruits and vegetables* in the ≥50 years old model was excluded because of too many missing observations (>5%). Interaction variables between Canadian region and all independent variables were added, and interaction terms with $P > 0.05$ were not included in the final models. The need for ethics approval was unnecessary because of the secondary analyses of publicly available, de-identified data.

4.3 Results

The descriptive statistics of men <50 years of age and men ≥50 years of age can be found in Tables 4.1 and 4.2. The variables in these tables were considered for binary logistic regression analyses.

Table 4.1: Descriptive statistics of Canadian men <50 years of age having a PSA screening test, 2009-2014 (n=6167).

Respondent characteristics	CCHS data N (weighted %)
Lifetime PSA screening	
Yes	929 (16.57)
No	5238 (83.43)
Age	
35-39	2094 (31.65)
40-44	2147 (33.58)
45-49	1926 (34.77)
Missing	0
Household income	
<20,000 CAD	395 (5.21)
20,000-39,999 CAD	835 (11.61)
40,000-59,999 CAD	984 (15.13)
60,000-79,999 CAD	970 (16.21)
≥80,000 CAD	2916 (51.37)
Missing	67 (0.48)
Educational attainment	
Low (some post-secondary or less)	1807 (27.59)
High (post-secondary certificate)	4195 (69.64)
Missing	165 (2.77)
Ethnicity	
White	4957 (70.37)
Visible minority	952 (25.68)
Missing	258 (3.94)
Has a regular doctor	
Yes	4921 (80.39)
No	1243 (19.59)
Missing	3 (0.02)
Had a digital rectal exam	
Yes	1879 (30.23)
No	4264 (69.50)
Missing	24 (0.27)
Had a colorectal exam	
Yes	1220 (19.78)
No	4922 (79.87)
Missing	25 (0.36)
Needs help with daily activities	
Yes	294 (3.41)
No	5872 (96.57)
Missing	1 (0.02)

Table 4.1 cont'd

Respondent characteristics	CCHS data N (weighted %)
Has urinary incontinence	
Yes	43 (0.54)
No	6119 (99.39)
Missing	5 (0.07)
Body mass index (BMI)	
Normal/underweight (<25)	1981 (33.49)
Overweight (25-29.9)	2634 (42.90)
Obese (≥30)	1481 (22.25)
Missing	71 (1.36)
Perceived health	
Poor	123 (1.39)
Fair	412 (5.96)
Good	1814 (30.73)
Very good/Excellent	3816 (61.91)
Missing	2 (0.02)
Physical activity	
Active	1662 (24.46)
Moderately active	1633 (24.59)
Inactive	2865 (50.83)
Missing	7 (0.13)
Type of smoker	
Current smoker	1807 (27.08)
Former/never smoker	4310 (72.26)
Missing	50 (0.66)
Daily consumption of fruits and vegetables	
<5 times per day	4097 (66.56)
5-10 times per day	1704 (27.34)
>10 times per day	176 (3.68)
Missing	190 (2.42)
Marital status	
Married/equivalent	4023 (76.04)
Single	2137 (23.66)
Missing	7 (0.30)
Country of birth	
Canada	4848 (66.09)
Other	1070 (30.25)
Missing	249 (3.66)
Number of chronic health conditions	
0	3834 (65.74)
1	1450 (22.25)
≥2	878 (11.97)
Missing	5 (0.04)

Table 4.1 cont'd

Respondent characteristics	CCHS data N (weighted %)
Alcohol usage in the last 12 months	
Yes	5254 (83.36)
No	782 (14.54)
Missing	131 (2.10)
Spoken language	
Native	5456 (82.73)
Non-native	185 (4.13)
Other	305 (9.69)
Missing	221 (3.45)
Region (CCHS year)	
ATL (2009/10)	883 (7.05)
ON (2011/12)	3528 (59.16)
QC (2013/14)	1756 (33.79)
Missing	0

Table 4.2: Descriptive statistics of Canadian men ≥50 years of age having a PSA screening test, 2009-2014 (n=15 881).

Respondent characteristics	CCHS data N (weighted %)
Lifetime PSA screening	
Yes	9727 (59.72)
No	6154 (40.28)
Age	
50-59	5366 (44.58)
60-69	5672 (32.32)
≥70	4843 (23.10)
Missing	0
Household income	
<20,000 CAD	1603 (7.30)
20,000-39,999 CAD	4120 (19.93)
40,000-59,999 CAD	3469 (20.26)
60,000-79,999 CAD	2414 (15.63)
≥80,000 CAD	4048 (35.95)
Missing	227 (0.93)
Educational attainment	
Low (some post-secondary or less)	6848 (39.19)
High (post-secondary certificate)	8514 (57.31)
Missing	519 (3.50)

Table 4.2 cont'd

Respondent characteristics	CCHS data N (weighted %)
Ethnicity	
White	14054 (82.82)
Visible minority	1084 (12.13)
Missing	743 (5.06)
Has a regular doctor	
Yes	14391 (89.42)
No	1484 (10.56)
Missing	6 (0.03)
Had a digital rectal exam	
Yes	12325 (74.83)
No	3477 (24.72)
Missing	79 (0.45)
Had a colorectal exam	
Yes	10455 (63.23)
No	5331 (36.17)
Missing	95 (0.59)
Needs help with daily activities	
Yes	1658 (8.69)
No	14217 (91.28)
Missing	6 (0.02)
Has urinary incontinence	
Yes	809 (3.87)
No	15037 (96.00)
Missing	35 (0.14)
Body mass index (BMI)	
Normal/underweight (<25)	5162 (32.70)
Overweight (25-29.9)	6919 (44.68)
Obese (≥30)	3677 (21.85)
Missing	123 (0.78)
Perceived health	
Poor	765 (4.03)
Fair	2128 (11.20)
Good	5287 (32.26)
Very good/Excellent	7665 (52.07)
Missing	36 (0.43)
Physical activity	
Active	4145 (24.81)
Moderately active	3978 (24.88)
Inactive	7742 (50.26)
Missing	16 (0.05)

Table 4.2 cont'd

Respondent characteristics	CCHS data N (weighted %)
Type of smoker	
Current smoker	3020 (19.25)
Former/never smoker	12714 (79.92)
Missing	147 (0.83)
Daily consumption of fruits and vegetables	
$<$5 times per day	10314 (65.85)
5-10 times per day	4298 (27.38)
$>$10 times per day	307 (2.07)
Missing	962 (4.70)
Marital status	
Married/equivalent	10493 (77.00)
Single	5353 (22.87)
Missing	35 (0.13)
Country of birth	
Canada	12813 (70.75)
Other	2387 (24.10)
Missing	681 (5.14)
Number of chronic health conditions	
0	4816 (35.67)
1	4782 (30.49)
$\geq$2	6273 (33.80)
Missing	10 (0.04)
Alcohol usage in the last 12 months	
Yes	12581 (80.41)
No	2954 (17.25)
Missing	346 (2.34)
Spoken language	
Native	14269 (83.98)
Non-native	500 (3.62)
Other	475 (7.81)
Missing	637 (4.59)
Region (CCHS year)	
ATL (2009/10)	2119 (7.11)
ON (2011/12)	8702 (56.10)
QC (2013/14)	5060 (36.79)
Missing	0

The total sample size of the combined dataset was 22 048. Prevalence rates with 95% CIs of lifetime PSA screening by region and age can be found in Figure 4.1. Key findings illustrated in Figure 4.1 from these data are the PSA screening rates among men aged 40-44 and 45-49. For these age groups, men in ATL and ON have higher screening rates than men in QC. These weighted point prevalence estimates can be found in Table 4.3. Note that the estimated prevalences among men aged 40-44 years of age are 17.48% in ATL (95% CI: [11.66-23.31]), 18.74% in ON (95% CI: [14.79-22.70]), and 6.92% in QC (95% CI: [3.97-9.87]), and among men aged 45-49 years of age are 31.24% in ATL (95% CI: [23.09-39.40]), 35.26% in ON (95% CI: [29.54-41.01]), and 16.20% in QC (95% CI: [10.69-21.72]).

Point prevalence estimates with 95% CIs for ten year age groups and cumulative age groups for comparisons to 2000/2001 can be found in Table 4.4. Estimates for men $\geq$50 years of age from ATL were 62.77% (95% CI: [59.49-66.05]), from ON were 62.74% (95% CI: [60.53-64.96]) and from QC were 54.40% (95% CI: [51.99-56.81]). Estimates for men $\geq$40 years of age from ATL were 50.40% (95% CI: [47.27-53.53]), from ON were 51.38% (95% CI: [49.52-53.25]) and from QC were 42.16% (95% CI: [39.95-44.37]).

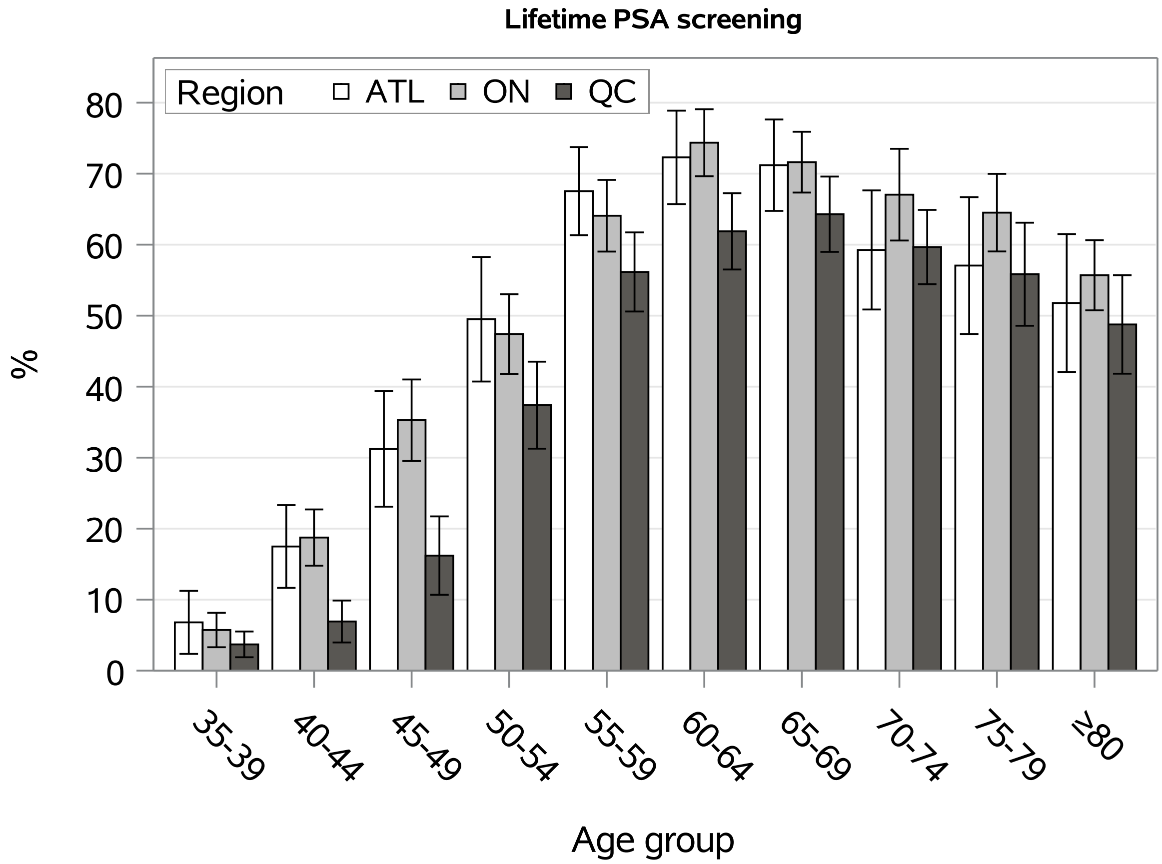

Figure 4.1: Prevalence of PSA screening in Canadian men (%) by age group and region. Error bars depict 95% CIs.

Table 4.3: Weighted prevalence % estimates of lifetime PSA screening by 5 year age groups and by region (95% CIs).

	Region		
Age group	ATL	ON	QC
35-39	6.80 (2.36-11.24)	5.72 (3.29-8.15)	3.69 (1.88-5.51)
40-44	17.48 (11.66-23.31)	18.74 (14.79-22.70)	6.92 (3.97-9.87)
45-49	31.24 (23.09-39.40)	35.26 (29.54-41.01)	16.20 (10.69-21.72)
50-54	49.49 (40.72-58.27)	47.41 (41.81-53.01)	37.39 (31.26-43.52)
55-59	67.55 (61.33-73.75)	64.08 (59.03-69.13)	56.16 (50.59-61.73)
60-64	72.30 (65.72-78.88)	74.36 (69.64-79.08)	61.88 (56.50-67.25)
65-69	71.20 (64.76-77.64)	71.62 (67.34-75.90)	64.29 (58.99-69.59)
70-74	59.25 (50.87-67.64)	67.04 (60.58-73.50)	59.66 (54.43-64.90)
75-79	57.06 (47.42-66.70)	64.51 (59.04-69.97)	55.84 (48.58-63.09)
$\geq$80	51.78 (42.07-61.49)	55.69 (50.75-60.63)	48.76 (41.82-55.70)

Table 4.4: Weighted prevalence % estimates of PSA screening by age groups 40-49, 50-59, 60-69, ≥ 70, ≥ 50 and ≥ 40 by region (95% CIs).

	Region		
Age group	ATL	ON	QC
40-49	24.57 (19.51-29.62)	27.14 (23.53-30.75)*	11.70 (8.51-14.89)
50-59	58.50 (52.79-64.20)*	55.46 (51.62-59.30)*	47.04 (42.84-51.25)
60-69	71.82 (67.15-76.48)*	73.22 (69.95-76.50)*	62.96 (59.16-66.76)*
≥ 70	56.64 (51.31-61.97)*	62.89 (59.51-66.28)*	55.78 (52.14-59.43)*
≥ 50	62.77 (59.49-66.05)*	62.74 (60.53-64.96)*	54.40 (51.99-56.81)*
≥ 40	50.40 (47.27-53.53)*	51.38 (49.52-53.25)*	42.16 (39.95-44.37)*

* Our rates were statistically higher compared to 2000/2001 rates [69]. The age groups 40-49, 50-59, 60-69 and ≥ 70 were compared to provincial estimates. The cumulative age groups ≥ 50 and ≥ 40 were compared to Canadian estimates from 2000/2001 [69].

Estimates, odds ratios (ORs) and 95% CIs of independent variables in the final logistic regression models for the <50 year old men and of ≥50 year old men can be found in Tables 4.5 and 4.6, respectively.

Table 4.5: Logistic regression model for lifetime PSA screening in Canadian men <50 years of age, 2009-2014 (n=5518).

Variable	OR	95% CI	P-value
Age§			
35-39†			
40-44	2.829	[1.948-4.110]	<.0001
45-49	5.995	[4.153-8.655]	<.0001
Household income			
<20,000 CAD	0.940	[0.531-1.662]	0.8303
20,000-39,999 CAD	0.967	[0.611-1.529]	0.8850
40,000-59,999 CAD	1.033	[0.716-1.492]	0.8606
60,000-79,999 CAD	0.791	[0.547-1.144]	0.2133
≥80,000 CAD†			
Educational attainment			
Low†			
High	1.081	[0.805-1.450]	0.6053
Ethnicity			
White†			
Visible minority	1.374	[0.969-1.948]	0.0746
Had a digital rectal exam§			
Yes	3.742	[2.857-4.901]	<.0001
No†			
Body mass index (BMI)			
Normal/underweight(<25)†			
Overweight (25-29.9)	1.198	[0.894-1.604]	0.2263
Obese (≥30)	1.006	[0.710-1.425]	0.9740
Physical activity index			
Active	1.083	[0.790-1.486]	0.6206
Moderately active	0.949	[0.695-1.294]	0.7398
Inactive†			

Table 4.5 cont'd

Variable	OR	95% CI	P-value
Type of smoker§			
Current smoker	0.554	[0.413-0.743]	<.0001
Former/never smoker†			
Daily consumption of fruits and vegetables§			
<5 times per day†			
5-10 times per day	0.890	[0.682-1.231]	0.4258
>10 times per day	2.980	[1.614-5.503]	0.0005
Number of chronic health conditions			
0†			
1	0.916	[0.682-1.231]	0.5613
≥2	0.883	[0.607-1.284]	0.5137
Spoken language‡			
Native†			
Non-native	0.372	[0.170-0.811]	0.0129
Other	0.821	[0.454-1.483]	0.5124
Has a regular doctor*			
At **ATL**			
Yes	0.831	[0.309-2.237]	0.7145
No†			
At **ON**			
Yes	3.280	[1.670-6.425]	0.0001
No†			
At **QC**			
Yes	4.739	[2.375-9.456]	<.0001
No†			
Had a colorectal exam*			
At **ATL**			
Yes	1.022	[0.514-2.032]	0.954
No†			
At **ON**			
Yes	2.405	[1.708-3.385]	<.0001
No†			

Table 4.5 cont'd

Variable	OR	95% CI	P-value
At **QC**			
Yes	1.243	[0.656-2.356]	0.540
No†			

†Reference category
*Interaction terms with *region*
‡P-value < 0.05, §P-value < 0.01 for testing whether all parameters associated with that effect are zero

For the <50 years of age model: The odds of being screened with the PSA test increased with age. Men aged 40-44 and 45-49 had approximately three ($P < 0.0001$) and six ($P < 0.0001$) times the odds, respectively, of having been screened with the PSA test compared to men aged 35-39 (Table 4.5, age; $P < 0.0001$, $P < .0001$, respectively). Men who have had a DRE had 3.7 times higher odds of ever having a PSA screening test than men who have not had a DRE (Table 4.5, DRE; $P < 0.0001$). Non-smokers had approximately two times higher odds of ever having a PSA screening test than smokers (Table 4.5, smoking status; $P < 0.0001$). Men who consume fruits and vegetables more than 10 times per day had approximately three times greater odds of ever having a PSA screening test than men who consumed less than five times per day (Table 4.5, fruit and vegetable consumption; P=0.0005). Men who speak their provincial language at home had 2.7 times the odds of ever having a PSA screening test compared to men who speak a national, non-provincial language at home (Table 4.5, spoken language; P=0.0129). It was found that men in ON and QC with regular doctors had higher odds of being screened than men in ON and QC without regular doctors, and men in ON who have had a CRE had higher odds of being screened than men in ON who have not had a CRE (Table 4.5, interaction terms; P=0.0001, $P < 0.0001$, $P < 0.0001$, respectively).

Table 4.6: Logistic regression model for lifetime PSA screening in Canadian men ≥50 years of age, 2009-2014 (n=14 362).

Variable	OR	95% CI	P-value
Age§			
50-59†			
60-69	1.708	[1.462-1.995]	<.0001
≥70	1.097	[0.923-1.306]	0.2937
Household income‡			
<20,000 CAD	0.715	[0.545-0.938]	0.0153
20,000-39,999 CAD	0.771	[0.632-0.941]	0.0104
40,000-59,999 CAD	0.829	[0.685-1.004]	0.0549
60,000-79,999 CAD	1.002	[0.817-1.228]	0.9885
≥80,000 CAD†			
Educational attainment			
Low†			
High	1.028	[0.896-1.180]	0.6935
Ethnicity			
White†			
Visible minority	0.883	[0.685-1.137]	0.3348
Has a regular doctor§			
Yes	3.123	[2.462-3.962]	<.0001
No†			
Had a digital rectal exam§			
Yes	2.407	[2.048-2.830]	<.0001
No†			
Had a colorectal exam§			
Yes	1.823	[1.578-2.105]	<.0001
No†			
Needs help with daily activities			
Yes	0.857	[0.677-1.085]	0.1995
No†			
Has urinary incontinence§			
Yes	0.498	[0.363-0.681]	<.0001
No†			

Table 4.6 cont'd

Variable	OR	95% CI	P-value
Body mass index (BMI)‡			
Normal/underweight(<25)†			
Overweight (25-29.9)	1.161	[0.996-1.352]	0.0562
Obese (≥30)	1.330	[1.102-1.605]	0.0030
Perceived health status§			
Poor	0.626	[0.450-0.869]	0.0052
Fair	0.614	[0.490-0.770]	<.0001
Good	0.837	[0.713-0.983]	0.0298
Very good/Excellent†			
Physical activity index			
Active	1.007	[0.857-1.182]	0.9331
Moderately active	1.020	[0.867-1.201]	0.8074
Inactive†			
Type of smoker			
Current smoker	0.865	[0.735-1.017]	0.0798
Former/never smoker†			
Marital status			
Married/equivalent	1.113	[0.956-1.297]	0.1676
Single†			
Number of chronic health conditions§			
0†			
1	1.303	[1.097-1.547]	0.0026
≥2	1.226	[1.020-1.474]	0.0302
Alcohol usage in the last 12 months			
Yes	1.090	[0.922-1.290]	0.3122
No†			
Spoken language			
Native†			
Non-native	1.026	[0.746-1.411]	0.8738
Other	1.264	[0.898-1.780]	0.1789

Table 4.6 cont'd

Variable	OR	95% CI	*P*-value
Region (CCHS year)§			
ATL (2009/10)	1.204	[1.008-1.438]	0.0404
ON (2011/12)†			
QC (2013/14)	0.743	[0.643-0.859]	<.0001

†Reference category
*Interaction terms with *region*
‡*P*-value < 0.05, §*P*-value < 0.01 for testing whether all parameters associated with that effect are zero

For the ≥50 model: Men aged 60-69 years of age had 1.7 times the odds of having been screened with the PSA test compared to men aged 50-59 years of age, while men aged ≥70 years of age did not differ with men aged 50-59 years of age (Table 4.6, age; $P < 0.0001$, P=0.2937, respectively). Men in households earning 20 000-39 999 CAD and <20 000 CAD had decreased odds of having been screened with the PSA test compared to men with household incomes exceeding 80 000 CAD (Table 4.6, household income; P=0.0104, P=0.0153, respectively). Men with a regular doctor had approximately three times the odds of having been screened with the PSA test compared to men without a regular doctor (Table 4.6, regular doctor; $P < 0.0001$). Those men who had a DRE had 2.4 times the odds of having been screened with the PSA test compared to men who have not had a DRE (Table 4.6, DRE; $P < 0.0001$). Those men who had a CRE had 1.8 times the odds of having been screened with the PSA test compared to men who have not had a CRE (Table 4.6, CRE; $P < 0.0001$). Men with urinary incontinence had approximately half the odds of having been screened with a PSA test compared to men without urinary incontinence (Table 4.6, urinary incontinence; $P < 0.0001$). Obese men had 33% higher odds of having been screened with a PSA test than normal weight and underweight men (Table 4.6, BMI; P=0.0030). Men who perceived their health to be less than very good or excellent (good, fair, and poor) had decreased odds of having been screened compared to men who perceived their health to be very good or excellent (Table 4.6, perceived health; P=0.0298, $P < 0.0001$, P=0.0052, respectively). Men with chronic health conditions (one and two or more) had higher odds of being screened with a PSA test than men without chronic health conditions (Table 4.6, chronic health conditions; P=0.0026, P=0.0302, respectively). Men in ATL had increased odds, and men in QC had decreased odds of having been screened with a PSA test compared to men who live in ON (Table 4.6, region; P=0.0404, $P < 0.0001$, respectively).

4.4 Discussion

This study examined lifetime PSA screening rates and factors associated with lifetime PSA screening in Canadian men aged 35 and older. Data were used from the 2009/2010, 2011/2012 and 2013/2014 CCHSs. Given that the validity of PSA screening is currently being questioned, we were interested in estimating rates of ever having had a PSA screening test in Canada. We identified factors associated with PSA screening among men younger than 50 years of age and among men aged 50 years and older, because of current Canadian guidelines [62, 184] and different possible health outcomes between these two groups [185–187].

One of our study objectives was to compute current (as of 2009-2014) lifetime PSA screening rates in Canada and compare them to the rates in Table III of Beaulac et al. in 2000/2001 [69]. In our Table 4.4, we present the lifetime PSA screening rates for ATL (2009/2010), ON (2011/2012), and QC (2013/2014) for different age groups. When we compare the corresponding 2000/2001 rates for NL, PEI, and NS to those in Table 4.4, all the 2000/2001 rates are statistically lower than ours except for men aged 40-49 from NS [69]. When we compare the 2000/2001 rates for ON to our rates in Table 4.4, all the 2001 rates are statistically lower than ours. Finally, when we compare the 2000/2001 rates for QC to our rates in Table 4.4, the 2000/2001 rates for men aged ≥60 years are statistically lower than ours, while the rates for men aged 40-59 did not statistically differ from ours. Despite the conflicting evidence surrounding using PSA testing for PCa screening, our results suggest that over the decade subsequent to 2000/2001, the rates of ever having a PSA screening test have generally increased in ATL, ON, and QC for men ≥40 years of age (with the exceptions of those noted).

When comparing the lifetime PSA screening rates for the two age groups in our work, we found that the rates are lower in men <50 years of age. For men <50 years of age, our estimated rates of screening increased with age. In the ≥50 years of age group, the estimated screening rates increased in men from 50-64 years of age, and the rates afterwards began to decline. We also noted differences among the regions. In men <50 years of age, men from QC aged 40-44 and 45-49 had lower PSA screening rates than their counterparts from ATL and ON aged 40-44 and 45-49. This finding might be related to provincial policy. For example in QC, the provincial Collège des médecins du Québec (CMQ) [190] advocated for shared decision making with patients aged 55-69 with no mention of screening men aged <55 years of age, and more recently the Institut national d'excellence en santé et services sociaux (INESSS) has put forth similar recommendations [191]. These provincial recommendations might explain the lower rates of PSA screening among men aged 40-49 in QC. Our other study objective was to determine factors associated with PSA screening in Canada. In Table 4.5 and Table 4.6 respectively, we present the models for ever having had a PSA screening test for men <50 and men ≥50 years of age. Physician-related factors (having a regular doctor, a CRE, and a DRE) were significantly positively associated in both models. Their presence in both models speaks to the role physicians play in PSA screening among men of all ages [80, 162, 192–194]. This could suggest regular physicians are prompting men of all ages to be screened. In fact, the literature supports this because the decision to have a PSA test is heavily influenced by physicians' recommendation [80,193,194]. Consistent with findings from Richardson et al. [70], we found that men who have had a CRE have higher odds of being screened with the PSA test. A vast majority of Canadian physicians use the DRE and PSA for PCa screening together in patients [80, 195–199]. Our work supports this, given that having a DRE increased the odds of having a PSA test in men of all ages. Gattellari and others [162] report more than half of PSA tests ordered in Australia were in combination with other pathological tests, and our work suggests a similar trend in Canada.

In men ≥50 years of age only, we found associations with increased income (+), obesity (+), very good or better perceived health (+), the presence of chronic health conditions (+), and having urinary incontinence (-) and having a lifetime PSA screening test. Men aged 60-69 had the highest odds of having been screened whereas there were no differences between men aged ≥70 years of age and men aged 50-59 years of age. This is consistent with Canadian guidelines [61,62] recommending against PSA screening in men older than 70. Higher income in older men predicted PSA screening. Other Canadian studies have found a positive association between income and PSA screening [68–70]. Obesity was associated with PSA screening, consistent with prior literature [156, 158, 200]. This might be because physicians are more likely to offer PSA tests to overweight male patients [156]. Physicians complete more technical tasks (i.e. prescribing a diagnostic plan, discussing lab work, etc.) than other tasks with obese patients [201] which likely would include PSA screening. Fontaine et al. [156] has also speculated this association exists due to an increased risk of lower urinary tract symptoms in obese men; however, this association persisted in our model after controlling for urinary incontinence. Men with lower self-perceived health had decreased odds of being screened, which has been found in prior literature documenting PSA screening [70, 165]. Although poor perceived health is associated with more doctor visits [202], it is also associated with mistrust of the healthcare system [203], which is a possible explanation for this finding. Chronic health conditions predicted PSA screening as has been documented previously in Canada [70].

Men ≥50 years of age with urinary incontinence had decreased odds of being screened compared to men without urinary incontinence. This finding might suggest that 1) men with urinary incontinence are worried about potential PSA test findings and thus do not seek out the test, and/or 2) men with health problems who required subsequent follow-ups (such as for PCa treatment), have a higher preponderance of urinary incontinence [204]. Urinary problems have been reasons for PSA testing in ON [205] and Australia [162], although it is unclear if the patient is informing the physician of their urinary incontinence or the physician requests this information which leads to the screening. More recent evidence from Sweden suggests patient request is a better predictor of PSA screening than urinary problems in Sweden [206] and physicians in ON have reported patient requests more often as a PSA screening initiator [205]. Thus, men in our study might not be informing their physicians of their urinary incontinence. In fact, some evidence exists that older men are reluctant to disclose their urinary incontinence with their physicians [207] which might be reflected in the decreased odds for these men being screened in the ≥50 years of age model.

In men <50 years of age only, we found associations with smoking (-), consumption of fruits and vegetables (+), and spoken language at home (speaking the non-provincial language at home [-]) with having a lifetime PSA screening test. These findings are consistent with the literature for PSA screening among non-smokers [69] and fruit and vegetable consumption in colorectal screening [167] and could suggest that men who are concerned about their health might seek having a PSA screening test. Men speaking a non-provincial language at home had a decreased odds of being screened, representing possibly a language barrier to seeking a PSA screening test. Pardoxically, for men in ON and QC under 50 years of age, there is an increased odds of having a PSA screening test and having regular doctors. Further research is warranted here, given that no Canadian guidelines advocate for screening under 50 years of age.

When considering both the <50 years of age model and the ≥50 years of age model, some themes emerge. Physician-related factors were important for both models, indicating the role physicians have in the PSA screening process. Among men aged <50 years, factors which are related to leading a healthy lifestyle (non-smoking, high fruit and vegetable consumption) seem to play a role in PSA screening. This might indicate that these healthy individuals initiate physician contact and subsequent PSA screening. Conversely, among men ≥50 years of age, non-behavioural-related factors which predict physician interaction (i.e. having chronic health conditions [208] or high income [209]) were found to be significant, suggesting non-behavioural factors are initiating physician contact and subsequent PSA screening in older men.

4.5 Limitations

Study strengths include the modeling and prevalence estimates of men aged 35-39 years of age, as this is undocumented in the literature to the best of our knowledge. This work also divides men by age, based on Canadian recommendations [62, 184] into less than 50 years of age and ≥50 years of age. However, some limitations exist. Responses were self-reported via the CCHS (i.e. Ever having taken a PSA test). Therefore, recall bias might have been a factor, or men might have had a poor understanding of what the PSA test was during the survey. Two factors which were not assessed in this work but were assessed in 2000/2001 [69] were geographic location and employment status. Employment status is an important variable for cancer screening, although it was not considered for this work given the very low response rate on the CCHS. Because lifetime screening was used as the outcome variable, some responses might have changed since the PSA test was actually taken [69]. For example, a man might have been screened with the PSA test and many years afterwards developed multiple chronic conditions. Lastly, this work was confined to ATL, ON and QC and thus might not generalize to all of Canada.

4.6 Conclusions

This study investigated lifetime screening rates for the PSA test in Canadian men, and factors associated with whether Canadian men have ever been screened with the PSA test. We found that rates of PSA screening have generally increased since 2000/2001 in the regions defined for this work (ATL, ON, and QC). We report that physician-related factors are important for the PSA screening of men of all ages. There might also be important differences among men aged $<$50 years of age and men $\geq$50 years of age. For instance, healthy-behaviours predict PSA screening in men $<$50 years of age, while factors which implicate high levels of physician contact predict PSA screening in men $\geq$50 years of age. Additional research is needed to investigate the effectiveness of the PSA test, research for improving PSA tests, or research to identify effective alternatives for the early detection of PCa.

These results, coupled with the finding that screening rates have generally increased since 2000/2001, demonstrates that physicians continue to play an important role in PSA screening and that despite mixed recommendations for PSA screening, rates continue to rise. On the basis of this work, it is clear that physicians play a central role with respect to PSA screening in Canada.

4.7 Acknowledgements

This work was supported by the TELUS Ride for Dad and the Prostate Cancer Fight Foundation.

Chapter 5

Key findings, discussion, and future directions

This thesis focused on projects related to health promotion and screening, two aspects which are largely responsible for disease prevention. Health promotion is a primary prevention method, and screening is a secondary prevention method. We directed our attention to a specific health promotion intervention and a particular screening methodology. In this Chapter, we summarize the key findings and implications of our work, discuss our findings under disease prevention, and discuss ideas for future research.

5.1 Office workplace health promotion: key findings and discussion

Because the Internet is growing in usage and office workplaces can access large segments of the population, we were interested in examining the efficacy of a particular online-health promotion intervention offered by fitbase for health insurance workers. We present the findings with respect to the research objectives for health promotion (Objectives 1-3) in this section:

We hypothesized that stress would be a primary concern for office workers. We found that stress and back pain were identified as equally problematic for office workers (about half of office workers frequently or constantly experienced both). Our finding is consistent with the literature, becaue office workers often face stress in the workplace [71–73] and suffer from back pain [84, 105–107]. However, in terms of improved well-being, office workers addressing back pain had a more favorable outcome than those focused on stress. Although we tend to focus on stress to a great degree in society, our work suggests that back pain is an equal or greater health issue in the office workplace.

Often, health promotion interventions measure a single intervention and its effects on a particular health behaviour or outcome. This work is particularly unique because we measure the effects of two modes of delivery for health promotion and their effect on office worker's well-being.

We hypothesized that office workers focusing on practical exercises would report improved well-being compared to workers who focused on information modules. We found that workers who focused on practical exercises compared to reading information modules had higher odds of improved well-being. Our work suggests that office workers may prefer 'doing' rather than reading: although the information modules may be improving office worker health literacy [210], they don't necessarily engage workers actively like the practical exercises. The guided exercises allowed workers to actively take part in their health improvement rather than passively reading information modules. Because of the guided, observational nature of the practical exercises, workers were allowed to take control of their well-being.

Contrary to our hypothesis that the well-being of office workers focusing on stress management would improve the most, office workers who focused on back pain related practical exercises reported having a higher sense of well-being compared to almost all other health categories. This finding is interesting given that stress and well-being are often thought as directly linked to one another, especially in a workplace setting [16], yet here we show that back pain has a greater influence on well-being. Our work suggests that office workers are in greater need for back care interventions than other health concerns.

From our work, we recommend that office workplace health promotion interventions should focus on completing practical exercises and address issues involving back pain.

5.2 PSA screening: key findings and discussion

For screening, we were interested in the prostate-specific antigen (PSA) test, given the controversy surrounding PSA screening. We estimated PSA screening rates to compare to the 2000/2001 rates for the purposes of identifying the impact that this controversy has had on PSA screening (if at all). We also identified several factors which could influence PSA screening in Canadian men. We present the findings with respect to the research Objectives for screening (Objectives 4 and 5) in this section.

We expected our rates estimated from the 2009-2014 data to be no greater than the rates found in 2000/2001 [69]. However, we found an increase in ATL, ON and QC across almost all age groups. Possible explanations for these increases could be the following. Since 2000, professional bodies in the US recommending PSA screening were the American Cancer Society in 2001 [212], American Urological Association in 2000 [213] and 2009 [214]. Also, a large randomized clinical trial from Europe reported reduced PCa mortality from PSA test utilization in 2009 [215]. Canadian physicians may have followed these US recommendations, and may have heeded the 2009 results from Europe, increasing PSA screening in their patients.

In 2011, the Canadian Urological Association (CUA) released recommendations for screening in men ≥50 years of age with a greater than ten year life expectancy [216], however we failed to see increased screening rates in subsequent years in ON or QC (2011-2014) compared to ATL in 2009/2010. One study indicates that a large proportion of physicians from ON are unaware of CUA guidelines or are not at all influenced by them [195], which might explain the failure to see an increase in screening within 2011-2014.

We show that screening rates in QC (2013/2014) are generally lower than ATL (2009/2010) and ON (2011/2012), especially in men aged 40-49. This might be related to provincial policy, as we found no documentation of professional bodies from QC recommending screening under 50 years of age. In fact, some evidence from Canada shows that physicians prefer provincial guidelines to national or international ones [196]. It is also possible that the decrease in PSA screening rates we see in QC were a result of the USPSTF (2012) recommendations against screening [51, 217], which is viewed by Canadian physicians as a fairly influential source for initiating screening [195].

With respect to factors influencing PSA screening, our findings corroborated our hypothesis that physician-related variables would be positively associated with PSA screening. Because these variables greatly influence PSA screening behaviour, it suggests that physicians are a good target population for the modulation of PSA screening rates. Physicians are the main health care providers responsible for initiating PSA screening in men [195] and this could explain the increased odds of screening for men who have regular doctors, who have had colorectal exams, and who have had digital rectal exams. These findings are consistent with the Canadian literature [69, 70, 80].

The increased odds of men being screened <50 years of age, who have regular doctors, had a colorectal exam, and have had a digital rectal exam, is concerning, given that no Canadian guidelines recommend screening in this group (excepting men at an increased risk [62]). Our results suggest that men who are interacting with physicians have higher odds of being screened. Whether it is the men, or their physicians, who initiates the PSA screening is unclear. The media or charitable organizations (i.e. Motorcycle Ride for Dad) may play an important role for men initiating PSA screening. We also show that about one-fourth of men from ATL and ON aged 40-49 have been screened, and a novel finding that approximately every twentieth man aged 35-39 has been screened. These numbers should almost certainly be decreased in men with an average-risk for PCa, because there is little to no evidence to screen these age groups.

From our findings, we suggest that Canadian policy makers aim to modulate PSA screening rates for the improvement of PSA screening efforts. We show that rates in Eastern Canada (ATL, ON, QC) are higher than the 2000/2001 rates in the same regions. By decreasing PSA screening, we could prevent the occurence of complications associated with screening (i.e. psychological distress). There might be no need to increase screening uptake in Canadian men given the general increase since 2000/2001.

In the next section, we will discuss how these results can relate to disease prevention.

5.3 Health promotion, Screening, and Disease Prevention

Health promotion aims to create healthy behaviours by allowing people to take control of their health [9]. Health promotion can be used in the pre-pathological phase of disease acquisition [3, 4] in an effort to prevent disease contraction. We aimed to better understand which components of an online-health promotion intervention were associated with improved well-being in office workers. We found that workers focused on back pain practical exercises (compared to other health categories) undergoing an online-health promotion intervention had maximal well-being. Poor well-being predicts a multitude of health problems [218]. Thus, by promoting well-being in office workers by using back pain interventions, we may not be solely improving back function, but also preventing many different health issues. Similarly, by incorporating practical exercises into office workplace health promotion programs, we can aim to improve office workers' sense of well-being in an attempt to prevent ill-health in this population.

Screening attempts to detect those who appear well but are in fact ill [38]. Screening is an important method for disease prevention during the pathological phase of disease progression

[3, 4]. We sought to estimate recent PSA screening rates and factors associated with PSA screening. The intention of the PSA test is to prevent harmful PCa, and thus understanding the rates and the associated factors with PSA screening can inform future prevention efforts. The PSA test can be used to detect PCa and prevent the harmful progression of PCa, however, the test itself is associated with health problems. False positives are common from PSA screening [53] which subject some men to psychological distress and complications from resultant biopsies. Thus, increased PSA screening rates results in increased false positives. By using the findings discussed in this thesis, we can help prevent the health problems associated with these false positives. An example lies in the unnecessary rates of screening seen in men aged 35-49 in this work. Excepting men at an increased risk for PCa, these rates should almost certainly be decreased to prevent the associated health problems which are a result of excess screening.

Both health promotion and screening can be thought of as types of disease prevention [3, 4]. It is important to note that our findings are important for the prevention of many health issues, not solely back pain in the office workplace (as discussed in Chapter 3) or PCa in Canada via the PSA test (as discussed in Chapter 4). Because health promotion is a primary prevention method, and because screening is a secondary prevention method, we can improve prevention efforts by updating our online-health promotion understanding and by using the PSA screening test according to current recommendations. We can inform primary and secondary prevention by implementing the results found in this work.

5.4 Future work

5.4.1 Health promotion

Future research should collect sociodemographic data. Although we could not gather sociodemographic data due to concerns of confidentiality, there may be important differences due to the gender [219] or the age of office workers.

A study assessing how satisfied office workers are with completing the practical exercises and with reading the information modules might be valuable. By identifying the satisfaction of an office worker with respect to these two methods, we can control for the actual improved well-being. This way, the difference in the well-being from the two modes of delivery could be compared.

A randomized control trial and more objective measures may also be valuable. For instance, a random group of office workers could be assigned solely to an 'information modules' group, and a random group of office workers could be assigned solely to a 'practical exercises' group, and then measure differences in well-being of the two groups with a more objective measure of well-being. The SF-36 [220], a validated questionnaire for assessing ones' health across many domains, could be a way to assess one's well-being in a more objective way.

Qualitative research might also be an interesting avenue to pursue. We could identify why office workers are satisfied or dissatisfied with certain elements of online-health training, and to describe their perception of a health issue. For example, one could ask an office worker "Are you satisfied with the practical exercises and information modules? if so, why?" or "How much does back pain affect your life and work?"

5.4.2 Screening

Most physicians report the negative implications of the PSA test and let their patients decide. However, our work suggests that higher physician contact results in higher odds for PSA screening. Research is needed to explain this paradox. We show that PSA screening rates are high in three Canadian regions despite inconclusive evidence of PSA test benefits.

It would be interesting to see the impact professional bodies have on PSA screening rates in Canada. A majority of Canadian physicians, that are aware of the Canadian Task Force on Preventive Health Care (CTFPHC) recommendation (2014) against PSA screening [61], report screening less often [221] and the CTFPHC may be the most trusted national source for Canadian physicians [195]. The CUA recommended PSA screening in 2017 [62]. Thus, it would be interesting to obtain PSA screening rates for after 2014, and then to note how PSA screening rates have changed since 2017.

Research is needed to discover the impact provincial guidelines have on initiating PSA screening across Canada to better ascertain regional differences in screening. Some evidence suggests physicians from British Columbia (BC) prefer provincial guidelines compared to the CTFPHC [196], that physicians from BC and ON prefer the CTFPHC guidelines among national recommendations [195,196], and that most physicians across Canada are influenced by the CTFPHC [221]. If the preference for provincial guidelines is consistent across all Canadian provinces, it would be important to ascertain whether provincial guidelines are based off of national guidelines (i.e. the CTFPHC) or if provincial recommendations are independently formulated. Discovering whether provincial guidelines cause a physician or man to initiate screening, and whether provincial guidelines are based off of national guidelines, could help create a more complete picture of the driving factors behind the high PSA screening rates for Canadian men seen in our work.

Research in Canada could also attempt to explain why men with higher physician contact have higher odds of PSA screening (as seen in this work), even though most physicians report explaining the negative implications of the test and then letting their patients decide [221]. This is especially important for men younger than 50 years of age who have frequent physician interaction, where no current recommendations exist for PSA screening in these men (excepting high risk for PCa men).

An alternative screening method to the PSA test is the Stockholm 3 Model (STHLM3). The STHLM3 utlizes PSA levels along with other factors including single nucleotide polymorphisms (SNPs), clinical attributes, and additional plasma proteins to detect men at a high risk for PCa [222]. The sensitivity and specificity of the STHLM3 is likely much better than the PSA screening test alone [222] and future work should identify the feasibility of implementing the STHLM3 PCa screening method in Canada. An analysis of cost-effectiveness in Canada is in need. If the STHLM3 is deemed not feasible for Canada, and if future research suggests the PSA test is a net negative to society, efforts to rectify these high screening rates might be to research ways to better relay the cons of PSA screening to a patient. This could be accomplished with the use of decision aids, which have been shown to decrease PSA screening [223] but are rarely used by physicians to convey PSA screening information to their patients [224].

5.5 Conclusions

We found that office workers focused on back pain and office workers focusing on practical exercises had increased odds of improved well-being from an online-health promotion intervention. Office workers make up a large segment of the population and the Internet is widely available to Canadians. Hence, our findings are applicable to many people. We suggested where our findings could be implemented in a workplace health promotion intervention's life cycle. We then described future avenues of research in this topic (including the influence sociodemographic factors might have on worker's well-being). From a prevention perspective, our findings could help prevent a multitude of health issues by improving the well-being of office workers.

On the topic of screening, we found that PSA screening in ATL, ON, and QC are higher compared to screening in 2000/2001, and that men who are not recommended to be screened are being screened. We show that different characteristics are associated with PSA screening in men <50 and ≥ 50 years of age, while physicians play a major role in PSA screening across all ages. Because physicians undoubtedly play a central role in PSA screening, we recommended them as a good target population to modulate unnecessary screening. We then discussed ideas for future work which could explain high PSA screening rates, including provincial policy. From a prevention perspective, we could aim to decrease the rates of psychological distress and biopsy complications from false positives due to excessive screening.

Using these findings, we recommend future online-health promotion efforts to incorporate practical exercises with an emphasis on back pain, and to decrease Canadian PSA screening in average-risk men younger than 50 years of age. It is hopeful that both efforts will improve disease prevention efforts, and Canadian public health as a whole.

References

[1] Public Health Agency of Canada. Chapter 2: The Chief Public Health Officers report on the state of public health in Canada 2008 – What is public health? [Internet]. 2008 [cited 2018 Oct]. Available from: https://www.canada.ca/en/public-health/corporate/publications/chief-public-health-officer-reports-state-public-health-canada/report-on-state-public-health-canada-2008/chapter-2a.html

[2] Tiedemann M. Law and Government Division: Legislative Summary LS-523E. Bill C-5: Public Health Agency of Canada Act. 2006. Available from: http://www.nitag-resource.org/uploads/media/default/0001/01/72d8d8c7dd3b1cc1ab13a66b58671eb928218239.pdf

[3] Leavell HR, Clark EG. Preventive Medicine for the Doctor in his Community - An Epidemiologic Approach. McGraw-Hill; 1965.

[4] Baumann LC, Karel A. In: Gellman MD, Turner JR, editors. Prevention: Primary, Secondary, Tertiary. Encyclopedia of Behavioral Medicine. Springer, New York, NY; 2013. p. 1532-1534.

[5] Gordon Jr RS. An operational classification of disease prevention. Public Health Rep. 1983 Mar; 98(2):107-109.

[6] Vijgen SM, Van Baal PH, Hoogenveen RT, De Wit GA, Feenstra TL. Cost-effectiveness analyses of health promotion programs: a case study of smoking prevention and cessation among Dutch students. Health Educ Res. 2007 Aug 4;23(2):310-8.

[7] Goldie SJ, Gaffikin L, Goldhaber-Fiebert JD, Gordillo-Tobar A, Levin C, Mahé C, et al. Cost-effectiveness of cervical-cancer screening in five developing countries. N Engl J Med. 2005 Nov 17;353(20):2158-68.

[8] World Health Organization. Ottawa Charter for Health Promotion: An International Conference on Health Promotion: the Move Towards a New Public Health, November 17-21, 1986, Ottawa, Ontario, Canada. World Health Organization; 1986.

[9] Hubley J, Copeman J. Practical health promotion. 2nd ed. Cambridge UK: Polity Press; 2013.

[10] United States Department of Health, Education, and Welfare. Healthy People: The Surgeon General's Report on Health Promotion and Disease Prevention. Washington DC; 1979.

[11] Tengland PA. Health promotion or disease prevention: a real difference for public health practice?. Health Care Anal. 2010 Sep 1;18(3):203-21.

[12] World Health Organization. Basic documents. 48th ed. Geneva: World Health Organization; 2014. Available from: http://apps.who.int/gb/bd/pdf/bd48/basic-documents-48th-edition-en.pdf

[13] Church TS, Thomas DM, Tudor-Locke C, Katzmarzyk PT, Earnest CP, Rodarte RQ, et al. Trends over 5 decades in US occupation-related physical activity and their associations with obesity. PloS One. 2011 May 25;6(5):e19657.

[14] Sorensen G, Emmons K, Hunt MK, Johnston D. Implications of the results of community intervention trials. Annu Rev Public Health. 1998 May;19:379-416.

[15] Pescud M, Teal R, Shilton T, Slevin T, Ledger M, Waterworth P, et al. Employers' views on the promotion of workplace health and wellbeing: a qualitative study. BMC Public Health. 2015 Dec;15:642.

[16] Danna K, Griffin RW. Health and well-being in the workplace: A review and synthesis of the literature. J Manage. 1999 Jun;25(3):357-84.

[17] Conrad P. Worksite health promotion: The social context. Soc Sci Med. 1988 Jan 1;26(5):485-9.

[18] Goetzel RZ, Henke RM, Tabrizi M, Pelletier KR, Loeppke R, Ballard DW, et al. Do workplace health promotion (wellness) programs work?. J Occup Environ Med. 2014 Sep 1;56(9):927-34.

[19] Conrad P. Health and fitness at work: A participants' perspective. Soc Sci Med. 1988 Jan 1;26(5):545-50.

[20] Mills PR, Kessler RC, Cooper J, Sullivan S. Impact of a health promotion program on employee health risks and work productivity. Am J Health Promot. 2007 Sep;22(1):45-53.

[21] Bertera RL. The effects of workplace health promotion on absenteeism and employment costs in a large industrial population. Am J Public Health. 1990 Sep;80(9):1101-5.

[22] Gibbs JO, Mulvaney D, Henes C, Reed RW. Work-site health promotion. Five-year trend in employee health care costs. Journal of occupational medicine. J Occup Med. 1985 Nov;27(11):826-30.

[23] Hymel PA, Loeppke RR, Baase CM, Burton WN, Hartenbaum NP, Hudson TW, et al. Workplace health protection and promotion: a new pathway for a healthierand saferworkforce. J Occup Environ Med. 2011 Jun 1;53(6):695-702.

[24] Cook RF, Billings DW, Hersch RK, Back AS, Hendrickson A. A field test of a web-based workplace health promotion program to improve dietary practices, reduce stress, and increase physical activity: randomized controlled trial. J Med Internet Res. 2007 Apr;9(2):e17.

[25] Malik SH, Blake H, Suggs LS. A systematic review of workplace health promotion interventions for increasing physical activity. Br J Health Psychol. 2014 Feb;19(1):149-80.

[26] Jimenez P, Bregenzer A. Integration of eHealth Tools in the Process of Workplace Health Promotion: Proposal for Design and Implementation. J Med Internet Res. 2018 Feb;20(2).

[27] Evers KE. eHealth promotion: the use of the Internet for health promotion. Am J Health Promot. 2006 Mar;20(4):1-4.

[28] Wantland DJ, Portillo CJ, Holzemer WL, Slaughter R, McGhee EM. The effectiveness of Web-based vs. non-Web-based interventions: a meta-analysis of behavioral change outcomes. J Med Internet Res. 2004 Oct;6(4):e40.

[29] Macea DD, Gajos K, Calil YA, Fregni F. The efficacy of Web-based cognitive behavioral interventions for chronic pain: a systematic review and meta-analysis. J Pain. 2010 Oct 1;11(10):917-29.

[30] del Pozo-Cruz B, Adsuar JC, Parraca J, del Pozo-Cruz J, Moreno A, Gusi N. A web-based intervention to improve and prevent low back pain among office workers: a randomized controlled trial. J Orthop Sports Phys Ther. 2012 Oct;42(10):831-D6.

[31] Stratton E, Lampit A, Choi I, Calvo RA, Harvey SB, Glozier N. Effectiveness of eHealth interventions for reducing mental health conditions in employees: A systematic review and meta-analysis. PloS One. 2017 Dec 21;12(12):e0189904.

[32] Billings DW, Cook RF, Hendrickson A, Dove DC. A web-based approach to managing stress and mood disorders in the workforce. J Occup Environ Med. 2008 Aug;50(8):960-8.

[33] Thiart H, Lehr D, Ebert DD, Berking M, Riper H. Log in and breathe out: internet-based recovery training for sleepless employees with work-related strainresults of a randomized controlled trial. Scand J Work Environ Health. 2015 Mar 1:164-74.

[34] Allexandre D, Bernstein AM, Walker E, Hunter J, Roizen MF, Morledge TJ. A web-based mindfulness stress management program in a corporate call center: a randomized clinical trial to evaluate the added benefit of onsite group support. J Occup Environ Med. 2016 Mar;58(3):254-64.

[35] Aikens KA, Astin J, Pelletier KR, Levanovich K, Baase CM, Park YY, et al. Mindfulness goes to work: Impact of an online workplace intervention. J Occup Environ Med. 2014 Jul 1;56(7):721-31.

[36] Joyce S, Shand F, Bryant RA, Lal TJ, Harvey SB. Mindfulness-Based Resilience Training in the Workplace: Pilot Study of the Internet-Based Resilience@Work (RAW) Mindfulness Program. J Med Internet Res. 2018;20(9):e10326.

[37] Carolan S, Harris PR, Cavanagh K. Improving Employee Well-Being and Effectiveness: Systematic Review and Meta-Analysis of Web-Based Psychological Interventions Delivered in the Workplace. J Med Internet Res. 2017 Jul;19(7):e271.

[38] Wilson JMG, Junger G. Principles and Practice of Screening for Disease. World Health Organization; 1968.

[39] Berwick DM, Murphy JM, Goldman PA, Ware Jr JE, Barsky AJ, Weinstein MC. Performance of a five-item mental health screening test. Med Care. 1991 Feb 1;29(2):169-76.

[40] Harada N, Nakajima Y, Higuchi K, Sekiya Y, Rothel J, Mori T. Screening for tuberculosis infection using whole-blood interferon- and Mantoux testing among Japanese healthcare workers. Infect Control Hosp Epidemiol. 2006 May;27(5):442-8.

[41] Ewigman BG, Crane JP, Frigoletto FD, LeFevre ML, Bain RP, McNellis D, RADIUS Study Group. Effect of prenatal ultrasound screening on perinatal outcome. N Engl J Med. 1993 Sep 16;329(12):821-7.

[42] Ridker PM, Hennekens CH, Buring JE, Rifai N. C-reactive protein and other markers of inflammation in the prediction of cardiovascular disease in women. N Engl J Med. 2000 Mar 23;342(12):836-43.

[43] Nyström L, Wall S, Rutqvist LE, Lindgren A, Lindqvist M, Ryden S, et al. Breast cancer screening with mammography: overview of Swedish randomised trials. Lancet. 1993 Apr 17;341(8851):973-8.

[44] Faivre J, Dancourt V, Lejeune C, Tazi MA, Lamour J, Gerard D, et al. Reduction in colorectal cancer mortality by fecal occult blood screening in a French controlled study. Gastroenterology. 2004 Jun 1;126(7):1674-80.

[45] Mayrand MH, Duarte-Franco E, Rodrigues I, Walter SD, Hanley J, Ferenczy A, et al. Human papillomavirus DNA versus Papanicolaou screening tests for cervical cancer. N Engl J Med. 2007 Oct 18;357(16):1579-88.

[46] Kaneko M, Eguchi K, Ohmatsu H, Kakinuma R, Naruke T, Suemasu K, et al. Peripheral lung cancer: screening and detection with low-dose spiral CT versus radiography. Radiology. 1996 Dec;201(3):798-802.

[47] Canadian Task Force on Preventive Health Care. Recommendations on screening for breast cancer in average-risk women aged 40–74 years. CMAJ. 2011 Nov 22;183(17):1991-2001.

[48] Canadian Task Force on Preventive Health Care. Recommendations on screening for colorectal cancer in primary care. CMAJ. 2016 Mar 15;188(5):340-8.

[49] Canadian Task Force on Preventive Health Care. Recommendations on screening for cervical cancer. CMAJ. 2013 Jan 8;185(1):35-45.

[50] Okotie OT, Roehl KA, Han M, Loeb S, Gashti SN, Catalona WJ. Characteristics of prostate cancer detected by digital rectal examination only. Urology. 2007 Dec 1;70(6):1117-20.

[51] Moyer VA. Screening for prostate cancer: US Preventive Services Task Force recommendation statement. Ann Intern Med. 2012 Jul 17;157(2):120-34.

[52] Lilja H, Ulmert D, Vickers AJ. Prostate-specific antigen and prostate cancer: prediction, detection and monitoring. Nat Rev Cancer. 2008 Apr 1;8(4):268-78.

[53] Kilpeläinen TP, Tammela TL, Roobol M, Hugosson J, Ciatto S, Nelen V, et al. False-positive screening results in the European randomized study of screening for prostate cancer. Eur J Cancer. 2011 Dec 1;47(18):2698-705.

[54] Scott JG, Friedman EK, Ferrante JM. Emotional consequences of persistently elevated PSA with negative prostate biopsies. Am J Cancer Prev. 2013 Jan 23;1(1):4-8.

[55] McNaughton-Collins M, Fowler FJ, Caubet JF, Bates DW, Lee JM, Hauser A, et al. Psychological effects of a suspicious prostate cancer screening test followed by a benign biopsy result. Am J Med. 2004 Nov 15;117(10):719-25.

[56] Grossman DC, Curry SJ, Owens DK, Bibbins-Domingo K, Caughey AB, Davidson KW, et al. Screening for prostate cancer: US Preventive Services Task Force recommendation statement. JAMA. 2018 May 8;319(18):1901-13.

[57] Schröder FH, Hugosson J, Roobol MJ, Tammela TL, Zappa M, Nelen V, et al. Screening and prostate cancer mortality: results of the European Randomised Study of Screening for Prostate Cancer (ERSPC) at 13 years of follow-up. Lancet. 2014 Dec 6;384(9959):2027-35.

[58] Fenton JJ, Weyrich MS, Durbin S, Liu Y, Bang H, Melnikow J. Prostate-specific antigenbased screening for prostate cancer: evidence report and systematic review for the US Preventive Services Task Force. JAMA. 2018 May 8;319(18):1914-31.

[59] Fenton JJ, Weyrich MS, Durbin S, Liu Y, Bang H, Melnikow J. Prostate-Specific Antigen-Based Screening for Prostate Cancer: A Systematic Evidence Review for the US Preventive Services Task Force: Evidence Synthesis No. 154. AHRQ publication 17-05229-EF-1. 2018.

[60] Roth JA, Gulati R, Gore JL, Cooperberg MR, Etzioni R. Economic analysis of prostate-specific antigen screening and selective treatment strategies. JAMA Oncol. 2016 Mar 24;2(7):890-8.

[61] Bell N, Gorber SC, Shane A, Joffres M, Singh H, Dickinson J, et al. Canadian Task Force on Preventive Health Care. Recommendations on screening for prostate cancer with the prostate-specific antigen test. CMAJ. 2014 Nov 4;186(16):1225-34.

[62] Rendon RA, Mason RJ, Marzouk K, Finelli A, Saad F, So A, et al. Canadian Urological Association recommendations on prostate cancer screening and early diagnosis. CUAJ. 2017 Oct 12;11(10):298-309.

[63] Cantor SB, Volk RJ, Cass AR, Gilani J, Spann SJ. Psychological benefits of prostate cancer screening: the role of reassurance. Health Expect. 2002 Jun;5(2):104-13.

[64] James LJ, Wong G, Craig JC, Hanson CS, Ju A, Howard K, et al. Mens perspectives of prostate cancer screening: A systematic review of qualitative studies. PloS One. 2017 Nov 28;12(11):e0188258.

[65] Smith SD, Birtwhistle R. Exploring patient perceptions of PSA screening for prostate cancer: Risks, effectiveness, and importance. Can Fam Physician. 2012 Sep 1;58(9):e502-7.

[66] Elwyn G, Frosch D, Thomson R, Joseph-Williams N, Lloyd A, Kinnersley P, et al. Shared decision making: a model for clinical practice. J Gen Intern Med. 2012 Oct 1;27(10):1361-7.

[67] Misra–Hebert AD, Kattan MW. Prostate Cancer ScreeningA New Recommendation for Meaningful Physician-Patient Conversations. JAMA Oncol. 2018 May 8;4(8):1049-1050.

[68] Gorday W, Sadrzadeh H, de Koning L, Naugler C. Association of sociodemographic factors and prostate-specific antigen (PSA) testing. Clin Biochem. 2014 Nov 1;47(16-17):164-9.

[69] Beaulac JA, Fry RN, Onysko J. Lifetime and recent prostate specific antigen (PSA) screening of men for prostate cancer in Canada. Can J Public Health. 2006 May 1:171-6.

[70] Richardson H, Aronson KJ, James A, McGregor ES, Bryant H. Factors related to use of prostate cancer screening: the Alberta Tomorrow Project. Open Med. 2007;1(1):e3-e12.

[71] Tsai SY. A study of the health-related quality of life and work-related stress of white-collar migrant workers. Int J Environ Res Public Health. 2012 Oct 19;9(10):3740-54.

[72] Johnson S, Cooper C, Cartwright S, Donald I, Taylor P, Millet C. The experience of work-related stress across occupations. J Manag Psychol. 2005 Mar 1;20(2):178-87.

[73] Krantz G, Berntsson L, Lundberg U. Total workload, work stress and perceived symptoms in Swedish male and female white-collar employees. Eur J Public Health. 2005 Apr 1;15(2):209-14.

[74] Heber E, Ebert DD, Lehr D, Cuijpers P, Berking M, Nobis S, et al. The benefit of web-and computer-based interventions for stress: a systematic review and meta-analysis. J Med Internet Res. 2017 Feb;19(2).

[75] Greening J, Lynn B. Vibration sense in the upper limb in patients with repetitive strain injury and a group of at-risk office workers. Int Arch Occup Environ Health. 1998 Feb 1;71(1):29-34.

[76] Canadian Community Health Survey (CCHS) Annual component User Guide. 2013-2014 [cited 2019 Jan]. Available from: http://odesi1.scholarsportal.info/documentation/CCHS_2013-2014/2013-2014/doc/CCHS_2014_2013-2014_User_Guide.pdf.

[77] Gagné C, Roberts G, Keown L. Weighted estimation and bootstrap variance estimation for analyzing survey data: how to implement in selected software. Ottawa (ON): Statistics Canada. 2014.

[78] Dunlop S, Coyte PC, McIsaac W. Socio-economic status and the utilisation of physicians' services: results from the Canadian National Population Health Survey. Soc Sci Med. 2000 Jul 1;51(1):123-33.

[79] Zarychanski R, Chen Y, Bernstein CN, Hébert PC. Frequency of colorectal cancer screening and the impact of family physicians on screening behaviour. CMAJ. 2007 Sep 11;177(6):593-7.

[80] Allard CB, Dason S, Lusis J, Kapoor A. Prostate cancer screening: Attitudes and practices of family physicians. CUAJ. 2013 Feb 26;6(3):188-93.

[81] Ryan BL, Koval J, Corbett B, Thind A, Campbell MK, Stewart M. Assessing the impact of potentially influential observations in weighted logistic regression. The Research Data Centres Information and Technical Bulletin: Statistics Canada. 2015.

[82] Pregibon D. Logistic regression diagnostics. Ann Stat. 1981;9(4):705-24.

[83] Sillanpää J, Huikko S, Nyberg M, Kivi P, Laippala P, Uitti J. Effect of work with visual display units on musculo-skeletal disorders in the office environment. Occup Med (Lond). 2003 Oct 1;53(7):443-51.

[84] Janwantanakul P, Pensri P, Jiamjarasrangsri V, Sinsongsook T. Prevalence of self-reported musculoskeletal symptoms among office workers. Occup Med (Lond). 2008 Jun 10;58(6):436-8.

[85] Portello JK, Rosenfield M, Bababekova Y, Estrada JM, Leon A. Computer–related visual symptoms in office workers. Ophthalmic Physiol Opt. 2012 Sep;32(5):375-82.

[86] van der Windt D, Croft P, Penninx B. Neck and upper limb pain: more pain is associated with psychological distress and consultation rate in primary care. J Rheumatol. 2002 Mar 1;29(3):564-9.

[87] Stallknecht SE, Strandberg-Larsen K, Hestbæk L, Andersen AM. Spinal pain and co-occurrence with stress and general well-being among young adolescents: a study within the Danish National Birth Cohort. Eur J Pediatr. 2017 Jun 1;176(6):807-14.

[88] Lee PP, Spritzer K, Hays RD. The impact of blurred vision on functioning and well-being. Ophthalmology. 1997 Mar 1;104(3):390-6.

[89] Buckley JP, Hedge A, Yates T, Copeland RJ, Loosemore M, Hamer M, et al. The sedentary office: a growing case for change towards better health and productivity. Br J Sports Med. 2015 Jun 17;49(21):1357-62.

[90] Close MA, Lytle LA, Chen DG, Viera AJ. Using the theory of planned behavior to explain intention to eat a healthful diet among Southeastern United States office workers. Nutrition & Food Science. 2018 Mar 12;48(2):365-74.

[91] Keller HH, Østbye T, Goy R. Nutritional risk predicts quality of life in elderly community-living Canadians. J Gerontol A Biol Sci Med Sci. 2004 Jan 1;59(1):68-74.

[92] Daniels K, Guppy A. Occupational stress, social support, job control, and psychological well-being. Hum Relat. 1994 Dec;47(12):1523-44.

[93] Brown KW, Ryan RM. The benefits of being present: mindfulness and its role in psychological well-being. J Pers Soc Psychol. 2003 Apr;84(4):822-48.

[94] Giluk TL. Mindfulness, Big Five personality, and affect: A meta-analysis. Pers Individ Dif. 2009 Dec 1;47(8):805-11.

[95] Cavanagh K, Strauss C, Forder L, Jones F. Can mindfulness and acceptance be learnt by self-help?: A systematic review and meta-analysis of mindfulness and acceptance-based self-help interventions. Clin Psychol Rev. 2014 Mar 1;34(2):118-29.

[96] Grant AM, Curtayne L, Burton G. Executive coaching enhances goal attainment, resilience and workplace well-being: A randomised controlled study. J Posit Psychol. 2009 Sep 1;4(5):396-407.

[97] Jackson D, Firtko A, Edenborough M. Personal resilience as a strategy for surviving and thriving in the face of workplace adversity: a literature review. J Adv Nurs. 2007 Oct 1;60(1):1-9.

[98] Tugade MM, Fredrickson BL. Resilient individuals use positive emotions to bounce back from negative emotional experiences. J Pers Soc Psychol. 2004 Feb;86(2):320-33.

[99] Mak WW, Ng IS, Wong CC. Resilience: enhancing well-being through the positive cognitive triad. J Couns Psychol. 2011 Oct;58(4):610-7.

[100] Klatt MD, Buckworth J, Malarkey WB. Effects of low-dose mindfulness-based stress reduction (MBSR-ld) on working adults. Health Educ Behav. 2009 Jun;36(3):601-14.

[101] Ong AD, Bergeman CS, Bisconti TL, Wallace KA. Psychological resilience, positive emotions, and successful adaptation to stress in later life. J Pers Soc Psychol. 2006 Oct;91(4):730-49.

[102] Zeidan F, Grant JA, Brown CA, McHaffie JG, Coghill RC. Mindfulness meditation-related pain relief: evidence for unique brain mechanisms in the regulation of pain. Neurosci Lett. 2012 Jun 29;520(2):165-73.

[103] Sturgeon JA, Zautra AJ. Resilience: a new paradigm for adaptation to chronic pain. Curr Pain Headache Rep. 2010 Apr 1;14(2):105-12.

[104] Carlisle S. Health promotion, advocacy and health inequalities: a conceptual framework. Health Promot Int. 2000 Dec 1;15(4):369-76.

[105] Madan I, Reading I, Palmer KT, Coggon D. Cultural differences in musculoskeletal symptoms and disability. Int J Epidemiol. 2008 May 29;37(5):1181-9.

[106] Juul-Kristensen B, Søgaard K, Støyer J, Jensen C. Computer users' risk factors for developing shoulder, elbow and back symptoms. Scand J Work Environ Health. 2004 Oct 1:390-8.

[107] Van den Heuvel SG, Van der Beek AJ, Blatter BM, Bongers PM. Do work-related physical factors predict neck and upper limb symptoms in office workers?. Int Arch Occup Environ Health. 2006 Aug 1;79(7):585-92.

[108] de Kluizenaar Y, Roda C, Dijkstra NE, Fossati S, Mandin C, Mihucz VG, et al. Office characteristics and dry eye complaints in European workersThe OFFICAIR study. Build Environ. 2016 Jun 30;102:54-63.

[109] Hagberg M, Rempel D. Work-related disorders and the operation of computer VDTs. Chapter 58 in Handbook of Human-Computer Interaction, 2nd Edition. M. Helander, T.K. Landauer, P. Prabhu (eds.), Elsevier Science BV; 1997.

[110] Dillon C, Petersen M, Tanaka S. Self-reported hand and wrist arthritis and occupation: Data from the US National Health Interview SurveyOccupational Health Supplement. Am J Ind Med. 2002 Oct 1;42(4):318-27.

[111] Gun RT. The incidence and distribution of RSI in South Australia 1980-81 to 1986-87. Med J Aust. 1990 Oct;153(7):376-80.

[112] Dagenais S, Caro J, Haldeman S. A systematic review of low back pain cost of illness studies in the United States and internationally. Spine J. 2008 Feb 29;8(1):8-20.

[113] Frymoyer JW, Cats-Baril WL. An overview of the incidences and costs of low back pain. Orthop Clin North Am. 1991 Apr;22(2):263-71.

[114] Hassard J, Teoh K, Cox T, Dewe P, Cosmar M, Gründler R, et al. Calculating the cost of work-related stress and psychosocial risks. European Agency for Safety and Health at Work; 2014.

[115] Yamada M, Mizuno Y, Shigeyasu C. Impact of dry eye on work productivity. Clinicoecon Outcomes Res. 2012;4:307-312.

[116] Daum KM, Clore KA, Simms SS, Vesely JW, Wilczek DD, Spittle BM, et al. Productivity associated with visual status of computer users. Optometry. 2004 Jan 1;75(1):33-47.

[117] Hashemi L, Webster BS, Clancy EA, Courtney TK. Length of disability and cost of work-related musculoskeletal disorders of the upper extremity. J Occup Environ Med. 1998 Mar 1;40(3):261-9.

[118] Ritterband LM, Gonder-Frederick LA, Cox DJ, Clifton AD, West RW, Borowitz SM. Internet interventions: In review, in use, and into the future. Prof Psychol: Res Pract. 2003 Oct;34(5):527-534.

[119] Freeman RB. The labour market in the new information economy. Oxf Rev Econ Policy. 2002 Sep 1;18(3):288-305.

[120] Buhrman M, Fältenhag S, Ström L, Andersson G. Controlled trial of Internet-based treatment with telephone support for chronic back pain. Pain. 2004 Oct 31;111(3):368-77.

[121] Hasson D, Anderberg UM, Theorell T, Arnetz BB. Psychophysiological effects of a web-based stress management system: a prospective, randomized controlled intervention study of IT and media workers [ISRCTN54254861]. BMC Public Health. 2005 Jul 25;5(1):78.

[122] Storm V, Dörenkämper J, Reinwand DA, Wienert J, De Vries H, Lippke S. Effectiveness of a web-based computer-tailored multiple-lifestyle intervention for people interested in reducing their cardiovascular risk: a randomized controlled trial. J Med Internet Res. 2016 Apr 11;18(4):e78

[123] Pedersen SJ, Cooley PD, Mainsbridge C. An e-health intervention designed to increase workday energy expenditure by reducing prolonged occupational sitting habits. Work. 2014 Jan 1;49(2):289-95.

[124] Mainsbridge CP, Cooley PD, Fraser SP, Pedersen SJ. The effect of an e-health intervention designed to reduce prolonged occupational sitting on mean arterial pressure. J Occup Environ Med. 2014 Nov;56(11):1189-94.

[125] Brattberg G. Internet-based rehabilitation for individuals with chronic pain and burnout: a randomized trial. Int J Rehabil Res. 2006 Sep 1;29(3):221-7.

[126] Brattberg G. Internet-based rehabilitation for individuals with chronic pain and burnout II: a long-term follow-up. Int J Rehabil Res. 2007 Sep 1;30(3):231-4.

[127] Halford C, Wallman T, Welin L, Rosengren A, Bardel A, Johansson S, et al. Effects of self-rated health on sick leave, disability pension, hospital admissions and mortality. A population-based longitudinal study of nearly 15,000 observations among Swedish women and men. BMC Public Health. 2012 Dec 22;12(1):1103.

[128] Hörnquist JO, Hansson B, Zar M. Well-being and future sick-leave: multivariate analyses with regard to preceding sick-leave. Eur J Public Health. 1997 Sep 1;7(3):284-90.

[129] Robertson I, Cooper C. Well-being: Productivity and happiness at work. United Kingdom: Palgrave Macmillan; 2011.

[130] George JM. Mood and absence. J Appl Psychol. 1989 Apr;74(2):317-324.

[131] Moulin F, Keyes C, Liu A, Caron J. Correlates and Predictors of Well-being in Montreal. Community Ment Health J. 2017 Jul 1;53(5):560-7.

[132] Chida Y, Steptoe A. Positive psychological well-being and mortality: a quantitative review of prospective observational studies. Psychosom Med. 2008 Sep 1;70(7):741-56.

[133] Schreuder KJ, Roelen CA, Koopmans PC, Groothoff JW. Job demands and health complaints in white and blue collar workers. Work. 2008;31(4):425-32.

[134] Richardson KM, Rothstein HR. Effects of occupational stress management intervention programs: a meta-analysis. J Occup Health Psychol. 2008 Jan 1;13(1):69-93.

[135] Tveito TH, Hysing M, Eriksen HR. Low back pain interventions at the workplace: a systematic literature review. Occup Med (Lond). 2004 Jan 1;54(1):3-13.

[136] Kaliniene G, Ustinaviciene R, Skemiene L, Vaiciulis V, Vasilavicius P. Associations between musculoskeletal pain and work-related factors among public service sector computer workers in Kaunas County, Lithuania. BMC Musculoskelet Disord. 2016;17(1):420.

[137] Oha K, Animägi L, Pääsuke M, Coggon D, Merisalu E. Individual and work-related risk factors for musculoskeletal pain: a cross-sectional study among Estonian computer users. BMC Musculoskelet Disord. 2014 May 28;15(1):181.

[138] Woods V. Musculoskeletal disorders and visual strain in intensive data processing workers. Occup Med (Lond). 2005 Mar 1;55(2):121-7.

[139] Farioli A, Mattioli S, Quaglieri A, Curti S, Violante FS, Coggon D. Musculoskeletal pain in Europe: role of personal, occupational and social risk factors. Scand J Work Environ Health. 2014 Jan;40(1):36-46.

[140] Lapointe J, Dionne CE, Brisson C, Montreuil S. Interaction between postural risk factors and job strain on self-reported musculoskeletal symptoms among users of video display units: a three-year prospective study. Scand J Work Environ Health. 2009 Mar 1:134-44.

[141] Klussmann A, Gebhardt H, Liebers F, Rieger MA. Musculoskeletal symptoms of the upper extremities and the neck: a cross-sectional study on prevalence and symptom-predicting factors at visual display terminal (VDT) workstations. BMC Musculoskelet Disord. 2008 Dec;9(1):96.

[142] Kuorinka I, Jonsson B, Kilbom A, Vinterberg H, Biering-Sørensen F, Andersson G, et al. Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. Appl Ergon. 1987 Sep 1;18(3):233-7.

[143] Coggon D, Ntani G, Palmer KT, Felli VE, Harari R, Barrero LH, et al. Disabling musculoskeletal pain in working populations: is it the job, the person, or the culture?. Pain. 2013 Jun 1;154(6):856-63.

[144] Hayden JA, Van Tulder MW, Tomlinson G. Systematic review: strategies for using exercise therapy to improve outcomes in chronic low back pain. Ann Intern Med. 2005 May 3;142(9):776-85.

[145] Lidegaard M, Jensen RB, Andersen CH, Zebis MK, Colado JC, Wang Y, et al. Effect of brief daily resistance training on occupational neck/shoulder muscle activity in office workers with chronic pain: randomized controlled trial. Biomed Res Int. 2013 Dec 31;2013.

[146] Punnett L, Prüss-ütün A, Nelson DI, Fingerhut MA, Leigh J, Tak S, et al. Estimating the global burden of low back pain attributable to combined occupational exposures. Am J Ind Med. 2005 Dec 1;48(6):459-69.

[147] Poushter J. Smartphone ownership and internet usage continues to climb in emerging economies [Internet]. Pew Research Center. 2016 Feb 22;22:1-44 [cited 2019 Jan]. Available from: http://www.pewglobal.org/2016/02/22/smartphone-ownership-and-internet-usage-continues-to-climb-in-emerging-economies/

[148] Internet users in Canada [Internet]. The World Factbook Central Intelligence Agency. 2019 [cited 2019 Jan]. Available from: https://www.cia.gov/library/publications/the-world-factbook/geos/ca.html

[149] Graham AL, Cobb NK, Raymond L, Sill S, Young J. Effectiveness of an internet-based worksite smoking cessation intervention at 12 months. J Occup Environ Med. 2007 Aug 1;49(8):821-8.

[150] Attard G, Parker C, Eeles RA, Schröder F, Tomlins SA, Tannock I, et al. Prostate cancer. Lancet. 2016 Jan 2;387(10013):70-82.

[151] Canadian Cancer Societys Advisory Committee on Cancer Statistics. Canadian Cancer Statistics 2016. Toronto, ON: Canadian Cancer Society; 2016 [cited 2019 Jan]. Available from: http://www.cancer.ca/~/media/cancer.ca/CW/cancer%20information/cancer%20101/Canadian%20cancer%20statistics/Canadian-Cancer-Statistics-2016-EN.pdf

[152] Huggins C, Scott WW, Heinen JH. Chemical composition of human semen and of the secretions of the prostate and seminal vesicles. Am J Physiol. 1942 May 1;136(3):467-73.

[153] Prostate Basics - Harvard Prostate Knowledge [Internet]. Harvard Prostate Knowledge. 2011 [cited 2017 Dec]. Available from:https://www.harvardprostateknowledge.org/prostate-basics.

[154] Djulbegovic M, Beyth RJ, Neuberger MM, Stoffs TL, Vieweg J, Djulbegovic B, et al. Screening for prostate cancer: systematic review and meta-analysis of randomised controlled trials. BMJ. 2010 Sep 14;341:c4543.

[155] Pron G. Prostate-Specific Antigen (PSA)Based Population Screening for Prostate Cancer: An Evidence-Based Analysis. Ont Health Technol Assess Ser. 2015;15(10):1-64.

[156] Fontaine KR, Heo M, Allison DB. Obesity and prostate cancer screening in the USA. Public Health. 2005 Aug 31;119(8):694-8.

[157] Ross LE, Taylor YJ, Howard DL. Trends in prostate-specific antigen test use, 2000-2005. Public Health Rep. 2011 Mar;126(2):228-39.

[158] Fowke JH, Signorello LB, Underwood III W, Ukoli FA, Blot WJ. Obesity and prostate cancer screening among AfricanAmerican and Caucasian men. Prostate. 2006 Sep 15;66(13):1371-80.

[159] Nderitu P, Van Hemelrijck M, Ashworth M, Mathur R, Hull S, Dudek A, et al. Prostate-specific antigen testing in inner London general practices: are those at higher risk most likely to get tested?. BMJ Open. 2016 Jul 1;6(7):e011356.

[160] Ross LE, Taylor YJ, Richardson LC, Howard DL. Patterns in prostate-specific antigen test use and digital rectal examinations in the Behavioral Risk Factor Surveillance System, 2002-2006. J Natl Med Assoc. 2009 Apr 1;101(4):316-24.

[161] Drazer MW, Huo D, Schonberg MA, Razmaria A, Eggener SE. Population-based patterns and predictors of prostate-specific antigen screening among older men in the United States. J Clin Oncol. 2011 Mar 28;29(13):1736-43.

[162] Gattellari M, Young JM, Ward JE. GP and patient predictors of PSA screening in Australian general practice. Fam Pract. 2003 Jun 1;20(3):294-303.

[163] Avery KN, Blazeby JM, Lane JA, Neal DE, Hamdy FC, Donovan JL. Decision-making about PSA testing and prostate biopsies: a qualitative study embedded in a primary care randomised trial. Eur Urol. 2008 Jun 30;53(6):1186-93.

[164] Patel K, Kenerson D, Wang H, Brown B, Pinkerton H, Burress M, et al. Factors influencing prostate cancer screening in low-income African Americans in Tennessee. J Health Care Poor Underserved. 2010;21(1):114-26.

[165] Essink-Bot ML, de Koning HJ, Nijs HG, Kirkels WJ, van der Maas PJ, Schröder FH. Short-term effects of population-based screening for prostate cancer on health-related quality of life. J Natl Cancer Inst. 1998 Jun 17;90(12):925-31.

[166] Avery KN, Metcalfe C, Vedhara K, Lane JA, Davis M, Neal DE, et al. Predictors of attendance for prostate-specific antigen screening tests and prostate biopsy. Eur Urol. 2012 Oct 31;62(4):649-55.

[167] Seeff LC, Nadel MR, Klabunde CN, Thompson T, Shapiro JA, Vernon SW, et al. Patterns and predictors of colorectal cancer test use in the adult US population. Cancer. 2004 May 15;100(10):2093-103.

[168] Subramanian S, Klosterman M, Amonkar MM, Hunt TL. Adherence with colorectal cancer screening guidelines: a review. Prev Med. 2004 May 31;38(5):536-50.

[169] Mitchell-Beren ME, Dodds ME, Choi KL, Waskerwitz TR. A colorectal cancer prevention, screening, and evaluation program in community black churches. CA Cancer J Clin. 1989 Mar 1;39(2):115-8.

[170] Kang SH, Bloom JR. Social support and cancer screening among older black Americans. J Natl Cancer Inst. 1993 May 5;85(9):737-42.

[171] Coughlin SS, Thompson T. Physician recommendation for colorectal cancer screening by race, ethnicity, and health insurance status among men and women in the United States, 2000. Health Promot Pract. 2005 Oct;6(4):369-78.

[172] Beeker C, Kraft JM, Southwell BG, Jorgensen CM. Colorectal cancer screening in older men and women: qualitative research findings and implications for intervention. J Community Health. 2000 Jun 1;25(3):263-78.

[173] Shapiro JA, Seeff LC, Nadel MR. Colorectal cancer-screening tests and associated health behaviors. Am J Prev Med. 2001 Aug 31;21(2):132-7.

[174] Tessaro I, Mangone C, Parkar I, Pawar V. Knowledge, barriers, and predictors of colorectal cancer screening in an appalachian church population. Prev Chronic Dis. 2006 Sep;3(4):A123.

[175] Katz SJ, Hofer TP. Socioeconomic disparities in preventive care persist despite universal coverage: breast and cervical cancer screening in Ontario and the United States. JAMA. 1994 Aug 17;272(7):530-4.

[176] Lerman C, Rimer B, Trock B, Balshem A, Engstrom PF. Factors associated with repeat adherence to breast cancer screening. Prev Med. 1990 May 1;19(3):279-90.

[177] Meiser B, Butow P, Barratt A, Friedlander M, Kirk J, Gaff C, et al. Breast cancer screening uptake in women at increased risk of developing hereditary breast cancer. Breast Cancer Res Treat. 2000 Jan 1;59(2):101-11.

[178] Fulton JP, Buechner JS, Scott HD, DeBuono BA, Feldman JP, Smith RA, et al. A study guided by the Health Belief Model of the predictors of breast cancer screening of women ages 40 and older. Public Health Rep. 1991 Jul;106(4):410-20.

[179] Katapodi MC, Facione NC, Miaskowski C, Dodd MJ, Waters C. The influence of social support on breast cancer screening in a multicultural community sample. Oncol Nurs Forum. 2002 Jun;29(5):845-52.

[180] Byrne MM, Davila EP, Zhao W, Parker D, Hooper MW, Caban-Martinez A, et al. Cancer screening behaviors among smokers and non-smokers. Cancer Epidemiol. 2010 Oct 31;34(5):611-7.

[181] Heo M, Allison DB, Fontaine KR. Overweight, obesity, and colorectal cancer screening: disparity between men and women. BMC Public Health. 2004 Nov 8;4(1):53.

[182] Wee CC, McCarthy EP, Davis RB, Phillips RS. Screening for cervical and breast cancer: is obesity an unrecognized barrier to preventive care?. Ann Intern Med. 2000 May 2;132(9):697-704.

[183] Rosen AB, Schneider EC. Colorectal cancer screening disparities related to obesity and gender. J Gen Intern Med. 2004 Apr 1;19(4):332-8.

[184] Canadian Cancer Society. Prostate-specific antigen (PSA) test. 2014 [cited 2018 Sept]. Available from:www.cancer.ca/en/cancer-information/diagnosis-and-treatment/tests-and-procedures/prostate-specific-antigen-psa/?region=on

[185] Gomella LG, Liu XS, Trabulsi EJ, Kevin Kelly W, Myers R, Showalter T, et al. Screening for prostate cancer: the current evidence and guidelines controversy. Can J Urol. 2011 Oct 1;18(5):5875-83.

[186] Smith CV, Bauer JJ, Connelly RR, Seay T, Kane C, Foley J, et al. Prostate cancer in men age 50 years or younger: a review of the Department of Defense Center for Prostate Disease Research multicenter prostate cancer database. The J Urol. 2000 Dec;164(6):1964-7.

[187] Khan MA, Han M, Partin AW, Epstein JI, Walsh PC. Long-term cancer control of radical prostatectomy in men younger than 50 years of age: update 2003. Urology. 2003 Jul 1;62(1):86-91.

[188] Statistics Canada. Canadian community health survey – annual component (CCHS). 2009-2014. Available from: http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&Id=259374

[189] Perkins JJ, Sanson-Fisher RW, Clarke SJ, Youman P. An exploration of screening practices for prostate cancer and the associated community expenditure. Br J Urol. 1998 Oct;82(4):524-9.

[190] College des Médecins du Quebec. Prostate cancer screening: Its YOUR decision [Internet]. 2013 [cited 2018 Dec]. Available from: http://www.cmq.org/publications-pdf/p-3-2013-09-01-en-depistage-cancer-de-la-prostate.pdf

[191] Institut national d'excellence en santé et services sociaux. Tool for facilitating the discussion about INESSSs recommendations concerning prostate-specific antigen (PSA)-based prostate cancer screening [Internet]. 2017 [cited Jan 2019]. Available from: https://www.inesss.qc.ca/fileadmin/doc/INESSS/Rapports/Oncologie/INESSS_outil_depistage_cancer_prostate_ANG.pdf

[192] Nair-Shalliker V, Bang A, Weber M, Goldsbury DE, Caruana M, Emery J, et al. Factors associated with prostate specific antigen testing in Australians: Analysis of the New South Wales 45 and Up Study. Sci Rep. 2018 Mar 9;8(1):4261.

[193] Pucheril D, Dalela D, Sammon J, Sood A, Sun M, Trinh QD, et al. The influence of physician recommendation on prostate-specific antigen screening. Urol Oncol. 2015 Oct;33(10):424.e1-7.

[194] So WK, Choi KC, Tang WP, Lee PC, Shiu AT, Ho SS, et al. Uptake of prostate cancer screening and associated factors among Chinese men aged 50 or more: a population-based survey. Cancer Biol Med. 2014 Mar;11(1):56-63.

[195] Akerman JP, Allard CB, Tajzler C, Kapoor A. Prostate cancer screening among family physicians in Ontario: An update on attitudes and current practice. Can Urol Assoc J. 2018 Feb;12(2):E53-E58.

[196] Hoag NA, Davidson RA, Pommerville PJ. Prostate cancer screening practices and attitudes among primary care physicians in Victoria, British Columbia. BC Med J. 2008 Oct;50(8):456-60.

[197] Ojewola RW, Tijani KH, Jeje EA, Ogunjimi MA, Anunobi CC, Adesanya AO. An evaluation of usefulness of prostate specific antigen and digital rectal examination in the diagnosis of prostate cancer in an unscreened population: Experience in a Nigerian teaching hospital. West Afr J Med. 2013;32(1):8-13.

[198] Crawford ED, Leewansangtong S, Goktas S, Holthaus K, Baier M. Efficiency of prostatespecific antigen and digital rectal examination in screening, using 4.0 ng/ml and agespecific reference range as a cutoff for abnormal values. Prostate. 1999 Mar 1;38(4):296-302.

[199] Catalona WJ, Richie JP, Ahmann FR, MLiss AH, Scardino PT, Flanigan RC, et al. Comparison of digital rectal examination and serum prostate specific antigen in the early detection of prostate cancer: results of a multicenter clinical trial of 6,630 men. J Urol. 1994 May 1;151(5):1283-90.

[200] Fagan HB, Wender R, Myers RE, Petrelli N. Obesity and cancer screening according to race and gender. J Obes. 2011 Dec 15;2011.

[201] Bertakis KD, Azari R. The impact of obesity on primary care visits. Obes Res. 2005 Sep;13(9):1615-23.

[202] Miilunpalo S, Vuori I, Oja P, Pasanen M, Urponen H. Self-rated health status as a health measure: the predictive value of self-reported health status on the use of physician services and on mortality in the working-age population. J Clin Epidemiol. 1997 May 1;50(5):517-28.

[203] Mohseni M, Lindstrom M. Social capital, trust in the health-care system and self-rated health: the role of access to health care in a population-based study. Soc Sci Med. 2007 Apr 1;64(7):1373-83.

[204] Carlsson S, Aus G, Bergdahl S, Khatami A, Lodding P, Stranne J, et al. The excess burden of side-effects from treatment in men allocated to screening for prostate cancer. The Göteborg randomised population-based prostate cancer screening trial. Eur J Cancer. 2011 Mar 1;47(4):545-53.

[205] Bunting PS, Goel V, Williams JI, Iscoe NA. Prostate-specific antigen testing in Ontario: reasons for testing patients without diagnosed prostate cancer. CMAJ. 1999 Jan 12;160(1):70-5.

[206] Hayat Roshanai A, Nordin K, Berglund G. Factors influencing primary care physicians decision to order prostate-specific antigen (PSA) test for men without prostate cancer. Acta Oncol. 2013 Nov 1;52(8):1602-8.

[207] Horrocks S, Somerset M, Stoddart H, Peters TJ. What prevents older people from seeking treatment for urinary incontinence? A qualitative exploration of barriers to the use of community continence services. Fam Pract. 2004 Nov 1;21(6):689-96.

[208] Broemeling AM, Watson DE, Prebtani F. Population patterns of chronic health conditions, co-morbidity and healthcare use in Canada: implications for policy and practice. Healthc Q. 2008;11(3):70-6.

[209] Lasser KE, Himmelstein DU, Woolhandler S. Access to care, health status, and health disparities in the United States and Canada: results of a cross-national population-based survey. Am J Public Health. 2006 Jul;96(7):1300-7.

[210] Berkman ND, Davis TC, McCormack L. Health literacy: what is it?. J Health Commun. 2010 Aug 31;15(S2):9-19.

[211] Holloway A, Watson HE. Role of self-efficacy and behaviour change. International journal of nursing practice. 2002 Apr;8(2):106-15.

[212] Smith RA, von Eschenbach AC, Wender R, Levin B, Byers T, Rothenberger D, et al. American Cancer Society guidelines for the early detection of cancer: update of early detection guidelines for prostate, colorectal, and endometrial cancers: Also: update 2001testing for early lung cancer detection. CA Cancer J Clin. 2001 Jan-Feb;51(1):38-75.

[213] Prostate-specific antigen (PSA) best practice policy. American Urological Association (AUA). Oncology (Williston Park). 2000;14(2):267-72, 277-8, 280 passim.

[214] Greene KL, Albertsen PC, Babaian RJ, Carter HB, Gann PH, Han M, et al. Prostate specific antigen best practice statement: 2009 update. J Urol. 2009 Nov;182(5):2232-41.

[215] Schröder FH, Hugosson J, Roobol MJ, Tammela TL, Ciatto S, Nelen V, et al. Screening and prostate-cancer mortality in a randomized European study. N Engl J Med. 2009 Mar 26;360(13):1320-8.

[216] Izawa JI, Klotz L, Siemens DR, Kassouf W, So A, Jordan J, et al. Prostate cancer screening: Canadian guidelines 2011. Can Urol Assoc J. 2011;5(4):235-40.

[217] Jemal A, Fedewa SA, Ma J, Siegel R, Lin CC, Brawley O, et al. Prostate cancer incidence and PSA testing patterns in relation to USPSTF screening recommendations. JAMA. 2015 Nov 17;314(19):2054-61.

[218] Diener E, Chan MY. Happy people live longer: Subjective wellbeing contributes to health and longevity. Appl Psychol Health Well Being. 2011 Mar;3(1):1-43.

[219] Stock C, Wille L, Krämer A. Gender-specific health behaviors of German university students predict the interest in campus health promotion. Health Promot Int. 2001 Jun 1;16(2):145-54.

[220] Ware Jr JE. SF-36 health survey update. Spine (Phila Pa 1976). 2000 Dec 15;25(24):3130-9.

[221] Goldenberg MG, Skeldon SC, Nayan M, Suppiah Y, Chow L, Fryml E, et al. Prostate-specific antigen testing for prostate cancer screening: A national survey of Canadian primary care physicians opinions and practices. Can Urol Assoc J. 2017 Dec;11(12):396-403.

[222] Grönberg H, Adolfsson J, Aly M, Nordström T, Wiklund P, Brandberg Y, et al. Prostate cancer screening in men aged 5069 years (STHLM3): a prospective population-based diagnostic study. Lancet Oncol. 2015 Dec 1;16(16):1667-76.

[223] Stacey D, Légaré F, Lewis K, Barry MJ, Bennett CL, Eden KB, et al. Decision aids for people facing health treatment or screening decisions. Cochrane Database Syst Rev. 2017 Apr 12;4:CD001431.

[224] Rim SH, Hall IJ, Massetti GM, Thomas CC, Li J, Richardson LC. Primary Care Providers Intended Use of Decision Aids for Prostate-Specific Antigen Testing for Prostate Cancer Screening. J Cancer Educ. 2018 Mar 26:1-5.