Health Promotion and Chronic Disease Prevention in Canada

Research, Policy and Practice

Volume 37 · Number 8 · August 2017

Inside this issue

To promote and protect the health of Canadians through leadership, partnership, innovation and action in public health.
— Public Health Agency of Canada

Published by authority of the Minister of Health.

ISSN 2368-738X
Pub. 160268
Journal_HPCDP-Revue_PSPMC@phac-aspc.gc.ca

Également disponible en français sous le titre : *Promotion de la santé et prévention des maladies chroniques au Canada : Recherche, politiques et pratiques*

Submission guidelines and information on article types are available at: http://www.phac-aspc.gc.ca/publicat/hpcdp-pspmc/authinfo-eng.php

Indexed in Index Medicus/MEDLINE, SciSearch® and Journal Citation Reports/Science Edition

Public Health Agency of Canada | Agence de la santé publique du Canada

Canada

https://doi.org/10.24095/hpcdp.37.8.01

Osteoporosis knowledge translation for young adults: new directions for prevention programs

Alyson Holland, PhD

This article has been peer reviewed.

Abstract

Introduction: Osteoporosis prevention is heavily reliant on education programs, which are most effective when tailored to their intended audience. Most osteoporosis prevention education is designed for older adults, making application of these programs to younger adults difficult. Designing programs for young adults requires understanding the information-seeking practices of young adults, so that knowledge about osteoporosis can be effectively translated.

Methods: Individual interviews were conducted with 60 men and women—multiethnic, Canadian young adults—to explore both the sources and types of information they search for when seeking information on nutrition or bone health.

Results: The results of this study raised themes related to the sources participants use, to their interests and to ways of engaging young adults. Prevention programs should make use of traditional sources, such as peers, family members and medical professionals, as well as emerging technologies, such as social media. Choice of sources was related to the perceived authority of and trust associated with the source. Messaging should relate to young adult interests, such as fitness and food—topics on which young adults are already seeking information—rather than being embedded within specific osteoporosis awareness materials. Engaging young adults means using relatable messages that are short and encourage small changes. Small gender-based differences were found in the information-seeking interests of participants. Differences related to age were not examined.

Conclusion: Creating short, action-oriented messages that are designed to encourage small changes in behaviour and are packaged with information that young adults are actively seeking is more likely to result in active engagement in prevention behaviours.

Keywords: *osteoporosis, prevention education, young adults, qualitative methods*

Highlights

- Effective knowledge translation requires use of traditional and emerging social networks.
- Young adults are not concerned with future disease risk, and relatable messaging must intersect with their current interests in appearance and physical fitness.
- Successful health promotion should use positive wording to suggest small behavioural changes in diet and food choice that can be incorporated daily.

Introduction

Osteoporosis is the most common metabolic bone disease, affecting almost 2 million people in Canada and close to 200 million worldwide.[1,2] Currently, one in three women and one in five men in Canada are affected, with disease onset generally beginning in the fifth decade of life.[3] Osteoporosis is associated with serious consequences, specifically fractures (hip, spine and wrist), which are associated with increased rates of morbidity, and mortality.[2] Individuals with osteoporosis experience chronic pain, greater rates of hospitalization, increased need for assistive living and loss of independence.[4] As a result, osteoporosis is recognized as a significant public health concern.[5] The high economic cost of osteoporosis, estimated at $2.3 billion a year in Canada, combined with a rising incidence of the disease has led to an increased focus on prevention in order to mitigate bone loss before fractures develop.[2] Osteoporosis prevention relies heavily on education as a mechanism for reducing future prevalence.[6,7] Nutrition and physical activity information form most prevention education, with nutrition being promoted as a relatively simple lifestyle modification.[8]

Osteoporosis prevention education relies on effective knowledge translation, which is the synthesis, dissemination, exchange and ethically sound application of knowledge to improve individual health and the effectiveness of the health system.[9] The process of knowledge translation can be conceptualized through the knowledge-to-action cycle, which constructs successful knowledge translation as a process that culminates in the continued application of learned information by knowledge users.[10,11] The knowledge-to-action cycle consists of identifying gaps in knowledge, understanding the knowledge-seeking practices and barriers to knowledge of the target audience and designing information that fills gaps, but is accessible, desirable and retained by the target audience.[11]

Prevention education in Canada is coordinated at the national level by Osteoporosis Canada, a nongovernmental organization

Author references:

Department of Anthropology, McMaster University, Hamilton, Ontario, Canada

Correspondence: Alyson Holland, Department of Anthropology, McMaster University, 1280 Main Street West, CNH 524, Hamilton, ON L8S 4L8; Tel: 905-525-9140 ext. 24423; Email: jaagumae@mcmaster.ca

dedicated to improving prevention and management of osteoporosis. While Osteoporosis Canada provides a central source for messages about osteoporosis, there is no national strategy for implementing best practices. As a result, each province has developed its own strategy for osteoporosis.* In 2005, Ontario introduced the Ontario Osteoporosis Strategy (OOS), designed to prevent and manage osteoporosis in one of Canada's most populous provinces. This program involves a multifactorial approach using fracture prevention, patient education, education of health professionals, fall risk reduction and patient self-management to reduce the impact of osteoporosis in Ontario. The OOS is designed primarily for older adults, as they are the demographic that experiences symptoms related to osteoporosis.[16] The program is implemented through the establishment of regional osteoporosis centres and fracture clinics that provide specialized treatment of individuals with low bone density scores or fragility fractures and the widespread delivery of prevention programs by Osteoporosis Canada to reduce fracture risk.[17] The OOS disseminates prevention education that focusses on influencing older adult lifestyles in such areas as fall prevention, dietary changes for comorbid conditions or age-related decreases in food consumption, pharmacological interventions and low-impact physical activity.[18] Young adults, defined here as those aged between 17 and 30 years, who are developing their adult food behaviours and who are currently building bone, are not being targeted by this prevention information, as their concerns and interests are very different from those of older adults.[6,19,20] Financial constraints on nonprofit organizations, which bear most of the burden of disseminating this information, influence the breadth of osteoporosis programs. The need to target individuals with the highest risk means that young adults are often not included. While young adults are not considered to be at high risk of developing osteoporosis, their food consumption behaviours can affect their future risk of osteoporosis, meaning that early prevention targeted to this group is clearly necessary to reduce the future prevalence of osteoporosis.[21] The reason for the lack of emphasis on osteoporosis education for young adults by government institutions is less clear, as the OOS recognizes the importance of education at all ages for future bone health, but has only implemented programs for fourth grade students.[12] While the OOS was implemented over a decade ago, only one evaluative study has been published,[17] so the current status of osteoporosis knowledge translation in Ontario is unclear. Information on osteoporosis knowledge translation in general has been focussed on evaluating knowledge and fracture patterns in older adults, with almost no investigation of how younger populations access and internalize osteoporosis information.[22,23]

The 2004 Canadian Community Health Survey indicated that young adults are consistently low in the bone-related nutrients calcium and vitamin D, which raises their future risk of osteoporosis and other bone problems.[24] Using osteoporosis prevention education to increase their intake of calcium and vitamin D requires designing education programs that are tailored to the lifestyles and information-seeking practices of young adults.[20] While the literature demonstrates an osteoporosis knowledge base exists among young adults,[25-27] the process by which knowledge is acquired and applied is unclear. This study explored the sources and types of information young adults consult for information on nutrition and bone health in order to generate strategies for more effective knowledge translation within osteoporosis education programs.

Methods

This study involved the use of in-depth, individual, semistructured interviews to explore the osteoporosis information-seeking behaviours of Canadian young adults. Interviews were conducted between September 2013 and June 2014 with 60 men and women (30 of each) of varying ethnic backgrounds. The participants were young adults between the ages of 17 and 30 years who were currently living in the greater Hamilton, Ontario, area. The age range of the participants represents a broad interpretation of the term *young adult* as found in the literature[28,29] and was chosen because it allows for the inclusion of students and young professionals who are establishing their own food behaviours as independent adults, while also still experiencing bone growth.[19,21] Ethnocultural affiliation was collected to ensure participants accurately represented the diverse population of Hamilton. Participants were asked to self-identify their ethnocultural affiliation, which created a large range of responses that could not be appropriately broken down into set categories.

Participants represented varying levels of education and socioeconomic status. Recruitment was undertaken at McMaster University (from the 4-year degree program), Mohawk college (2-year program), and from the community. Participants from the community included post-secondary graduates and students who did not have any post-secondary education (including current high school students and high school graduates who were employed or unemployed). Potential participants were recruited through posters on campus and in the community, as well as through social media (Facebook).

Participants were required to be within the age range, living in Hamilton and able to give consent. Ethics approval was obtained from the McMaster University and Mohawk College research ethics boards and written consent was obtained before participation in the study.

Participants were asked to complete a sociodemographic questionnaire and to participate in an individual interview. The sociodemographic questionnaire was designed to collect information on age, gender, income, education, occupation and ethnocultural background. Interviews were conducted in private spaces on campus or in an area accessible to the community (e.g. library, YMCA) and lasted between 60 and 90 minutes. All interviews were conducted, audiotaped and transcribed verbatim by the researcher. Participants were asked questions relating to their attitudes about and participation in activities related to nutrition and bone health (e.g. "How important is nutrition/bone health to your daily life?"), information-seeking behaviours related to health and nutrition (e.g. "Where do you look for information on bone health/nutrition?") and interests related to health and nutrition (e.g. "What interests you about bone health/nutrition?"). (The full interview

* Osteoporosis Canada published an overview of provincial osteoporosis strategies in 2008.[12] Manitoba has since implemented a bone density testing program in addition to its falls prevention program.[13] Other examples of provincial strategies include Nova Scotia's falls prevention program and series of osteoporosis multidisciplinary education programs,[14] and the British Columbia Medical Association and BC Ministry of Health guidelines for osteoporosis diagnosis, prevention and treatment, released in 2012.[15]

guide is available from the author upon request.) Participants were also asked to suggest ways that health messaging for young adults could be improved. Interviews were semistructured and all participants were asked the same set of questions from the interview guide. Probes were used to elicit further information and were specific to the responses given. Participants were allowed to direct the conversation, creating a variety of responses to the interview questions. This study was part of a larger doctoral project that explored young adult engagement with nutrition-based osteoporosis prevention education, with the goal of establishing how knowledge on nutrition and disease risk is acquired. A detailed discussion of the methodology and research questions used is available elsewhere.[30]

Analysis of the interview transcripts was completed using NVivo software version 10 (QSR International Pty, Melbourne, AUS) for organization of codes and identification of relationships between themes. Thematic content analysis was used to identify manifest (explicit) and latent themes within the data that reflected the meanings, experiences and realities expressed by the participants.[31] Identification of themes was accomplished following the process outlined by Bernard[32] for theoretical qualitative content analysis in anthropology. The development of codes followed a theoretical approach whereby the research question was used to guide the data analysis. Since this project was part of a larger study, data was analyzed following specific research questions. The interview guide was developed to investigate specific concepts rather than to broadly explore a phenomenon. In this case, the research question related to understanding the process by which young adults sought out nutrition- and health-based knowledge.

Coding was conducted in two rounds. The initial round used a priori codes related to the research question (e.g. engagement, knowledge, sources), and resulted in broad categories. The second round of coding occurred within these previously established broad categories and did not use any a priori codes. Instead, themes were identified and coded as they emerged in the text,[32] which allowed for more nuanced subthemes to emerge. Both manifest themes stated by participants and latent themes that emerged through close reading and interpretation of the data were generated. Each transcript was read through twice by the author to make sure all possible codes were assigned. Once codes had been generated, they were organized using NVivo 10 into hierarchies that reflected overarching themes and merged to eliminate duplicate concepts. The process of coding occurred over six months and the researcher practised reflexive consideration of the data as a whole in an attempt to address any biases. The coding and analysis were conducted by the author alone.

Participants were disaggregated by gender in order to explore gender-based differences in information-seeking practices related to health. No investigation by age was possible due to the small number of participants in each age group; the subdivisions in the young adult age categories do not reflect meaningful differences. The wide range of ethnocultural identities that were self-reported meant that no analysis by ethnicity was possible. However, broad trends in the choice of sources and nutrition- and health-related interests were investigated.

Results

General results

Three major areas of discussion arose from the interviews: sources of information, nutrition and health interests, and suggestions for young adult engagement with health and nutrition information. Sources of information are most crucial for successful knowledge translation, as these were the places where participants actively or passively received information. While information on health or nutrition was rarely consciously sought by participants, they still identified authoritative networks through which they gathered information when it was sought. The degree of information they absorbed from these sources was directly related to their own nutrition and health interests, which dictated the types of information they sought and the specific sources they used. All participants' beliefs about nutrition replicated the reductionist discourses of authoritative sources, though their own interests in nutrition were rooted in their social environment and physical bodies. As a result, the suggestions made by participants for improving knowledge translation involved creating education programs that engage with the actual nutrition and health interests of young adults, which capture their attention and are congruent with their actual motivations.

Sources of information

Participants identified a large range of sources they consulted when seeking or receiving nutrition information. These sources included doctors and other health professionals, parents, family and friends, government, food labels, magazines, advertisements, books, schools, newspapers, church, the Internet, and specifically, social media. For example, one participant said, "I would probably, you know, talk to my parents first and see what they say. And then go from there. Go to my doctor and say, 'hey this is what I think' and then kind of go from that" (Man, 19, College, participant [P] #45). The most commonly cited sources were the Internet, the government, doctors, friends and parents (Table 1); most participants listed two or three sources that they regularly consulted. While most information seeking occurred online, participants indicated that traditional networks of parents and peers were also important sources. No broad differences in sources used were observed at either end of the age range, reflecting the use of these sources by all young adults.

Overall, the assessment of sources by participants seemed highly subjective and

TABLE 1
Preferred bone health and nutrition-related information sources reported by young adults, aged 17 to 30 years, Hamilton, Ontario, 2013–2014

Sources	Number of respondents (N = 60)
Internet	57
Government	11
Doctors	25
Friends	18
Parents	15
School	7
Pharmacists	6
Magazines	6
TV	3
Books	2
Newspaper	2
Church	1

related to preconceived beliefs: "I do a little bit of research if it seems really farfetched. But if it's in front of me, I'm reading it, it's something that I kind of agree with doing or following or listening to, then yeah" (Woman, 28, graduate, P#77). Most participants preferred sources that provided information that supported their opinions and behaviours.

Almost all participants judged sources based on their reliability, e.g. "[Social media] isn't reliable, it's just someone's opinion" (Man, 29, university, P#08); their perceived authority, e.g. "Famous people, they know more about nutrition" (Woman, 21, university, P#05); and their trustworthiness, e.g. "I try and stay on the men's health. Because I know I can trust men's health, because some of the tips I followed I've been like actually this is useful" (Man, 18, high school, P#80). Sources that participants viewed as authoritative and reliable, such as parents, were seen as implicitly trustworthy, and most participants were less likely to require evidence or additional fact-checking. The intimate knowledge parents had of their children perhaps made them a commonly chosen source by participants. "I would go to my dad because the Internet just has so much stuff and it's all conflicting and he knows me to say 'I know what you want to do, this will help you do what you want to do'" (Man, 28, university, P#28).

Participants who mentioned health professionals as a source viewed them as knowledgeable and authoritative based on knowledge they assumed they had. "My doctor just tells me the stuff so I just do what he says because he's a doctor" (Man, 18, university, P#14). Doctors in particular were more often identified by women as preferential sources, though men also ranked doctors highly.

All participants who looked to friends and nonparent family members as sources picked those that could present evidence (either scientific or anecdotal) of knowledge in the field. Generally, the source had to demonstrate either participation in behaviours perceived as healthy or nutritious or training in a health field before they would be considered a good source. "I'd say most is word-of-mouth. From people who are more educated than I am in the field. So I'd say my mom is a big one. I'd say my coach is a big one. Fellow teammates is a big one" (Woman, 23, university, P#15).

The need for evidence and professional affiliation in sources was commonly raised by participants. Online sources were especially subjected to these requirements and had to provide evidence or be referenced, "I use things like blogs and stuff like that but try to reference it" (Woman, 30, university, P#03); be endorsed by a health professional; or be associated with a government institution, "I would go to some sites that are a little bit more valid. Government sites on nutrition" (Woman, 24, university, P#04). However, there were a small number of participants (n = 6) who did not require the same standard of validity in their information and simply chose the most common Internet results. "I would open up the top 10 and if five of them or six of them said 'look for blueberries, blueberries are what you need' then generally I'd go with that" (Man, 20, college, P#69).

Social media, as on online source, was treated slightly differently. All but four participants stated they did not actively search for nutrition or health information on social media; however, when probed, they indicated that if health or nutrition information was presented to them through social media (e.g. on a Facebook or Twitter feed) they often read it if it appeared interesting. This view on social media was summarized by one participant, who said about Facebook, "I get it in the newsfeed. But I haven't really looked for it. But every now and then if there's something that catches my eye and I make sure that I read the whole, like the poster or the article" (Man, 28, college, P#73).

The four participants who did use social media as a source of information followed health professionals and friends in order to increase their exposure to health information or posed questions on these platforms to gather responses from those they viewed as informed. "I find a lot of my information through social media, and people, my friends, might have some insight that I've never thought of" (Man, 19, college, P#45). While viewed as a poor source by most participants (for being unreliable and based on opinion), social media was used daily by all but two participants and provided passive exposure to health and nutrition information that they would not have otherwise sought out.

Health- and nutrition-related interests

Most participants discussed health and nutrition as different concepts; however, they did not do so explicitly. The topic of health-seeking was raised primarily in discussions of disease symptoms, whereas nutrition was discussed in terms of building on an existing healthy state. Almost all participants indicated they only searched specifically for health information (not including nutrition information) when they were checking symptoms, usually through the use of symptom-checking sites (e.g. WebMD). "I know everyone says that you look and you Google it and it tells you you're going to die. I would start there and work my way getting people's opinions, getting what they think and then go to my doctor" (Man, 18, university, P#14). Participants viewed health sites as engaging in fear mongering, and there was a general belief that there was no reason to look up health questions unless there was a specific problem. General interest in health information did not increase with age, but continued to be problem-oriented. A greater interest in health information (and active seeking) was seen in participants of all ages who had experienced previous health problems, indicating the importance of experience in motivating behaviour.

While 12 participants indicated they were not at all interested in food or nutrition, among the rest of the participants, the reasons for performing nutrition searches generally fell into three groupings: to learn what to eat to achieve a specific outcome; to learn what was in their food; or for following catchy titles or learning food facts. All but three participants indicated that they infrequently sought nutrition information, but that they often encountered nutrition information as the by-product of other information-seeking behaviours. "I don't really type in what kinds of elements I need to take. I would just say what kind of food would you need to eat if you are in this situation or that situation" (Woman, 21, university, P#05). Most participants read about food as part of achieving fitness or weight loss goals, increasing overall health, creating a healthier diet to avoid illness, reducing food costs, finding recipes and mitigating fear of disease. Fitness and weight loss goals were often the motivation for dietary change. "[I look for] what vitamins a certain food is high in, how many calories does it have, because by knowing what

kinds of vitamins it has it sort of leads into what kinds of exercises should I do? In what way will it optimize my physical motion?" (Man, 22, college, P#42). Participants were more likely to search for information or follow links that lead to increased strength (n = 15) or weight loss (n = 23). While both men and women were interested in fitness and weight loss, men more commonly mentioned fitness as a goal, whereas women more commonly mentioned weight loss or appearance. Searches for healthy diets were also linked to creating thinner or stronger bodies.

Participants were also interested in the content of the foods they consumed. Research into the ingredients in prepared foods or nutrients in whole foods for a small number of participants was motivated by an interest in food politics or food science. A larger proportion of participants were interested in food content as part of a desire to achieve fitness, lose weight, and eat a healthy diet to avoid illness. Participants were particularly interested in the origins of their food and the specific effects that nutrients or added chemicals had on the body.

> I don't know it's just kind of been, it's a fun thing I guess. It's good to know about what you're putting into your body and being aware of it. I think overall it's an awareness of what you're eating and it's your health, you need to be your own advocate for your health. I think for me it's an awareness of what's out there and what's good and maybe what's even better. And maybe what's not so good, but is being marketed as good (Woman, 23, graduate, P#55).

As this participant indicated, food interests are tied to health, the body and a growing desire of individuals to take control of their own health. Most participants indicated that it was important to know what they were consuming so that they were aware of the balance of "good" and "bad" foods they consumed. By doing their own research, these participants felt they were actively engaging in their own health care and making informed choices. Participants were interested in going beyond knowing which foods to eat and were instead searching for information on why to eat them. "[I want to know] how certain foods would benefit me and why it's important to get certain things" (Woman, 22, graduate, P#43). The desire to be active participants in their own health led them to search out more information about their food that explained why they needed to consume certain foods and how it would affect their body.

The final reason for searching for food information was a passive interest in following up on intriguing article titles or food facts. These participants (n = 16) generally clicked on web links that offered unusual claims, contradictory information or interesting food facts. "I really like reading like 'did you knows' and like random facts and stuff. That could be something that you like never knew. Like did you know that this food has all these types of nutrients and it's good for like this and this and this. And this is what it does to your body" (Woman, 18, university, P#2). Most were not actively searching for food information, but were motivated by what they read. "The Yahoo articles are like 'the five foods you need every day' or something like that. So you kind of read through it and it kind of gets you thinking, 'do I really need that, did I have it recently?' And then if it gets you thinking about something else, then you'll start looking into other things" (Man, 21, university, P#6). These types of searches were most often linked to social media as they appeared as links posted by friends or acquaintances and were not encountered during active research into food information.

Engaging young adults with nutrition and bone health information

Close to a quarter of participants believed that it was not possible to motivate young adults because they just were not interested. As one participant stated, "It all depends on them. If they don't want to do that, so even if they have knowledge they won't follow it" (Woman, 23, college, P#46). Those participants who did feel nutrition messaging could be improved suggested that information should be explanatory (n = 28) and relatable (n = 30). "I think if you told me something, how would it affect me? Like if you were to say it would help me lose weight or help me become stronger and you give me examples, I think that would maybe get people and me to be more interested in it" (Woman, 17, non-student, P#85).

Most participants felt that young adults did not have enough knowledge to make informed choices and that it was important to tell them why certain foods or behaviours were necessary. "I think in high school we should learn more about it. They always just like tell us the same things like how I said before, like eat this amount of this in a day. But they never actually tell you what the actual benefits of things are and all the different types of foods" (Woman, 18, university, P#2). Participants expressed the desire that the information provided would include explanations, rather than just lists of foods and behaviours.

While participants wanted explanations, they also thought that the types of changes suggested need to fit into the busy lives of young adults. Rather than advocating large-scale changes, a third of participants suggested small and simple modifications that could be easily integrated into daily activities. "I'm always surprised by how very small things could change. So something as simple as an effective media campaign could potentially change a small habit that you continue for the rest of your life" (Man, 28, university, P#30).

Participants supported campaigns for greater awareness of osteoporosis and bone-related nutrition information; however, there was a lack of agreement on how messages should be framed. Some participants were supportive of the use of fear messaging as a tool: "I think we just need to kind of get it out there. Like I know we shouldn't be doing this, but the fear principle works pretty well. If we kind of show what osteoporosis it, how scary it can be, how much it can affect your life and it's so easy to prevent it, just have a glass of milk" (Woman, 22, college, P#43). Others believed the use of fear would not be most effective in the long term: "I know if you always show someone with the disease or talk about it with sad music in the background, you always hit someone's chord, but they'll forget about it" (Man, 22, graduate, P#87). Participants in the latter camp felt that there were too many diseases and that young adults were inured to fear-based messaging. The use of incentives or positive messages was suggested by a quarter of participants.

The plethora of health information available to young adults appeared to make filtering information difficult. As a result, most participants felt that information

would be most accessible when placed in information sources they already access. "I think reaching us at the level that we feel most comfortable at, whether it's through university or on Facebook, things that you know we'll be actually interacting with" (Woman, 21, university, P#18). Social media was raised as an important source by most participants, as almost all participants used it. Popular social media sites such as Facebook, YouTube and Twitter were suggested as good mechanisms for spreading information. "I would think it would be means of what they are heavily attached to. So I would say social networks, apps on the phone. It would have to be stuff that is technology-based, because if it's just posters people just walk past them because they are texting" (Woman, 27, college, P#23). The endorsement of social media by most participants was interesting as they had previously identified social media as a problematic source that was unreliable. Technology or media-based approaches in general were commonly cited as the main way of accessing information. The importance of celebrity endorsements was also suggested by a small number of participants (n = 5), as celebrities have large online followings and exert influence over young adult decisions. "If you're really trying to make a cause about it then there's endorsements, get the right people, get the right faces behind it. Get all the right people to tweet it. I bet if you got Kim Kardashian to start supporting osteoporosis, you'd probably have half of North America aware of osteoporosis" (Man, 26, college, P#49).

Discussion

The results of this study indicate that osteoporosis education in Ontario should involve targeted messaging for young adults through short, relatable messages that are delivered through emerging and traditional networks, and that focus on small-scale changes in areas of young adult interest. As in other studies, most of the information seeking by young adults in this study occurred online.[33,34] However, participants indicated that influence is still exerted by parents, doctors, educators and peer communities. Even older young adults who were no longer living in their family home turned to their parents as a source of information. This is in line with the literature on health information seeking that places doctors, parents and peers as influential sources in young adult lives.[33,35] The increased reliance on doctors as an important source of information for women also reflects trends in the literature that identify women as more likely to engage with health professionals.[36] Parents and health professionals were considered to be reliable due to their personal and professional relationships with participants. To potentiate this line of knowledge transfer, parents of adolescents and young adults should also receive osteoporosis information that focusses on long-term benefits of calcium and vitamin D intake. Encouraging doctors to discuss the importance of diet in relation to future bone health would also be beneficial in increasing young adult awareness, as participants are attuned to the concerns that medical professionals raise. Research has demonstrated that family physicians in Ontario have significant knowledge gaps on osteoporosis.[18,37] Increasing the knowledge base of physicians and encouraging the delivery of unsolicited prevention information would increase the uptake of osteoporosis information in young adults.

The importance of peer networks, especially online communities, is shown in the reliance young adults place on the Internet as a knowledge-seeking tool. Peer groups are an influential force in young adult lives and the opinions and social pressures exerted by peers shape the decisions they make.[38,39] Encouraging online sharing of osteoporosis-related nutrition information through social media peer groups has the potential for reaching large numbers of young adults. Participants admitted that they were often not actively seeking nutrition information, but were easily attracted to interesting information. Disseminating information through these online networks, especially when messages are packaged with the information that young adults are already seeking (e.g. fitness, weight loss, healthy eating, interesting facts) should increase the exposure and uptake of this information.

Social media has become an essential tool for spreading health awareness, but when attempting to reach users who are not actively seeking health information, it relies on the interest garnered by the title or topic. Some types of social media (Facebook, Twitter) create large aggregates of information posted by growing peer networks, which makes it possible to spread information quickly to users who are not searching specific content, but also easy for individual posts to become lost within the flow of information.[40] Others, such as blogs or YouTube, require individuals to be actively searching for related content, making it difficult to reach individuals who are not searching health or nutrition information.[40] However, the benefits of these types of peer sharing systems can be seen in the recent success of the Amyotrophic Lateral Sclerosis (ALS) Ice Bucket Challenge[41,42,†] though the longevity of this awareness has yet to be assessed. Part of this success was due to celebrity support, which caused widespread interest and emulation, an association that participants in this study were aware of.[43] Designing prevention information for online consumption requires a greater focus on titles and images that attract attention, while also packaging knowledge in a way that is relevant to the targeted audience.

The reasons why young adults seek nutrition- and health-related information play an important role in how we translate this information to them. The concepts of health and nutrition were discussed separately by participants; health seeking was viewed as disease-centric, and seeking information about nutrition was related to improvement of an existing healthy state. While participants associated nutrition with health, they saw health-seeking behaviours as symptom checking and therefore a higher priority because it indicated the need for treatment, whereas seeking information about nutrition was preventative and useful for self-improvement, but not essential. Participants indicated they are primarily concerned with nutrition as a by-product or means of achieving other interests, such as attractive appearance, fitness, weight loss or a healthier body. This is well supported in other research studies about youth and motivation for healthy eating[44-47] and is not surprising, considering that Health Canada's healthy eating plan, *Eating Well with Canada's Food Guide,* is designed to

† The ALS Ice Bucket Challenge was a highly successful social media campaign in the summer of 2014 that encouraged members of the public to post a video of themselves pouring ice-cold water over their head and challenging a friend to do the same. The goal was to raise awareness about ALS, as well as raise funds—participants were encouraged to make a donation after undergoing the challenge. The campaign was widely shared through social media sites and endorsed by celebrities, becoming a large, viral campaign.[40]

promote nutrition as a mechanism to avoid chronic illness and obesity.[48]

Slight gender-based differences in the type of health information sought reflects differential motivations between men and women in relation to nutrition and bone health. Gender-based differences in the understanding of bone health, nutrition and osteoporosis prevention in this sample are explored in detail elsewhere.[30] The results of the present study indicate that in the creation of targeted messages for young adults, stakeholders should also consider framing a variety of messages that are tailored to the interests of both men and women. Previous disease experiences also emerged as an important factor in health and nutrition information-seeking behaviours and represent an area that requires further study.

The results also indicate that the promotion of nutrition education should be divorced from disease-specific contexts and instead integrated into the diverse topics that reflect uses that young adults have for food. Since their choices are not driven by disease-based or health-seeking behaviours per se, osteoporosis information should be embedded in the information that young adults are already seeking. Rather than focussing on raising disease awareness, information should be placed into fitness and weight loss contexts as health facts that help with the creation of a stronger, healthier body. Raising awareness of bones as a component of strength training or the need to maintain bone health in order to improve appearance would speak to the issues that concern young adults. Similarly, in order to deliver bone health information to young adults who are interested in the nutrient content of food or who are concerned with larger food systems, it should be integrated into relevant knowledge sources.

The preponderance of disease-based information available to young adults, especially via the Internet, can overwhelm users.[49] The use of short messages distils complex information into retainable facts. Including simple suggestions about how to incorporate bone-healthy changes into daily life as part of these short messages makes them more attractive to young adults. Short and simple facts about calcium, vitamin D and bone health, such as the benefits of increasing intake of dairy or dark leafy vegetables, are more appealing to young adults who view themselves as too busy to make major lifestyle modifications.

Transitioning away from disease-specific messaging means also focussing less on scare tactics and instead promoting incentives. Including explanations for *why* young adults should be consuming calcium and vitamin D for bone health also makes them more likely to pay attention to and retain messages. The absence of clear cause-and-effect reasoning made it difficult for participants in this study to justify making nutritional changes and to conceptualize the consequences of their current behaviours to their future disease risk. Providing them with concrete reasons, while tying the information into the aspects of their bodies that they are concerned about, is likely to be more effective as it uses positive rather than negative messages to encourage change.

Ultimately nutrition represents an important mechanism for delivering osteoporosis-prevention information to young adults. Nutrition-based changes are easily incorporated into individual's lives and the framing of osteoporosis education messages within nutrition allows information to be delivered in ways that are relevant to the interests of young adults. Building linkages between food behaviours and disease states has the potential to increase engagement in prevention and potentially reduce future rates of osteoporosis.

Strengths and limitations

This study is a robust, qualitative examination of osteoporosis-related knowledge translation in a representative sample of Ontario young adults. Due to the qualitative nature of this study, it did use a small sample size, which makes the results difficult to generalize to the larger population, but provides contextual knowledge for southern Ontario. Two-thirds of the participants were also enrolled in post-secondary institutions, which has the potential to bias the results toward individuals with higher education; however, this is reflective of levels of post-secondary enrollment in Ontario. Interview data relied on participants' self-report, which can result in omissions and problems with memory recall. Due to the small number of individuals in each age category, it was not possible to explore age-based differences in this sample. Additionally, coding and analysis were completed by the author only and had the potential to introduce bias.

Conclusion

Reducing the future prevalence of osteoporosis requires decreasing the future osteoporosis risk of contemporary young adults who still have the potential to mitigate their bone loss. Creating effective osteoporosis prevention education programs for young adults means ensuring information is translated to them in ways they can identify, access and apply to their own lives. The exploration of information-seeking behaviours in young adults in this study revealed that while they had extensive networks that would enable information seeking, they rarely actively sought information on nutrition for osteoporosis prevention. Raising awareness of osteoporosis to increase engagement in prevention behaviours would be made more effective by embedding osteoporosis education into the types of information that young adults are currently consuming. Translating this knowledge to young adults requires presenting information in ways that firmly link osteoporosis with young adult physical bodies, engaging with online media for information sharing and focussing efforts on more traditional networks (parents, physicians) that might be devalued in the digital age, but that are still influential sources trusted by the young adults in this study. Osteoporosis prevention information should build messages that encourage small-scale, convenient lifestyle modifications that are targeted at young adults and are coupled with explanations. While this study presents some suggestions as to how existing prevention programs can be modified, the next step is to develop specific messaging for young adults that can then be evaluated for its effectiveness.

Acknowledgements

Support for this project was provided by the Ontario Graduate Scholarship. My supervisor, Dr. Tina Moffat, and my committee members, Dr. Megan Brickley and Dr. Stephanie Atkinson, provided support and guidance in the design and implementation of this project.

Conflicts of interest

The author declares no conflicts of interest.

References

1. Kanis J on behalf of the World Health Organization Scientific Group. Assessment of osteoporosis at the primary health care level. Sheffield (UK): World Health Organization Collaborating Centre for Metabolic Bone Diseases, University of Sheffield; 2007. [Technical report]. 339 p.

2. Tarride JE, Hopkins RB, Leslie WD, et al. The burden of illness of osteoporosis in Canada. Osteoporos Int. 2012;23(11):2591-600.

3. Osteoporosis Canada. Facts and statistics [Internet]. Toronto (ON): Osteroporosis Canada; 2017 [cited 2016 Feb]. Available from: http://www.osteoporosis.ca/osteoporosis-and-you/osteoporosis-facts-and-statistics/

4. World Health Organization (WHO). Prevention and management of osteoporosis. Geneva (CH): WHO; 2003. [Technical Report Series No. 921.] 164 p.

5. Cooper C, Cole ZA, Holroyd CR, et al. Secular trends in the incidence of hip and other osteoporotic fractures. Osteoporos Int. 2011;22(5):1277-88.

6. Kasper MJ, Peterson MG, Allegrante JP. The need for comprehensive educational osteoporosis prevention programs for young women: results from a second osteoporosis prevention survey. Arthritis Rheum. 2001;45(1):28-34.

7. Tussing L, Chapman-Novakofski K. Osteoporosis prevention education: behaviour theories and calcium intake. J Am Diet Assoc. 2005;105(1):92-7.

8. World Health Organization (WHO). Diet, nutrition and the prevention of chronic diseases. Geneva (CH): WHO; 2003. 160 p. [WHO Technical Report Series, No. 916].

9. Canadian Institutes of Health Research (CIHR). Knowledge translation strategy 2004–2009 [Internet]. Ottawa (ON): CIHR; 2008 Jun 2 [cited 2016 Feb]. Available from: http://www.cihr-irsc.gc.ca/e/26574.html

10. Graham I, Logan J, Harrison M, et al. Lost in knowledge translation: time for a map? J Contin Educ Health Prof. 2006;26(1):13-24.

11. Straus SE, Tetroe J, Graham ID, editors. Knowledge translation in health care. Chichester (UK): John Wiley & Sons; 2013. 424 p.

12. Osteoporosis Canada. Breaking barriers, not bones: 2008 national report card on osteoporosis care. Toronto (ON): Osteoporosis Canada; 2008. 33 p.

13. Government of Manitoba. Manitoba falls prevention strategy and framework [Internet]. Winnipeg (MB): Government of Manitoba; 2006 [cited 2016 Feb]. Available from: http://www.gov.mb.ca/healthyliving/hlp/injury/falls.html

14. Nova Scotia Department of Health and Wellness. Halifax Osteoporosis Multidisciplinary Education (HOME) [Internet]. Halifax (NS): Nova Scotia Department of Health and Wellness; 2016 [cited 2016 Feb]. Available from: http://www.cdha.nshealth.ca/osteoporosis/halifax-osteoporosis-multidisciplinary-education-home

15. British Columbia Ministry of Health, British Columbia Medical Association. Osteoporosis: diagnosis, treatment and fracture prevention. Vancouver (BC): Guidelines and Protocols and Advisory Committee; 2012. 17 p.

16. Ontario Ministry of Health and Long-Term Care, Osteoporosis Society of Canada. Osteoporosis action plan: an osteoporosis strategy for Ontario. Queen's Printer for Ontario; 2003. 88 p. [Catalogue No.: 7610-2238899].

17. Jaglal SB, Hawker G, Cameron C, et al. The Ontario osteoporosis strategy: implementation of a population-based osteoporosis action plan in Canada. Osteoporos Int. 2012;21(6):903-8.

18. Jaglal SB, Hawker G, Bansod V, et al. A demonstration project of a multicomponent educational intervention to improve integrated post-fracture osteoporosis care in five rural communities in Ontario, Canada. Osteoporos Int. 2009;20(2):265-74.

19. Baxter-Jones ADG, Faulkner RA, Forwood MR, Mirwald RL, Bailey DA. Bone mineral accrual from 8 to 30 years of age: an estimation of peak bone mass. J Bone Miner Res. 2011;26(8):1729-39.

20. Chan MF, Kwong WS, Zang Y, Wan P. Evaluation of an osteoporosis prevention education programme for young adults. J Adv Nurs. 2007;57(3):270-85.

21. Neumark-Sztainer D, Story M, Perry C, Casey MA. Factors influencing food choices of adolescents: findings from focus-group discussions with adolescents. J Am Diet Assoc. 1999;99(8):929-37.

22. Burgener M, Arnold M, Katz JN, et al. Older adults' knowledge and beliefs about osteoporosis: results of semistructured interviews used for the development of education materials. J Rheumatol. 2005;32(4):673-7.

23. Doheny MO, Sedlak CA, Estok PJ, Zeller R. Osteoporosis knowledge, health beliefs, and DXA T-scores in men and women 50 years of age and older. Orthop Nurs. 2007:26(4):243-50.

24. Health Canada. Do Canadian adults meet their nutrient requirements through food intake alone? Ottawa (ON): Health Canada; 2012. 8 p. [Catalogue No.: H164-112/3-2012E-PDF].

25. Chang S-F. A cross-sectional survey of calcium intake in relation to knowledge of osteoporosis and beliefs in young adult women. Int J Nurs Pract. 2006;12(1):21-7.

26. Ford MA, Bass MA, Keathley R. Osteoporosis knowledge and attitudes: a cross-sectional study among college-age students. J Am Coll Health. 2007;56(1):43-7.

27. Ziccardi SL, Sedlak CA, Doheny MO. Knowledge and health beliefs of osteoporosis in college nursing students. Orthop Nurs. 2004;23(2):128-33.

28. Butow P, Palmer S, Pai A, Goodenough B, Luckett T, King M. Review of adherence-related issues in adolescents and young adults with cancer. J Clin Oncol. 2010;28(32):4800-9.

29. Geiger A, Castellino SM. Delineating the age ranges used to define adolescents and young adults. J Clin Oncol. 2011;29(16):e492-e493.

30. Holland A. Thwarting the silent thief: informing nutrition-based osteoporosis prevention education for young adults [dissertation]. [Hamilton (ON)]: McMaster University; 2016. 229 p.

31. Braun V, Clarke V. Using thematic analysis in psychology. Qual Res Psychol. 2006;3(2):77-101.

32. Bernard H. Research methods in anthropology: qualitative and quantitative approaches. 5th ed. Maryland (UK): AltaMira Press; 2011. 680 p.

33. Gray NJ, Klein JD, Noyce PR, Sesselberg TS, Cantrill JA. Health information-seeking behavior in adolescence: the place of the internet. Soc Sci Med. 2005;60(7):1467-78.

34. Hesse BW, Nelson DE, Kreps GL, et al. Trust and sources of health information: the impact of the internet and its implications for health care providers: findings from the first Health Information National Trends Survey. Arch Intern Med. 2005; 165(22):2618-24.

35. Canadian Council of Food and Nutrition (CCFN). Tracking nutrition trends: a 20-year history [Internet]. Ottawa (ON): CCFN; 2009 [cited 2016 Feb]. Available from: http://www.cfdr.ca/Downloads/CCFN-docs/20-Years-of-TNT-(Sep12)---Final.aspx

36. Thompson AE, Anisimowicz Y, Miedema B, Hogg W, Wodchis WP, Aubrey-Bassler K. The influence of gender and other patient characteristics on health care-seeking behaviour: a QUALICOPC study. BMC Fam Pract. 2016;17:38. doi: 10.1186/s12875-016-0440-0

37. Jaglal SB, McIsaac WJ, Hawker G, et al. Information needs in the management of osteoporosis in family practice: an illustration of the failure of the current guideline implementation process. Osteoporos Int. 2003;14(8): 672-6.

38. Kelder S, Perry CL, Klepp KI, Lytle LL. Longitudinal tracking of adolescent smoking, physical activity, and food choice behaviors. Am J Public Health. 1994;84(7):1121-6.

39. Story M, Neumark-Sztainer D, French S. Individual and environmental influences on adolescent eating behaviors. J Am Diet Assoc. 2002;102(3 Suppl):S40-S51.

40. Korda H, Itani Z. Harnessing social media for health promotion and behavior change. Health Promot Pract. 2013;14(1):15-23.

41. Carrì MT. Philanthropy: ice bucket challenge should jolt funding [letter]. Nature. 2014;515(7527):343.

42. Koohy H, Koohy B. A lesson from the ice bucket challenge: using social networks to publicize science. Front Genet [Internet]. 2014 Dec 15 [cited 2016 Feb];5:430. Available from: http://dx.doi.org/10.3389/fgene.2014.00430

43. Ni MY, Chan BHY, Leung GM, Lau EHY, Pang H. Transmissibility of the Ice Bucket Challenge among globally influential celebrities: retrospective cohort study. BMJ. 2014;349:g7185. doi: 10.1136/bmj.g7185

44. Betts NM, Amos RJ, Keim KS, Peters P, Stewart B. Ways young adults view foods. J Nutr Educ. 1997;29(2):73-9.

45. Counihan CM. Food rules in the US: individualism, control, and hierarchy. Anthropol Q. 1992;65(2):55-66.

46. Ousley L, Cordero ED, White S. Fat talk among college students: how undergraduates communicate regarding food and body weight, shape & appearance. Eat Disord. 2008;16(1): 73-84.

47. Rozin P, Bauer R, Catanese D. Food and life, pleasure and worry, among American college students: gender differences and regional similarities. J Pers Soc Psychol. 2003;85(1):132-41.

48. Bush MA, Martineau C, Pronk JA, Brulé D. Eating well with Canada's food guide: "a tool for the times". Can J Diet Pract Res. 2007;68(2):92-6.

49. Murero M, Rice R, editors. The internet and health care: theory, research, and practice. Mahwah (NJ): Lawrence Erlbaum Associates; 2006. 403 p.

https://doi.org/10.24095/hpcdp.37.8.02

Rotating shift work associated with obesity in men from northeastern Ontario

Anne Grundy, PhD (1,2); Michelle Cotterchio, PhD (3,4); Victoria A. Kirsh, PhD (4); Victoria Nadalin, MA (3); Nancy Lightfoot, PhD (5); Nancy Kreiger, PhD (4,6)

This article has been peer reviewed.

Abstract

Introduction: While some studies have suggested associations between shift work and obesity, few have been population-based or considered multiple shift schedules. Since obesity is linked with several chronic health conditions, understanding which types of shift work influence obesity is important and additional work with more detailed exposure assessment of shift work is warranted.

Methods: Using multivariate polytomous logistic regression, we investigated the associations between shift work (evening/night, rotating and other shift schedules) and overweight and obesity as measured by body mass index cross-sectionally among 1561 men. These men had previously participated as population controls in a prostate cancer case-control study conducted in northeastern Ontario from 1995 to 1999. We obtained information on work history (including shift work), height and weight from the existing self-reported questionnaire data.

Results: We observed an association for ever (vs. never) having been employed in rotating shift work for both the overweight (OR [odds ratio] = 1.34; 95% CI [confidence interval]: 1.05–1.73) and obese (OR = 1.57; 95% CI: 1.12–2.21) groups. We also observed nonsignificant associations for ever (vs. never) having been employed in permanent evening/night shifts. In addition, we found a significant trend of increased risk for both overweight and obesity with increasing duration of rotating shift work.

Conclusion: Both the positive association between rotating shift work and obesity and the suggested positive association for permanent evening/night shift work in this study are consistent with previous findings. Future population-based research that is able to build on our results while examining additional shift work characteristics will further clarify whether some shift patterns have a greater impact on obesity than others.

Keywords: *shift work, obesity, men, population-based research*

Highlights

- We examined the relationship between having worked at a job that included night shift work (evening/night, rotating or other shift schedules) and overweight and obesity in men living in northeastern Ontario.
- Men who had ever been employed in rotating shift work were more likely to be overweight or obese, and similar findings were suggested for men who had ever been employed in jobs involving evening/night shift work.
- We observed a significant trend of increasing risk of overweight and obesity with increasing duration of rotating shift work.
- Since obesity is linked with several chronic health conditions, understanding which types of shift work are specifically associated with obesity is important to the development of workplace policies that are best for workers' health.

Introduction

Shift work has been identified as a risk factor for a number of chronic health conditions in which obesity is thought to play a role.[1-6] Specifically, increased risk of cardiovascular disease,[1] type II diabetes,[2,3] metabolic syndrome[4,5] and cancer[6] have been noted among shift workers.

Cross-sectional,[4,7-17] cohort[18-23] and longitudinal[24-26] studies have evaluated links between shift work and obesity. Some found an increased risk of obesity[4,7,13-15,17-20,23,26] or weight gain[9] among shift workers, while others found no association,[8-12,16,24,25] results which appeared to be independent of study design. Most previous studies of shift work and obesity have been conducted in specific workplace settings, primarily restricted to individuals employed in single industries,[7,8,10-15,17,19,20,23,24,26,27] with only a few population-based studies, especially among men.[4,18] As a result, assessment of shift work exposure has been limited, with most studies examining only one specific shift schedule or pattern.[4,8-17,19-28]

Author references:

1. Centre de recherche du Centre hospitalier de l'Université de Montréal (CRCHUM), Montréal, Quebec, Canada
2. Department of Social and Preventive Medicine, Université de Montréal, Montréal, Quebec, Canada
3. Prevention and Cancer Control, Cancer Care Ontario, Toronto, Ontario, Canada
4. Dalla Lana School of Public Health, University of Toronto, Toronto, Ontario, Canada
5. School of Rural and Northern Health, Laurentian University, Sudbury, Ontario, Canada
6. Department of Nutritional Sciences, University of Toronto, Toronto, Ontario, Canada

Correspondence: Anne Grundy, Université de Montréal Hospital Research Centre, 850 Saint-Denis Street, 2nd Floor, Montréal, QC H2X 0A9; Tel: 514-890-8000 ext. 15921; Email: anne.grundy@umontreal.ca

Furthermore, while most studies used day-only workers as a referent group,[4,7-15,17,19-23,25,27] others simply compared the effects of different shift schedules to one another without a truly "unexposed" group.[16,24,26] A need for studies with a more detailed assessment of shift work (e.g. type of shifts worked and cumulative number of years in shift work jobs) has been identified.[28] This population-based study of over 1500 men in northeastern Ontario, Canada, improves upon previous work in several ways. Specifically, it uses a detailed assessment of shift work including jobs across multiple industries with both rotating and permanent shift patterns to evaluate the relationship between shift work history and obesity among men.

Methods

Study sample

We conducted an analysis of data provided by controls who had previously participated in a prostate cancer case-control study. The original study was conducted in northeastern Ontario from 1995 to 1999[29,30] and examined associations of occupational and other factors with prostate cancer risk. Study controls were men aged 45 to 84 years, with no history of prostate cancer, randomly selected from residential telephone listings in northeastern Ontario.[29,30] Controls were asked to complete a mailed questionnaire, which collected information concerning a number of personal characteristics, and served as the data source for this analysis. As previously described, the response rate for controls in this study was 47.5%,[29] with a total of 1622 men available for this analysis. Ethics approval for the original study was provided by the Laurentian Hospital Research Ethics Board and approval for this new analysis was provided by the Health Sciences North Research Institute Ethics Board and the Laurentian University Research Ethics Board.

Shift work assessment

An occupational history was included in the study questionnaire. The men were asked to report all of the jobs they had held over their lifetime. Participants reported the age at which they started and ended each job, in order to calculate duration of employment for each job. Men also reported the type of work schedule (i.e. day-only, evening/night shifts, rotating shifts or other) for each job listed to characterize the history of their shift work. Shift work was characterized as ever having worked in evening/night, rotating or other types of shift work individually ("ever shift workers"). We estimated lifetime duration of rotating shift work by adding the number of years spent in rotating shifts across all jobs, with duration of work in part-time jobs divided in half.

Obesity assessment

Obesity was assessed using body mass index (BMI; kg/m^2), with participants asked to self-report their height and weight five years prior to completion of the questionnaire, as well as their height in their early thirties and weight in their early thirties and fifties. BMI five years prior to study participation was estimated, as these data were originally collected for a prostate cancer case-control study,[29] in which BMI prior to cancer development among case-patients was of interest to researchers. In order to ensure data from controls was comparable to case-patients, we also assessed BMI five years prior to study participation for all controls and the controls were used in the current analysis. As such, BMIs for the time frame five years prior to study participation were used to characterize obesity in this study. Men with a BMI of less than 25 were categorized as normal weight; a BMI of 25 to less than 30 was characterized as overweight and a BMI greater than or equal to 30 as obese.[31]

To reduce missing BMI data, if height five years prior to the study was missing, height in early thirties was used, if available. For men whose weight five years prior to the study was missing, weight in early fifties was used for men aged 50 to 59. (Men of other age groups whose weight was missing were excluded as there was no acceptable substitute. Men had to be at least 45 years of age to enrol in the study, and as such their weight in their early thirties was not an acceptable substitute for weight five years prior to the study.) This alternative BMI calculation was used for a total of 51 (11%) normal weight individuals, 104 (12%) overweight individuals and 34 (14%) obese participants. Sixty-one men were missing height or weight information and could not have their BMI classified.

Assessment of potential confounders

Potential confounders of the shift work–obesity relationship were age, marital status, socioeconomic status, physical activity, total energy intake (diet) and smoking status.[28] We used education and family income to capture aspects of socioeconomic status. We used general activity and occupational activity variables to characterize physical activity. For general physical activity, men reported the number of times per month they engaged in at least 20 minutes of both strenuous and moderate-intensity physical activity during four lifetime periods (teens, thirties, fifties, and five years before the study). Participants reported strenuous and moderate-intensity physical activity in separate questions, with examples of each type of activity provided. We created a physical activity index by summing the number of times men reported engaging in moderate- and vigorous-intensity activities across each of the four lifetime periods. We then created quartiles of the physical activity index, with higher values representing individuals who were more active over their lifetime.

To assess occupational physical activity, men were asked to report the usual type of activity undertaken in their job using one of four categories (sitting, light, moderate or strenuous activity), again during four lifetime periods (early twenties, early thirties, early fifties and five years prior to the study). We categorized occupational activity by the number of age periods during which men reported engaging in moderate or strenuous occupational activity: none, one, two, three or four time periods. We assessed diet two years prior to study participation using information collected in the full dietary history included in the study questionnaire, from which total energy intake was estimated in a previous analysis.[30] Total energy intake was characterized both continuously and in quartiles. We defined smoking status by history of ever having smoked filtered or nonfiltered cigarettes; men were characterized as never, former or current smokers.

Statistical analysis

We described characteristics of men classified as normal, overweight and obese using means and standard deviations for continuous variables and percentages for categorical variables. We also stratified descriptive characteristics by history of ever having been employed in shift work. To characterize the type of work being done by individuals in this population employed in jobs involving shift work, we

described the work environment for each job reported for each of day, evening/night, rotating and other types of shift work.

We estimated odds ratios (ORs) and 95% confidence intervals (CIs) for associations between shift work and overweight and obesity using multivariate polytomous logistic regression, using the normal weight group as a referent.[32] The association between ever having engaged in shift work and obesity was explored using three characterizations of ever shift work in separate statistical models. Specifically, we examined ever having performed permanent evening/night shifts, rotating shifts or other types of shift. We were only able to examine the impact of duration of shift work on rotating shift workers, since there was insufficient statistical power for the permanent evening/night shift workers. We categorized duration of shift work in three groups (> 0–14 years, 15–29 years and ≥ 30 years) to distinguish short-, medium- and long-term shift workers. These categories have been previously used in associations between shift work and cancer.[33-36]

We selected confounders using a directed acyclic graph. Directed acyclic graphs (DAGs) are causal diagrams that illustrate the direction of relationships between variables of interest and other unknown confounders. They have been suggested as an alternative to traditional epidemiological methods of confounder identification[37] as they explicitly display and facilitate the causal-inference process.[38] Specifically, in contrast to statistically driven methods of model building, DAGs focus on the theoretical causal relationships between variables when identifying potential confounders.[37] They are used in epidemiology to identify a confounder set (minimally sufficient set) that will control for potential confounding between an exposure and an outcome, given the hypothesized causal relationships.[37] We used DAGitty software[39,*] to create a DAG and identify a minimally sufficient adjustment set for the association between shift work and overweight and obesity. The DAG is shown in Figure 1; we identified a minimally sufficient adjustment set that included age and socioeconomic status, the latter as determined by education and family income, and adjusted all multivariate models for these variables. We conducted all analyses using SAS, Version 9.2 (SAS Institute Inc., Cary, NC, USA).

Results

The proportion of men with a history of ever having been employed in any type of shift work ("ever shift workers") who had a post-secondary or post-graduate education was lower than among those who had never been employed in any type of shift work ("never shift workers"). Similarly, a greater proportion of "ever" than "never" shift workers were also in the bottom two family income categories; were current or former smokers; and had been employed in occupations that involved moderate or strenuous physical activity during three or four lifetime periods (Table 1).

When comparing across the categories of obesity status, a greater proportion of normal weight individuals reported having obtained a post-secondary or post-graduate education (25%) compared to overweight (19%) or obese (16%) men. Furthermore, a greater proportion of men in the overweight or obese categories reported having held jobs involving moderate or strenuous physical activity in three or four lifetime periods (overweight, 49%; obese, 48%) compared to normal weight individuals (43%). Conversely, while the proportion of men in the top two quartiles of recreational activity was similar for normal (54%) and overweight (53%) men, the proportion was slightly lower among individuals who were obese (47%). There were no major differences in total energy consumption, with 41% of individuals in the normal and overweight groups in the top two consumption quartiles compared to 44% of men in the obese group (Table 1).

The frequencies of different shift types across ten categories of work environment are shown in Table 2. Evening/night work was the least commonly reported shift schedule; restaurant/hotel work was reported by the highest proportion (11%) of men for this shift type. Rotating shift patterns were more common; for this shift type, mine (63%), factory/plant floor (49%), and laboratory work (26%) had the highest proportion of rotating shifts. Other shift schedules were most common in restaurant/hotel (37%) or vehicle work (22%).

Following the exclusion of 61 men for missing BMI information, a total of 1561 men were included in the multivariate analysis. Rotating shift work was associated with both overweight (OR = 1.34; 95% CI: 1.05–1.73) and obesity (OR = 1.57, 95% CI: 1.12–2.21). In addition, although not statistically significant, odds ratios for both overweight (OR = 1.12, 95% CI: 0.70–1.79) and obese (OR = 1.31, 95% CI: 0.71–2.39) relative to normal weight individuals were elevated for evening/night shift work (Table 3). There was no association between other shift work patterns and obesity. While odds ratios were generally higher in the obese compared to the overweight group, tests for trend across categories were not significant (data not shown).

Duration of employment in rotating shift work was characterized according to one of four categories: none, > 0 to 14 years, 15 to 29 years and 30 or more years. We observed a significant association between 30 or more years of rotating shift work and being obese (OR = 1.86, 95% CI: 1.16–2.96). Odds ratios with obesity were elevated for > 0 to 14 and 15 to 29 years of rotating shift work and for all three duration categories and overweight (Table 4). For both the overweight (p = .03) and obese (p = .008) groups, we observed a significant trend across shift work duration categories.

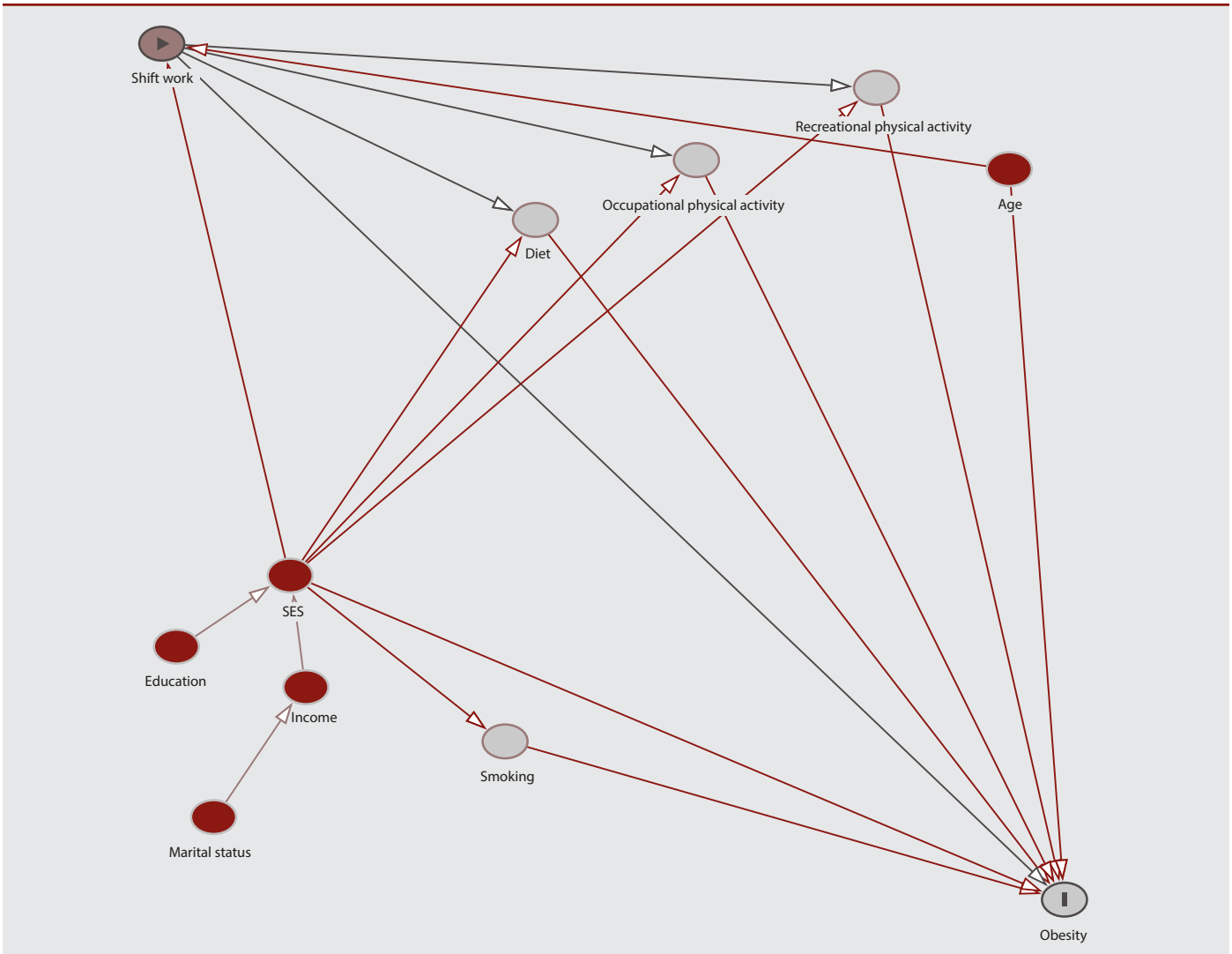
We performed a sensitivity analysis excluding all men whose BMI was calculated using either their height in their early thirties or weight during their fifties (n = 189 individuals). These findings were very similar to those seen in the full dataset (data not shown) both for ever shift work and for duration of shift work for both evening/night and rotating shift types.

Discussion

In this study of over 1500 men, we found evidence that rotating shift work is associated with an increased risk of being overweight or obese. Permanent evening/night shift work was also associated with an increased risk, although these results were not statistically significant. Previous studies

* www.dagitty.net

FIGURE 1
Directed acyclic graph for the association between shift work and obesity using DAGitty[a]



Abbreviation: SES, socioeconomic status.

[a] DAGitty software[39] for drawing and analyzing causal diagrams; www.dagitty.net.

of shift work and obesity have primarily been conducted in the context of single workplaces or industries, and few have directly compared the impact of permanent and rotating shift patterns within a single study population, as was done here. Most existing studies of shift work and obesity have focussed on rotating shift patterns and, similar to our results, demonstrated significant positive associations between shift work and obesity,[7,17,19,20,22,27] although some studies have not supported this pattern.[10,21] Furthermore, few studies have specifically considered the effects of permanent night work. One cross-sectional study linked permanent late-night shift work with weight gain among nurses and security personnel,[9] while permanent night shifts were associated with a higher prevalence of obesity among both poultry plant workers[14] and women working in a semiconductor manufacturing factory.[15]

We observed a trend of increasing risk of both overweight and obesity with increasing duration of rotating shift work. While odds ratios were elevated for all shift work durations, the association was strongest and statistically significant for 30 or more years of rotating shift work and obesity. Few earlier studies have considered duration of shift work in evaluating relationships with obesity. Among women participating in the Million Women Study, a trend of increasing obesity by duration of shift work was observed.[18] Duration of shift work was also identified as a predictor of BMI among oil and gas workers[8] and waist-hip ratio among female hospital nurses and male factory workers.[16] In a study using a categorical definition of duration similar to ours, a positive relationship with waist-hip ratio was seen for 2 to 5 years and 5 or more years of shift work, and for BMI after 5 years among male shift workers.[22] However, not all studies have shown positive associations with obesity, as another cross-sectional study of men aged 35 to 60 years found no impact of shift work duration.[7] As in our analysis, these existing studies examined the influence of shift work duration on obesity cross-sectionally[7,8,16,18,22] and were unable to definitively establish a temporal relationship between shift work and obesity.

Associations between duration of shift work and obesity are of interest as obesity is a potential intermediate between shift

TABLE 1
Characteristics of study population by obesity and shift work status, northeastern Ontario, 1995–1998 (n = 1561)[a]

	Obesity status[b]						Shift work history			
	Normal (n = 457)		Overweight (n = 855)		Obese (n = 249)		Never shift workers (n = 543)		Ever shift workers[c] (n = 1079)	
	n/Mean	%/SD	n/Mean	%/SD	n/Mean	%/SD	n/Mean	%/SD	n/Mean	%/SD
Age	69.6	7.4	68.7	7.1	67.1	6.9	67.9	7.8	68.6	7.4
Marital status[d]										
Single	12	3%	15	2%	6	2%	15	3%	22	2%
Married/common-law	384	84%	724	85%	211	85%	449	83%	915	85%
Divorced/separated/widowed	60	13%	115	13%	31	12%	79	15%	139	13%
Education										
Elementary or less	141	31%	286	34%	87	35%	148	27%	382	35%
High school	200	44%	405	48%	121	49%	224	41%	523	48%
Post-secondary	86	19%	134	16%	38	15%	131	24%	142	13%
Post-graduate	27	6%	25	3%	3	1%	31	6%	28	3%
Family income										
< $20 000	59	13%	96	11%	24	10%	55	10%	130	12%
$20 000–$39 999	147	32%	278	33%	81	33%	155	29%	362	34%
$40 000–$59 999	126	28%	250	30%	68	27%	144	27%	311	29%
$60 000–$79 999	45	10%	90	11%	26	10%	71	13%	102	9%
$80 000–$99 999	15	3%	27	3%	11	4%	29	5%	26	2%
≥ $100 000	14	3%	27	3%	11	4%	29	5%	30	3%
Smoking status										
Never smoker	117	26%	197	23%	54	23%	152	28%	239	22%
Former smoker	258	56%	532	62%	158	63%	316	58%	659	61%
Current smoker	80	18%	117	14%	34	14%	68	12%	169	16%
Physical Activity Index[e]										
< 56	113	25%	177	21%	63	25%	150	28%	235	22%
56–89	100	22%	226	26%	70	28%	130	24%	283	26%
90–121	117	26%	232	27%	52	21%	129	24%	280	26%
≥ 122	127	28%	220	26%	64	26%	134	25%	281	26%
Overall occupational activity[f]										
Category 4	38	8%	79	9%	19	8%	54	10%	84	8%
Category 3	158	35%	344	40%	100	40%	162	30%	448	42%
Category 2	84	19%	179	21%	58	23%	87	16%	253	23%
Category 1	59	13%	90	11%	30	12%	59	11%	125	12%
None	118	26%	163	19%	42	17%	181	33%	169	16%
Total energy consumption (kJ/wk)—continuous	53 941	17 357	54 356	19 111	57 966	20 659	54 427	18 617	55 030	19 195

Continued on the following page

TABLE 1 (continued)
Characteristics of study population by obesity and shift work status, northeastern Ontario, 1995–1998 (n = 1561)[a]

	Obesity status[b]						Shift work history			
	Normal (n = 457)		Overweight (n = 855)		Obese (n = 249)		Never shift workers (n = 543)		Ever shift workers[c] (n = 1079)	
	n/Mean	%/SD	n/Mean	%/SD	n/Mean	%/SD	n/Mean	%/SD	n/Mean	%/SD
Total energy consumption (kJ/wk)—categorical										
≤ 44 706	138	30%	243	28%	56	22%	144	27%	306	28%
44 707–54 784	101	22%	209	24%	68	27%	129	24%	262	24%
54 785–66 330	93	20%	193	23%	50	20%	102	19%	138	22%
≥ 66 331	96	21%	152	18%	59	24%	106	20%	209	19%
Unknown	29	6%	58	7%	16	6%	62	11%	64	6%

Abbreviations: kJ/wk, kilojoules per week; SD, standard deviation.

[a] Data source: Lightfoot N, Conlon M, Kreiger N, Sass-Kortsak A, Purdham J, Darlington G. Medical history, sexual, and maturational factors and prostate cancer risk. Ann Epidemiol. 2004;14(9): 655-62.

[b] n = 61 individuals were missing BMI information.

[c] Workers who have ever participated in any type (evening/night, rotating and other) of shift work.

[d] Three participants (1 normal weight, 1 overweight, 1 obese; all 3 non-shift workers) missing marital status.

[e] Total number of hours that men reported engaging in moderate- or vigorous-intensity physical activity during four lifetime periods (teens, thirties, fifties and 5 years prior to the study).

[f] Intensity of occupational activity reported in four time periods (respondents' twenties, thirties and fifties, and 5 years prior to the study). Those reporting any moderate or strenuous occupational activity were classified in four categories: Category 1 = moderate/strenuous activity in 1 time period, Category 2 = moderate/strenuous activity in 2 time periods, Category 3 = moderate/strenuous activity in 3 time periods, Category 4 = moderate/strenuous activity in 4 time periods.

work and other health outcomes such as cancer. Specifically, several studies examining relationships between shift work and breast cancer in women have observed an elevated breast cancer risk among long-term shift workers.[1,40,41] Earlier analysis of the prostate cancer case-control study that is the data source for this analysis found an association between 7 or fewer years of rotating shift work and prostate cancer risk, but no associations for longer durations,[42] while a 2012 Canadian study demonstrated an elevated risk of prostate cancer for each of three durations of shift work: less than 5 years, 5 to 10 years and 10 or more years.[43] In addition, recent results from Spain demonstrated nonsignificant increased risks of prostate cancer among both permanent and rotating night workers who had worked these shifts for 28 or more years.[44] No studies specifically examining relationships between shift work, obesity and cancer risk in a longitudinal context have been conducted.

Several mechanisms through which shift work exposure could be associated with obesity have been suggested, mainly revolving around circadian disruption. For example, metabolic efficiency is different depending on the time of day at which food is consumed and thus, differences in meal timing among individuals working at night could be a mechanism through which shift work influences obesity.[45] Sleep disturbances may also influence metabolism, and several studies have demonstrated that sleep durations are generally shorter among individuals working at night.[2,18,46,47] While total energy intake was available in this study, the timing of meals and information concerning sleep patterns (such as duration) was not, thus the impact of these mechanisms could not be evaluated.

TABLE 2
Work environments for individual jobs based on different shift types, northeastern Ontario, 1995–1998 (n = 1561)[a]

Shift type	Work environment																			
	Mine (n = 790)		Factory/ plant floor (n = 1426)		Laboratory (n = 73)		Vehicle (n = 730)		Restaurant/ hotel (n = 107)		Warehouse floor (n = 179)		Outdoors (n = 1425)		Construction site (n = 433)		Office (n = 1370)		Other (n = 1623)	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Day	137	17	624	44	53	73	394	54	35	33	132	74	1019	86	373	86	1177	86	1108	68
Evening/ night	19	2	38	3	1	1	23	3	12	11	4	2	22	2	3	1	29	2	50	3
Rotating	495	63	693	49	19	26	146	20	19	18	31	17	148	10	39	9	70	5	235	14
Other	121	15	71	5	0	0	163	22	40	37	9	5	234	16	16	4	94	7	222	14

[a] Data source: Lightfoot N, Conlon M, Kreiger N, Sass-Kortsak A, Purdham J, Darlington G. Medical history, sexual, and maturational factors and prostate cancer risk. Ann Epidemiol. 2004;14(9): 655-62.

TABLE 3
Associations of ever[a] shift work with overweight and obesity, northeastern Ontario, 1995–1998 (n = 1561)[b]

Type of shift work[c]	Normal (n = 457)			Overweight (n = 855)				Obese (n = 249)			
	n	%	OR[d] (95% CI)	n	%	OR[b] (95% CI)	OR[e] (95% CI)	n	%	OR[b] (95% CI)	OR[e] (95% CI)
Evening/night shift work	30	7	1.00 (ref)	67	8	1.21 (0.77–1.89)	1.12 (0.70–1.79)	22	9	1.38 (0.78–2.45)	1.31 (0.71–2.39)
Rotating shift work	178	39	1.00 (ref)	410	48	1.44 (1.15–1.82)	1.34 (1.05–1.73)	135	53	1.77 (1.30–2.42)	1.57 (1.12–2.21)
Other shift work	136	30	1.00 (ref)	252	29	0.99 (0.77–1.27)	0.98 (0.75–1.28)	71	29	0.94 (0.67–1.32)	0.97 (0.67–1.41)

Abbreviations: CI, confidence interval; OR, odds ratio; ref, referent.

[a] Ever shift workers were men who reported ever having worked in evening/night, rotating or other types of shifts.

[b] Data source: Lightfoot N, Conlon M, Kreiger N, Sass-Kortsak A, Purdham J, Darlington G. Medical history, sexual, and maturational factors and prostate cancer risk. Ann Epidemiol. 2004;14(9): 655-62.

[c] Categories of shift work type (e.g. night vs. rotating, etc.) are not mutually exclusive.

[d] Unadjusted model.

[e] Model adjusted for age, education and family income.

Strengths and limitations

Strengths of this study include the population-based design allowing multiple patterns of shift work to be captured within a single population. Compared to previous studies conducted in single industries or workplaces that examined only one type of shift pattern,[7,8,10-15,17,19,20,23,24,26,27] this analysis demonstrated that relationships with obesity were stronger for rotating shift work patterns than permanent evening/night shift patterns. This analysis also considered the influence of several potential confounders of shift work–obesity relationships, an improvement over previous studies for which lack of appropriate consideration of possible confounders was identified as a limitation in a 2011 review.[28] Finally, this study used a lifetime occupational history to characterize shift work, a more comprehensive method of exposure assessment than many previous studies in which only an individual's current job or employment history with one company were considered.[7-11,13-17,19-25,27]

Despite these strengths, certain limitations of our study exist. Although the use of a population-based dataset allowed for a broader range of shift patterns (permanent evening/nights and rotating) to be captured within a single study than in most previous work,[7-27] detailed information concerning shift characteristics (such as specific rotation patterns, the number of consecutive nights, forward vs. backward rotation pattern) was not available. Furthermore, for our analysis, evening and night shifts were considered together, as were all types of rotating shift patterns that could include either evening or night shifts. The importance of information concerning specific features of shift work in exposure assessment was emphasized by a 2009 IARC Working Group,[48] and more work that incorporates these shift work characteristics when examining relationships with obesity is needed in the future. If different shift types produce different levels of circadian disruption then the

TABLE 4
Association of duration of rotating shift work with overweight and obesity status, northeastern Ontario, 1995–1998 (n = 1561)[a]

Duration of rotating shift work (years)	Normal (n = 457)		Overweight (n = 855)				Obese (n = 249)			
	n	%	n	%	OR (95% CI)[b]	OR (95% CI)[c]	n	%	OR (95% CI)[b]	OR (95% CI)[c]
None	279	61	447	52	1.00 (ref)	1.00 (ref)	117	47	1.00 (ref)	1.00 (ref)
>0–14	74	16	172	20	1.45 (1.06–1.98)	1.29 (0.93–1.80)	53	21	1.71 (1.13–2.58)	1.50 (0.96–2.35)
15–29	42	9	87	10	1.29 (0.87–1.92)	1.27 (0.83–1.96)	27	11	1.53 (0.90–2.60)	1.29 (0.72–2.29)
≥ 30	62	14	149	17	1.50 (1.08–2.09)	1.42 (0.99–2.03)	52	21	2.00 (1.31–3.07)	1.86 (1.16–2.96)
p-trend					.008	.03			< .001	.008

Abbreviations: CI, confidence interval; OR, odds ratio; ref, referent.

[a] Data source: Lightfoot N, Conlon M, Kreiger N, Sass-Kortsak A, Purdham J, Darlington G. Medical history, sexual, and maturational factors and prostate cancer risk. Ann Epidemiol. 2004;14(9): 655-62.

[b] Unadjusted model.

[c] Model adjusted for age, education and family income.

combining of shift types, as was done in our analysis, could produce residual confounding.

Long work hours have also been associated with risk of obesity;[49] however, data concerning this issue was not available in our study. In addition, although approximately 1500 men were included in this study, the proportion exposed to evening/night shift work in each obesity group was relatively small (< 10%). Because of this small sample size, and particularly as we could not consider duration of this type of shift work, this study may have had limited power to detect real associations between permanent evening/night shift work and obesity. Future studies including a greater number of permanent evening/night shift workers will be better able to examine these relationships. In addition, there may be residual confounding by work environment if specific characteristics of certain work environments other than shift work are the true risk factors for obesity. However, given that the results of our study showing that rotating shift work increases the risk of obesity are consistent with previous work conducted in several different workplaces,[7,17,19,20,22,27] it seems more likely that the observed shift work–obesity relationship is real.

The use of self-reported heights and weights to assess BMI presents a risk of outcome misclassification, as overestimates of height and underestimates of weight in self-reported data can lead to underestimates of BMI.[50] BMI misclassification could have reduced the precision of estimates of associations between shift work and overweight and obesity, as truly overweight or obese participants could have been included in the normal weight group. However, the proportion of men classified as overweight or obese in our study (70.7%) is similar to proportion of overweight and obese men aged 45 years and over from northeastern Ontario health units (68.0%) measured by Statistics Canada in 2000.[51]

Self-report was also used for measures of diet, as well as for general and occupational physical activity, such that all three of these measures could be affected to some extent by misclassification. However, given that these measures were used descriptively in the study population but were not included in multivariate models assessing shift work–obesity associations, any misclassification is unlikely to have influenced the observed relationships.

The relatively low response rate for controls in this data set (47.5%) also presents a possible selection bias, specifically if study participation was related to both shift work history and obesity status. However, the proportion of men with a history of shift work in our study (33%) is similar to the proportion of Canadians reported to be employed in shift work in the 2005 Statistics Canada Survey of Labour and Income Dynamics,[52] which could suggest shift work was not a major determinant of study participation. While one might suspect that the true proportion of shift workers in northeastern Ontario is higher than the national average, such that shift workers are underrepresented in our study population, given that study participation did not appear to be associated with obesity status, any association between shift work and study participation is unlikely to produce a true selection bias.

Finally, as this study was conducted among men who were almost exclusively Caucasian,[30] these results may not be generalizable to other population subgroups, such as women or men of other ethnicities.

Conclusion

This study demonstrated a positive association between rotating shift work and overweight and obesity and suggested a relationship for evening/night shift work. We also observed associations between increasing duration of rotating shift work and obesity, with the strongest associations for long-term rotating shift work. While a number of studies previous to this have supported a relationship between shift work and obesity,[4,7,13-15,17-20,26,27] additional population-based research like ours will further clarify whether some shift patterns have a greater influence on obesity than others. As shift work is a necessary component of many occupations, understanding which shift patterns are related to health outcomes such as obesity is necessary for the development of policies on the optimal organization of shifts for workers' health.

Acknowledgements

Funding for the original prostate cancer case-control study was provided by research grants from the National Health Research and Development Program (Project No. 6606-5574-502), The Northern Cancer Research Foundation and The Canadian Union of the Mine, Mill & Smelter Workers—Local 598. Anne Grundy was supported during this work by a post-doctoral fellowship from Cancer Care Ontario.

Conflicts of interest

The authors have no conflicts of interest to declare.

Authors' contributions

NL was the principal investigator of the Men's Health Study, the prostate cancer case-control study from which data for this analysis was drawn. Design of the shift work analysis, statistical analysis, interpretation of results and manuscript writing was performed by AG, with feedback from MC, VK, VN, NL and NK.

References

1. Wang X-S, Armstrong MEG, Cairns BJ, Key TJ, Travis RC. Shift work and chronic disease: the epidemiological evidence. Occup Med (Lond). 2011; 61(2):78-89.

2. Pan A, Schernhammer ES, Sun Q, Hu FB. Rotating night shift work and risk of type 2 diabetes: two prospective cohort studies in women. PLoS Med. 2011;8(12):e1001141. doi: 10.1371 /journal.pmed.1001141

3. Morikawa Y, Nakagawa H, Miura K, et al. Shift work and the risk of diabetes mellitus among Japanese male factory workers. Scand J Work Environ Health. 2005;31(3):179-83.

4. Karlsson B, Knutsson A, Lindahl B. Is there an association between shift work and having a metabolic syndrome? Results from a population based study of 27 485 people. Occup Environ Med. 2001;58(11):747-52.

5. De Bacquer D, Van Risseghem M, Clays E, Kittel F, De Backer G, Braeckman L. Rotating shift work and the metabolic syndrome: a prospective study. Int J Epidemiol. 2009; 38(3):848-54.

6. Straif K, Baan R, Grosse Y, et al. Carcinogenicity of shift-work, painting, and fire-fighting. Lancet Oncol. 2007;8(12):1065-6.

7. Di Lorenzo L, De Pergola G, Zocchetti C, et al. Effect of shift work on body mass index: results of a study performed in 319 glucose-tolerant men working in a Southern Italian industry. Int J Obes Relat Metab Disord. 2003;27(11):1353-8.

8. Parkes KR. Shift work and age as interactive predictors of body mass index among offshore workers. Scand J Work Environ Health. 2002;28(1): 64-71.

9. Geliebter A, Gluck ME, Tanowitz M, Aronoff NJ, Zammit GK. Work-shift period and weight change. Nutrition. 2000 Jan;16(1):27-9.

10. Nakamura K, Shimai S, Kikuchi S, et al. Shift work and risk factors for coronary heart disease in Japanese blue-collar workers: serum lipids and anthropometric characteristics. Occup Med (Lond). 1997;47(3):142-6.

11. Ghiasvand M, Heshmat R, Golpira R, et al. Shift working and risk of lipid disorders: a cross-sectional study. Lipids Health Dis. 2006;5:9. doi: 10.1186/1476-511X-5-9.

12. Karlsson BH, Knutsson AK, Lindahl BO, Alfredsson LS. Metabolic disturbances in male workers with rotating three-shift work. Results of the WOLF study. Int Arch Occup Environ Health. 2003;76(6):424-30.

13. Ishizaki M, Morikawa Y, Nakagawa H, et al. The influence of work characteristics on body mass index and waist to hip ratio in Japanese employees. Ind Health. 2004;42(1):41-9.

14. Macagnan J, Pattussi MP, Canuto R, Henn RL, Fassa AG, Olinto MT. Impact of nightshift work on overweight and abdominal obesity among workers of a poultry processing plant in southern Brazil. Chronobiol Int. 2012;29(3): 336-43.

15. Chen JD, Lin YC, Hsiao ST. Obesity and high blood pressure of 12-hour night shift female clean-room workers. Chronobiol Int. 2010;27(2):334-44.

16. Ha M, Park JP. Shiftwork and metabolic risk factors of cardiovascular disease. J Occup Health. 2005;47:89-95.

17. Manenschijn L, van Kruysbergen RGPM, de Jong FH, Koper JW, van Rossum EFC. Shift work at young age is associated with elevated long-term cortisol levels and body mass index. J Clin Endocrinol Metab. 2011;96(11): E1862-E1865.

18. Wang X-S, Travis RC, Reeves G, et al. Characteristics of the Million Women Study participants who have and have not worked at night. Scand J Work Environ Health. 2012;38(6):590-9.

19. Suwazono Y, Dochi M, Sakata K, et al. A longitudinal study on the effect of shift work on weight gain in male Japanese workers. Obesity (Silver Spring). 2008;16(8):1887-93.

20. Morikawa Y, Nakagawa H, Miura K, et al. Effect of shift work on body mass index and metabolic parameters. Scand J Work Environ Health. 2007;33(1):45-50.

21. van Amelsvoort LG, Schouten EG, Kok FJ. Impact of one year of shift work on cardiovascular disease risk factors. J Occup Environ Med. 2004; 46(7):699-706.

22. van Amelsvoort L, Schouten EG, Kok FJ. Duration of shiftwork related to body mass index and waist to hip ratio. Int J Obes Relat Metab Disord. 1999;23(9):973-8.

23. Sakata K, Suwazono Y, Harada H, Okubo Y, Kobayashi E, Nogawa K. The relationship between shift work and the onset of hypertension in male Japanese workers. J Occup Environ Med. 2003;45(9):1002-6.

24. Yamada Y, Kameda M, Noborisaka Y. Excessive fatigue and weight gain in cleanroom workers after changing from an 8-hour to a 12-hour shift. Scand J Work Environ Health. 2001; 27(5):318-26.

25. Watari M, Uetani M, Suwazono Y, Kobayashi E, Kinouchi N, Nogawa K. A longitudinal study of the influence of smoking on the onset of obesity at a telecommunications company in Japan. Prev Med (Baltim). 2006;43(2): 107-12.

26. Biggi N, Consonni D, Galluzzo V, Sogliani M, Costa G. Metabolic syndrome in permanent night workers. Chronobiol Int. 2008;25(2):443-54.

27. Kubo T, Oyama I, Nakamura T, et al. Retrospective cohort study of the risk of obesity among shift workers: findings from the Industry-based Shift Workers' Health study, Japan. Occup Environ Med. 2011;68(5):327-31.

28. van Drongelen A, Boot CRL, Merkus SL, Smid T, van der Beek AJ. The effects of shift work on body weight change - a systematic review of longitudinal studies. Scand J Work Environ Health. 2011;37(4):263-75.

29. Lightfoot N, Conlon M, Kreiger N, Sass-Kortsak A, Purdham J, Darlington G. Medical history, sexual, and maturational factors and prostate cancer risk. Ann Epidemiol. 2004; 14(9):655-62.

30. Darlington GA, Kreiger N, Lightfoot N, Purdham J, Sass-Kortsak A. Prostate cancer risk and diet, recreational physical activity and cigarette smoking. Chronic Dis Can. 2007; 27(4):145-53.

31. World Health Organization. Obesity: preventing and managing the global epidemic. Report of a WHO Consultation, Geneva, 3-5 Jun 1997. Geneva; 1998. 252 p.

32. Hosmer D, Lemeshow S. Special topics. In: Applied logistic regression. 2nd ed. Toronto (ON): John Wiley & Sons Inc; 2000. p. 260-352.

33. Schernhammer ES, Laden F, Speizer FE, et al. Rotating night shifts and risk of breast cancer in women participating in the nurses' health study. J Natl Cancer Inst. 2001;93(20):1563-8.

34. Lie J-AS, Kjuus H, Zienolddiny S, Haugen A, Stevens RG, Kjærheim K. Night work and breast cancer risk among Norwegian nurses: assessment by different exposure metrics. Am J Epidemiol. 2011;173(11):1272-9.

35. Hansen J, Lassen CF. Nested case-control study of night shift work and breast cancer risk among women in the Danish military. Occup Environ Med. 2012;69(8):551-6. doi: 10.1136/oemed-2011-100240.

36. Grundy A, Richardson H, Burstyn I, et al. Increased risk of breast cancer associated with long-term shift work in Canada. Occup Environ Med. 2013; 70(12):831-8.

37. Greenland S, Pearl J, Robins JM. Causal diagrams for epidemiologic research. Epidemiology. 1999;10(1): 37-48.

38. Szklo M, Nieto FJ. Epidemiology beyond the basics. 3rd ed. Burlington (MA): Jones & Bartlett Learning; 2014. p. 162-163.

39. Textor J, Hardt J, Knüppel S. DAGitty: a graphical tool for analyzing causal diagrams. Epidemiology. 2011;22(5):745.

40. Erren TC, Pape HG, Reiter RJ, Piekarski C. Chronodisruption and cancer. Naturwissenschaften. 2008; 95(5):367-82.

41. Wang F, Yeung KL, Chan WC, et al. A meta-analysis on dose-response relationship between night shift work and the risk of breast cancer. Ann Oncol. 2013;24(11):2724-32.

42. Conlon M, Lightfoot N, Kreiger N. Rotating shift work and risk of prostate cancer. Epidemiology. 2007;18(1): 182-3.

43. Parent M-É, El-Zein M, Rousseau M-C, Pintos J, Siemiatycki J. Night work and the risk of cancer among men. Am J Epidemiol. 2012;176(9): 751-9.

44. Papantoniou K, Castaño-Vinyals G, Espinosa A, et al. Night shift work, chronotype and prostate cancer risk in the MCC-Spain case-control study. Int J Cancer. 2015;137(5):1147-57.

45. Antunes LC, Levandovski R, Dantas G, Caumo W, Hidalgo MP. Obesity and shift work: chronobiological aspects. Nutr Res Rev. 2010;23(1):155-68.

46. Grundy A, Sanchez M, Richardson H, et al. Light intensity exposure, sleep duration, physical activity, and biomarkers of melatonin among rotating shift nurses. Chronobiol Int. 2009; 26(7):1443-61.

47. Grundy A, Tranmer J, Richardson H, Graham CH, Aronson KJ. The influence of light at night exposure on melatonin levels among Canadian rotating shift nurses. Cancer Epidemiol Biomarkers Prev. 2011;20(11):2404-12.

48. Stevens RG, Hansen J, Costa G, et al. Considerations of circadian impact for defining "shift work" in cancer studies: IARC Working Group Report. Occup Environ Med. 2011;68(2):154-62.

49. Luckhaupt SE, Cohen MA, Li J, Calvert GM. Prevalence of obesity among U.S. workers and associations with occupational factors. Am J Prev Med. 2014;46(3):237-48.

50. Shields M, Connor Gorber S, Tremblay M. Estimates of obesity based on self-report versus direct measures. Health Rep. 2008;19(2):61-76.

51. Statistics Canada. CANSIM database: Table 105-0007: Body mass index (BMI), by age group and sex, household population aged 18 and over excluding pregnant women, Canada, provinces, territories, health regions (January 2000 boundaries) and peer groups, every 2 years [Internet]. Ottawa (ON): Statistics Canada; [cited 2014 Feb 11]. Available from: http://www5.statcan.gc.ca/cansim

52. Williams C. Work-life balance of shift workers. Perspect Labour Income. 2008;75(5):5-16.

https://doi.org/10.24095/hpcdp.37.8.03

At-a-glance

The 2017 Canadian Chronic Disease Indicators

*CCDI Steering Committee**

Following the first major review of the Chronic Disease and Injury Indicator Framework (CDIIF) since its inception in 2012, the 2017 edition is being released in this issue of *Health Promotion and Chronic Disease Prevention in Canada* (HPCDP) under its new name: Canadian Chronic Disease Indicators (CCDI; see Table 1).

Background

The Public Health Agency of Canada (PHAC) developed the Chronic Disease Indicator Framework in 2012 in order to improve access to current surveillance data by providing up-to-date, consistent, reliable and ongoing information on chronic disease and associated risk and protective factors. In 2014, the Framework was expanded to include injury, and was renamed Chronic Disease and Injury Indicator Framework (CDIIF). The CDIIF includes indicators based on six main domains: social and environmental determinants, maternal and child health risk and protective factors (RPFs), behaviour RPFs, risk conditions, disease prevention practices, and health outcomes/status. Its target audience is policy makers and public health professionals but it has broad applicability as a reference tool. The CDIIF is updated annually and made publicly available online through an interactive data tool and a downloadable summary document called "Quick Stats," and is published in the HPCDP Journal.

In early 2016, a steering committee was established to provide direction and make decisions related to the ongoing refinement, improvement and dissemination of the CDIIF and its related products. The steering committee is comprised of PHAC members with knowledge and expertise in domains covering the following topic areas: chronic disease (including mental illness); chronic disease RPFs; family violence and elder abuse; and maternal, child and youth health. While the initial set of indicators was determined by a core group and after broad internal and external stakeholder consultations, the committee undertook a comprehensive review of these indicators to identify gaps and areas for improvement.

Main changes to the CDIIF

As a result of their review, the steering committee took the following actions:

(1) ***Refocussed the scope of the CDIIF to include only chronic disease and to exclude injury***, to reflect its original purpose and account for the inherent differences between chronic disease and injury in terms of risk factors, causes and outcomes.

(2) ***Renamed the CDIIF to Canadian Chronic Disease Indicators (CCDI)*** to reflect the change in scope and simplify the title.

(3) ***Revised the existing content to address important gaps and emerging issues.*** Nineteen new measures were added, 21 existing measures were deleted or replaced and many indicators were modified or merged.

- Additions included indicators that put more emphasis on social determinants and maternal and child health factors influencing the development of chronic diseases (such as community belonging, childhood poverty, weight gain, diabetes and hypertension during pregnancy, and preterm birth). Other indicators were added to include cannabis use (due to the upcoming legislative change in Canada), dementia, including Alzheimer's disease, exposure to second-hand smoke and the *Canadian 24-Hour Movement Guidelines for Children and Youth*.
- Changes were made to indicators related to multimorbidity and morbidity, contact with a health care professional and healthy eating and smoking.
- Deletions included redundant indicators, and all indicators related to intentional and unintentional injury, with the exception of suicide.

Future work

An in-depth review of indicators in the CCDI is anticipated to take place every three years. Data gaps identified for future consideration include resilience, social support, discrimination and stigma, built environment, prenatal smoking and alcohol consumption and developmental disorders.

* Marisol Betancourt, Brenda Branchard, Geneviève Gravel, Susie Dzakpasu, Wendy Hovdestad, Debjani Mitra, Siobhan O'Donnell, Jay Onysko, Louise Pelletier (chair), Karen C. Roberts

Author reference:

Public Health Agency of Canada, Ottawa, Ontario, Canada

Correspondence: Louise Pelletier, Public Health Agency of Canada, 785 Carling Avenue, AL 6806A, Ottawa, ON K1A 0K9; Tel: 613-960-5339; Email: louise.pelletier@phac-aspc.gc.ca

TABLE 1

CANADIAN CHRONIC DISEASE INDICATORS

QUICK STATS, 2017 EDITION

INDICATOR GROUP	INDICATOR MEASURE(S)	LATEST DATA[a]	DATA SOURCE (YEAR)
SOCIAL AND ENVIRONMENTAL DETERMINANTS			
Education	% of population that reports having less than a high school education, population aged 20+ years	12.1%	CCHS (2015)
Income	% of population living below low-income cut-offs, after tax, total population	9.2%	CIS (2015)
Childhood poverty	% of children living below low-income cut-offs, after tax, population aged < 18 years[b] (New)	8.6%	CIS (2015)
Employment	Average annual unemployment rate (% of labour force that was unemployed during reference period), population aged 15+ years	7.1%	LFS (2016)
Community belonging	% of population that reports a "very strong" or "somewhat strong" sense of belonging to their local community, population aged 12+ years (New)	67.9%	CCHS (2015)
MATERNAL AND CHILD HEALTH RISK AND PROTECTIVE FACTORS			
Family violence	% of population that reports experiencing any of three types of child abuse (physical abuse, sexual abuse or exposure to intimate partner violence) before the age of 15, population aged 15+ years	23.6%	GSS (2014)
Diabetes during pregnancy	Rate of pregnant women with diagnosed diabetes (pre-existing and gestational diabetes) (New)	81.7 per 1000 total births[c]	DAD (2015–2016)
Hypertension during pregnancy	Rate of pregnant women with diagnosed hypertension (pre-existing and gestational hypertension) (New)	68.1 per 1000 total births[c]	DAD (2015–2016)
Maternal weight during pregnancy	% of women who report gestational weight gain above recommended Health Canada guidelines (New)	48.9%	CCHS (2015)
Congenital heart defects	Rate of infants with congenital heart defects (New)	108.2 per 10 000 total births[c]	CCASS (2014)[d]
Preterm birth	% of live births with a gestational age at birth of less than 37 completed weeks (New)	8.0 per 100 live births	DAD (2015)
Breastfeeding	% of women who report exclusive breastfeeding of their child for at least the first 6 months of life, women aged 15+ years	31.7%	CCHS (2015)
Exposure to second-hand smoke	% of households with children aged < 15 years that report regular child exposure to environmental tobacco smoke at home	2.8%	CTADS (2015)
BEHAVIOURAL RISK AND PROTECTIVE FACTORS			
24-hour movement	% of children and youth who meet the 24-Hour Movement Guidelines, population aged 5 to 17 years (New)	9.5%	CHMS (2014–2015)
Physical activity	% of children and youth who meet physical activity recommendations by accumulating at least 60 minutes of moderate-to-vigorous physical activity per day (measured data), population aged 5 to 17 years	37.6%[e]	CHMS (2014–2015)
	% of adults who meet physical activity guidelines by accumulating at least 150 minutes of moderate-to-vigorous physical activity each week, in bouts of 10 minutes or more (measured data), population aged 18+ years	17.5%	CHMS (2014–2015)
Sedentary behaviour	% children and youth who report meeting sedentary behaviour recommendations by spending 2 hours or less per day watching television or using computers during leisure time, population aged 5 to 17 years	28.5%[e]	CHMS (2014–2015)
Sleep	% of population that reports obtaining the recommended amount of daily sleep, population aged 5+ years	65.5%	CHMS (2014–2015)
Nutrition	% of population that reports consuming fruit and vegetables at least 5 times/day, population aged 12+ years	31.5%[e]	CCHS (2015)
	% of children and youth who report drinking sugar-sweetened beverages daily, population aged 5 to 17 years	16.0%	CHMS (2014–2015)
Chronic stress	% of population that reports life to be "quite a bit" or "extremely" stressful most days in the last 12 months, population aged 12+ years	21.4%	CCHS (2015)
Alcohol use	% of population that reports exceeding low risk alcohol drinking guidelines for chronic drinking, population aged 15+ years	15.2%	CTADS (2015)
Smoking	% of population that reports being current smokers (daily or occasional), population aged 15+ years	13.0%	CTADS (2015)
Drug use	% of population that reported using cannabis at least once a week in the last 3 months, population aged 15+ years (New)	5.2%	CTADS (2015)
Main chronic disease risk factors prevalence	% of population that reports having at least one of four main chronic disease risk factors (tobacco smoking, physical inactivity, unhealthy eating and harmful use of alcohol), population aged 20+ years (New)	84.7%	CCHS (2015)
RISK CONDITIONS			
Obesity	% of children and youth that are obese (measured data), population aged 5 to 17 years	13.1%	CHMS (2014–2015)
	% of adults that are obese (measured data), population aged 18+ years	28.1%	CHMS (2014–2015)
Elevated blood glucose	% of population with elevated[f] blood glucose (measured data), population aged 18+ years	4.1%	CHMS (2014–2015)
Elevated blood cholesterol	% of population with elevated[f] blood cholesterol [TC:HDL-C ratio] (measured data), population aged 18+ years	18.7%	CHMS (2014–2015)
Hypertension	% of population with diagnosed hypertension, population aged 20+ years	25.1%	CCDSS (2013/14)[g]

INDICATOR GROUP	INDICATOR MEASURE(S)	LATEST DATA[a]	DATA SOURCE (YEAR)
DISEASE PREVENTION PRACTICES			
Contact with health care professional	% of population that reports having a regular healthcare provider, population aged 12+ years (New)	81.8%	CCHS (2015)
	% of population that reported consulting a dentist, dental hygienist or orthodontist at least once in the past 12 months, population aged 12+ years	68.5%	CCHS (2015)
Disease screening	% of women who report having had a mammogram at least once in the past 5 years, population aged 50 to 74 years	83.5%	CCHS (2012)
	% of women who report having had at least one Pap smear test in the past 3 years, population aged 25 to 69 years	79.7%	CCHS (2012)
	% of population that reports having had at least one fecal occult blood test, colonoscopy and/or sigmoidoscopy in the recommended time period, population aged 50 to 74 years	51.1%	CCHS (2012)
Vaccination (influenza)	% of population living with a chronic health condition that reported having a seasonal flu shot in the past 12 months, population aged 12+ years	50.0%	CCHS (2015)
HEALTH OUTCOMES/STATUS			
General health	% of population that reports their health is "very good" or "excellent," population aged 12+ years	62.0%	CCHS (2015)
	% of population that reports their mental health is "very good" or "excellent," population aged 12+ years	72.5%	CCHS (2015)
	Life expectancy at birth	83 years	CCDSS (2010/11–2012/13)
	Life expectancy at age 65	21.6 years	CCDSS (2010/11–2012/13)
	Health-adjusted life expectancy at birth	71.9 years	CCDSS (2010/11–2012/13)
	Health-adjusted life expectancy at age 65	16.6 years	CCDSS (2010/11–2012/13)
Morbidity—prevalence	% of population with diagnosed diabetes, population aged 1+ years	8.1%	CCDSS (2013/14)
	% of population that reports having diagnosed cardiovascular diseases (heart disease or stroke), population aged 20+ years	5.8%	CCHS (2015)
	% of population with diagnosed stroke, population aged 20+ years	2.7%	CCDSS (2013/14)
	% of population with diagnosed heart failure, population aged 40+ years	3.7%	CCDSS (2013/14)
	% of population with diagnosed ischemic heart disease, population aged 20+ years	8.5%	CCDSS (2013/14)
	% of population with diagnosed asthma, population aged 1+ years	11.1%	CCDSS (2013/14)
	% of population with diagnosed chronic obstructive pulmonary disease, population aged 35+ years	9.9%	CCDSS (2013/14)
	% of population that reports ever being diagnosed with cancer, population aged 12+ years (New)	7.1%	CCHS (2015)
	% of population that reports ever having symptoms consistent with at least 1 of 6 mental or substance use disorders,[h] population aged 15+ years	33.3%	CCHS (2012– MH)
	% of population that reports having diagnosed mood and/or anxiety disorders, population aged 12+ years	12.2%	CCHS (2015)
	% of population with diagnosed osteoarthritis, population aged 20+ years (New)	13.0%	CCDSS (2013/14)
	% of population with diagnosed osteoporosis, population aged 40+ years	11.7%	CCDSS (2013/14)
	% of population with diagnosed dementia, including Alzheimer's disease, population aged 65+ years (New)	7.1%	CCDSS (2013/14)
	% of population that reports having been diagnosed with at least 1 of the 5 major chronic diseases,[i] population aged 20+ years (New)	29.2%	CCHS (2015)
Multimorbidity	% of population that reports having been diagnosed with at least 2 of the 5 major chronic diseases,[i] population aged 20+ years (New)	6.9%	CCHS (2015)
	% of population that reports having been diagnosed with at least 2 of the 10 common chronic diseases,[j] population aged 20+ years	15.8%	CCHS (2015)
Morbidity—incidence	Rate of newly diagnosed diabetes cases, population aged 1+ years	593.1 per 100 000	CCDSS (2013/14)
	Rate of newly diagnosed asthma cases, population aged 1+ years	487.5 per 100 000	CCDSS (2013/14)
	Rate of newly diagnosed chronic obstructive pulmonary disease cases, population aged 35+ years	830.9 per 100 000	CCDSS (2013/14)
	Rate of newly diagnosed heart failure cases, population aged 40+ years	534.7 per 100 000	CCDSS (2013/14)
	Rate of newly diagnosed ischemic heart disease cases, population aged 20+ years	604.1 per 100 000	CCDSS (2013/14)
	Rate of newly diagnosed acute myocardial infarction cases, population aged 20+ years	224.4 per 100 000	CCDSS (2013/14)
	Rate of newly diagnosed osteoarthritis cases, population aged 20+ years (New)	886.8 per 100 000	CCDSS (2013/14)
	Rate of newly diagnosed hip fracture cases, population aged 40+ years	158.4 per 100 000	CCDSS (2013/14)
	Rate of newly diagnosed dementia cases, including Alzheimer's disease, population aged 65+ years (New)	1426.5 per 100 000	CCDSS (2013/14)
	Rate of all newly diagnosed cancer cases, total population	563.6 per 100 000[k]	CCR/NCIRS (2017)
Disability	% of population that reports being limited in their activities "sometimes" or "often" due to disease/illness, population aged 12+ years	32.7%	CCHS (2014)

INDICATOR GROUP	INDICATOR MEASURE(S)	LATEST DATA[a]	DATA SOURCE (YEAR)
Mortality	Death rate due to a major chronic disease (diabetes, cancer, cardiovascular diseases, chronic respiratory diseases), total population	473.0 per 100 000	CVSD (2013)
	Death rate due to cardiovascular diseases, total population	194.7 per 100 000	CVSD (2013)
	Death rate due to cancer, total population	213.7 per 100 000	CVSD (2013)
	Death rate due to chronic respiratory diseases, total population	44.7 per 100 000	CVSD (2013)
	Death rate due to diabetes, total population	20.0 per 100 000	CVSD (2013)
	Death rate due to suicide, total population	11.5 per 100 000	CVSD (2013)
	Death rate due to dementia, including Alzheimer's disease, total population (New)	61.8 per 100 000	CVSD (2013)
	Death rate within one year of hip fracture, population aged 40+ years that had a hip fracture (New)	230.4 per 1000	CCDSS (2012/13)
Premature mortality	Probability of dying between ages 30 and 69 years from one of the major chronic diseases (cardiovascular diseases, cancer, chronic respiratory diseases, diabetes)	10.4%	CVSD (2013)
	Probability of dying between ages 30 and 69 years from cardiovascular disease	3.0%	CVSD (2013)
	Probability of dying between ages 30 and 69 years from cancer	6.3%	CVSD (2013)
	Probability of dying between ages 30 and 69 years from chronic respiratory disease	0.6%	CVSD (2013)
	Probability of dying between ages 30 and 69 years from diabetes	0.4%	CVSD (2013)

Abbreviations: CCASS, Canadian Congenital Anomalies Surveillance System; CCDSS, Canadian Chronic Disease Surveillance System; CCHS, Canadian Community Health Survey; CCR, Canadian Cancer Registry; CHMS, Canadian Health Measures Survey; CIS, Canadian Income Survey; CTADS, Canadian Tobacco, Alcohol and Drugs Survey; CVSD, Canadian Vital Statistics–Death Database; DAD, Discharge Abstract Database; GSS, General Social Survey; HDL-C, high-density lipoprotein cholesterol; LFS, Labour Force Survey; MH, Mental Health; NCIRS, National Cancer Incidence Reporting System; TC, total cholesterol.

Note: Indicators/measures identified as data gaps: Prenatal smoking, prenatal alcohol drinking, developmental disorders (including autism spectrum disorder [ASD] and fetal alcohol spectrum disorder [FASD]), social support, resilience, discrimination and stigma and built environment.

[a] All rates in this table are crude and based on actual data, unless otherwise stated.

[b] Includes all children aged 0–17 years living in economic families and not living in economic families.

[c] Total births include live births and stillbirths.

[d] One year follow-up.

[e] This indicator has changed from previous editions; estimates are not directly comparable.

[f] This indicator captures people found to have elevated levels of the risk condition measured in a single fasting sample regardless of diagnosis status (excluding pregnant women).

[g] CHMS data exist for this indicator to present pan-Canadian rates of blood pressure status by diagnosis.

[h] The six mental or substance use disorders include major depressive episode, bipolar disorder, generalized anxiety disorder and abuse of or dependence on alcohol, cannabis or other drugs.

[i] The five main groups of chronic diseases include: cancer, diabetes, cardiovascular diseases (heart disease and/or stroke), chronic respiratory diseases (asthma and/or chronic obstructive pulmonary disease) and mood and anxiety disorders.

[j] The 10 chronic diseases included are heart disease, stroke, cancer, asthma, chronic obstructive pulmonary disease, diabetes, arthritis, Alzheimer's disease or other dementia, mood disorders and anxiety disorders.

[k] These numbers are projected estimates for 2017 that are based on the August 2015 CCR tabulation master file (1992–2013) and the NCIRS (1969–1991).

Suggested citation: Public Health Agency of Canada. Canadian Chronic Disease Indicators, Quick Stats, 2017 Edition. Ottawa (ON): Public Health Agency of Canada; 2017. #CCDI

For questions or comments, please contact us at: infobase@phac-aspc.gc.ca

Visit the Canadian Chronic Disease Indicators "online tool" to view additional data breakdowns (e.g. by sex, trends over time, etc.): http://infobase.phac-aspc.gc.ca/. Please note that the 2017 online tool will be released in September 2017.

https://doi.org/10.24095/hpcdp.37.8.04

At-a-glance

The Physical Activity, Sedentary Behaviour and Sleep (PASS) Indicator Framework

Karen C. Roberts, MSc; Gregory Butler, MSc; Brenda Branchard; Deepa P. Rao, PhD; Victoria Otterman, BA; Wendy Thompson, MSc; Gayatri Jayaraman, PhD

The Physical Activity, Sedentary Behaviour and Sleep (PASS) Indicator Framework is being released in this issue of *Health Promotion and Chronic Disease Prevention in Canada* (HPCDP).

Background

Physical activity surveillance in Canada has traditionally focussed on measuring and reporting on the most active end of the activity spectrum. Emerging research suggests that in addition to insufficient moderate-to-vigorous physical activity (MVPA), sedentary behaviour and inadequate sleep are also important risk factors for chronic disease. In order to create effective public health policy and program initiatives to target all levels of activity (MVPA, light physical activity, sedentary behaviour and sleep), the demand for reliable, nationally representative data and information on the patterns of all of these behaviours among Canadians has increased. As a result, the need for a broader, modernized approach to national physical activity surveillance, with the inclusion of sedentary behaviour, sleep and the proximal and distal factors that impact all of these behaviours, was identified as a priority for the Public Health Agency of Canada (PHAC) in 2014.

An important first step in modernizing PHAC's surveillance approach was the development of an indicator framework to identify and systematically organize key indicators for routine reporting. The PASS Indicator Framework was informed by the research literature and developed through an iterative, consultative process with scientific experts and policy and program makers from across the country at various levels of government. In its final form, containing 55 unique indicators, the PASS Indicator Framework provides comprehensive, high quality information on the outcomes and risk and protective factors related to physical activity, sedentary behaviour and sleep for Canadian adults (aged 18+; see Table 1), children (aged 5–11 years; see Table 2) and youth (aged 12–17; see Table 2). The PASS Indicator Framework is centred around a conceptual model that incorporates a socioecological approach—addressing outcomes and factors at the individual and broader social and built-environment levels. It provides surveillance indicators and measures as well as calculated estimates using traditional and nontraditional data sources. Its target audience is key stakeholders such as provincial, territorial and regional public health officials as well as the federal Health Portfolio and other relevant government departments, organizations, ministries and public health units.

The PASS Indicators will be made publicly available on the PHAC Public Health Infobase website (infobase.phac-aspc.gc.ca) through an interactive data tool alongside the Canadian Chronic Disease Indicators and the Positive Mental Health Surveillance Indicator Framework. The interactive data tool can be used to monitor trends over time and offers the ability to break data down by key variables; it will support PHAC and stakeholders in targeting and monitoring intervention strategies. This issue of the HPCDP Journal contains the first Quick Stats documents containing the PASS Indicators.

Future work

The PASS Indicators are evergreen. Although measures and data exist to report on many indicators identified within the Indicator Framework, there are still gaps, especially at the environmental levels. Active enhancement and data development using surveys and nontraditional data sources, including administrative databases, is currently underway, as is targeted research and surveillance to address these data gaps.

Author reference:

Public Health Agency of Canada, Ottawa, Ontario, Canada

Correspondence: Behaviours, Environments and Lifespan Team, Centre for Surveillance and Applied Research, Public Health Agency of Canada, 785 Carling Avenue, Ottawa, ON K1A 0K9; Email: chronic.publications.chroniques@phac-aspc.gc.ca

TABLE 1

PHYSICAL ACTIVITY, SEDENTARY BEHAVIOUR AND SLEEP (PASS) INDICATORS

QUICK STATS, ADULTS (AGED 18+), CANADA, 2017 EDITION

INDICATOR GROUP	INDICATOR(S)	MEASURE(S)	LATEST DATA	DATA SOURCE (YEAR)
PHYSICAL ACTIVITY				
Individual	Physical activity guideline adherence	% of adults aged 18 to 79 years who meet physical activity guidelines by accumulating at least 150 minutes of moderate-to-vigorous physical activity each week, in bouts of 10 minutes or more	17.5%	CHMS (2014–2015)
	Total moderate-to-vigorous physical activity amount	Average number of minutes per day adults aged 18 to 79 years are engaged in moderate-to-vigorous physical activity	24.1 minutes	CHMS (2014–2015)
	Occupational physical activity and active chores amount	Average number of hours per week adults report doing physical activities while at work, in or around their home or while volunteering	2.9 hours	CCHS (2015)
	Leisure time physical activity amount	Average number of hours per week adults report doing sports, fitness or recreational physical activities, organized or non-organized, that lasted a minimum of 10 continuous minutes	1.8 hours	CCHS (2015)
	Sports participation amount	% of population aged 15 or older who reported regularly participating in any sports during the past 12 months	26.0%	GSS (2010)
	Active travel amount	% of adults who report walking or cycling to work or school	21.8%	CCHS (2014)
		Average number of hours per week adults report using active ways like walking or cycling to get to places	1.7 hours	CCHS (2015)
	Intention level	% of adults who, when thinking about the next six months, intend to be physically active	73.9%	PAM (2014–2015)
	Enjoyment level	% of adults who report that physical activity is generally pleasant	87.0%	PAM (2014–2015)
	Confidence level	% of adults who report they are confident that they could regularly do a total of 30 minutes or more of moderate physical activity three or four times a week	67.0%	PAM (2014–2015)
	Physical literacy	In development		
	Physical health status	% of adults who report their health is “very good” or “excellent”	61.1%	CCHS (2015)
	Mental health status	% of adults who report their mental health is “very good” or “excellent”	72.1%	CCHS (2015)
Family/social environment	Level of peer and spousal support	In development		
	Community norms	In development		
	Presence and type of barriers for physical activity	In development		
Built/society environment	Community walkability	In development		
	Presence of parks and recreation facilities	% of adults who “somewhat agree” or “strongly agree” that their neighbourhood has several free or low cost recreation facilities, such as parks, walking trails, bike paths, recreation centres, playgrounds, public swimming pools, etc.	78.1%	CCHS RR (2011)
	Presence of active transport infrastructure	% of adults who report their community has infrastructure that supports walking or biking (well-maintained sidewalks or designated areas for biking)	78.2%	CCHS RR (2011)
	Shower access at work	% of adults aged 18 to 75 who report having access to showers or change rooms at or near work	45.6%	CCHS (2007–2008)
	Community spending on sports and recreation programs	In development		
	Community spending on active transportation plans	In development		
SEDENTARY BEHAVIOUR				
Individual	Total sedentary time amount	Average number of hours per day spent sedentary, excluding sleep time, population aged 18 to 79 years	9.6 hours	CHMS (2014–2015)
	Recreational screen time amount	Average number of hours per week adults aged 18 to 79 years report spending on a computer or tablet, e.g. watching videos, playing computer games, emailing or surfing the Internet	25.0 hours	CHMS (2014–2015)
	Workplace sedentary time amount	In development		
	Non-active travel amount	In development		
	Awareness level	In development		
Family/social environment	Presence and type of barriers for reducing sedentary behaviour	In development		
	Work sedentary behaviour norms	In development		
Built/society environment	Supportive work policies	In development		

INDICATOR GROUP	INDICATOR(S)	MEASURE(S)	LATEST DATA	DATA SOURCE (YEAR)
SLEEP				
Individual	Nighttime sleep amount	Average number of hours adults aged 18 to 79 years report sleeping in a 24-hour period	7.2 hours	CHMS (2014–2015)
	Awareness about sleep benefits	In development		
	Sleep quality—sleep continuity	% of adults aged 18 to 79 years who report having trouble going to sleep or staying asleep "most of the time" or "all of the time"	24.9%	CHMS (2014–2015)
	Sleep quality—sleep efficiency	In development		
	Sleep hygiene—sleep timing	In development		
	Sleep hygiene—stress	In development		
	Sleep hygiene—physical activity	In development		
	Sleep hygiene—caffeinated beverage consumption	In development		
Family/social environment	Sleep routines	In development		
Built/society environment	Presence and type of barriers for sleep	In development		
	Electronic media in the bedroom	In development		
	Nocturnal environment noise	In development		

Abbreviations: CCHS, Canadian Community Health Survey; CCHS RR, Canadian Community Health Survey Rapid Response; CHMS, Canadian Health Measures Survey; GSS, General Social Survey; PAM, Physical Activity Monitor.

Note: "In development" refers to measures that are under development either because a data source is currently not available or because more research has to be done to identify a promising measure and data source.

Correspondence: Behaviours, Environments and Lifespan Team, Centre for Surveillance and Applied Research, Public Health Agency of Canada, 785 Carling Avenue, Ottawa, ON K1A 0K9; Email: chronic.publications.chroniques@phac-aspc.gc.ca

Suggested citation: Public Health Agency of Canada. Physical Activity, Sedentary Behaviour and Sleep (PASS) Indicators: Quick Stats, adults (aged 18+), Canada, 2017 edition. Ottawa (ON): Public Health Agency of Canada; 2017.

Visit the Physical Activity, Sedentary Behaviour and Sleep Indicators online: http://infobase.phac-aspc.gc.ca/

TABLE 2

PHYSICAL ACTIVITY, SEDENTARY BEHAVIOUR AND SLEEP (PASS) INDICATORS

QUICK STATS, CHILDREN (AGED 5 TO 11) AND YOUTH (AGED 12 TO 17), CANADA, 2017 EDITION

INDICATOR GROUP	INDICATOR(S)	MEASURE(S)	LATEST DATA	DATA SOURCE (YEAR)
PHYSICAL ACTIVITY				
Individual	Physical activity recommendation adherence	% of children and youth who meet physical activity recommendations by accumulating at least 60 minutes of moderate-to-vigorous physical activity per day	37.6%	CHMS (2014–2015)
	Total moderate-to-vigorous physical activity amount	Average number of minutes per day children and youth are engaged in moderate-to-vigorous physical activity	57.0 minutes	CHMS (2014–2015)
	24-hour movement	% of children and youth who meet the Canadian 24-Hour Movement Guidelines for Children and Youth	9.5%	CHMS (2014–2015)
	School physical activity amount	Average number of hours per week youth in Grades 6 to 10 report taking part in physical activity that makes them out of breath or warmer than usual during class time at school	2.3 hours	HBSC (2014–2015)
		Average number of hours per week that parents report children spend doing physical activity during class time	2.0 hours	CHMS (2014–2015)
	Sports participation amount (leisure time)	% of Canadian parents who report that their children participated in sports in the last 12 months	74.2%	PAM (2014–2015)
	Active play amount (leisure time)	% of children who accumulate 3 hours or less per week of active play (unstructured physical activity) outside of school	48.8%	CHMS (2014–2015)
	Active travel amount	% of youth who report walking or cycling to work or school	53.0%	CCHS (2014)
		Average amount of hours per week youth report using active ways like walking or cycling to get to places	3.3 hours	CCHS (2015)
	Intention level	In development		
	Enjoyment level	% of youth who report they enjoy being physically active	In development	
	Confidence level	% of youth who report they are confident in their ability to be physically active	In development	
	Physical literacy	In development		
	Physical health status	% of youth who report their health is “very good” or “excellent”	72.6%	CCHS (2015)
		% of parents who report the health of their child is “very good” or “excellent”	88.4%	CHMS (2014–2015)
	Mental health status	% of youth who report their mental health is “very good” or “excellent”	73.9%	CHMS (2014–2015)
		% of parents who report their child’s mental health is “very good” or “excellent”	In development	
Family/social environment	Level of parental support	% of Canadian parents who report “often” or “very often” playing active games with their children in the past year	36.1%	PAM (2014–2015)
	Level of peer support	% of youth in Grades 9 and 10 who report that most of their friends “often” participate in organized sports activities with others	58.2%	HBSC (2014)
Built/society environment	Perceived distance to school	In development		
	Level of community safety	% of Canadian parents who identify safety concerns as a barrier to children’s physical activity	24.0%	PAM (2014–2015)
	Community walkability	In development		
	Presence of parks and recreation facilities	% of youth who “somewhat agree” or “strongly agree” that their neighbourhood has several free or low cost recreation facilities, such as parks, walking trails, bike paths, recreation centres, playgrounds, public swimming pools, etc.	79.2%	CCHS RR (2011)
	Presence of active transport infrastructure	In development		
	Supportive policies at school	% of schools that have a committee that oversees policies and practices concerning physical activity (e.g. health action team)	42.3%	HBSC (2014 - Admin)
	Community spending on sports and recreation programs	In development		
	Community spending on active transportation plans	In development		

INDICATOR GROUP	INDICATOR(S)	MEASURE(S)	LATEST DATA	DATA SOURCE (YEAR)
SEDENTARY BEHAVIOUR				
Individual	Sedentary behaviour recommendation adherence	% of children and youth who report meeting sedentary behaviour recommendations by spending 2 hours or less per day watching television or using a computer during leisure time	28.5%	CHMS (2014–2015)
	Amount of sedentary time	Average number of hours per day children and youth spend sedentary, excluding sleep time	8.4 hours	CHMS (2014–2015)
	Recreational screen time amount	Average number of hours per week youth report spending on a computer or tablet, e.g. watching videos, playing computer games, emailing or surfing the Internet	4.2 hours	CHMS (2014–2015)
	Sedentary time at school	In development		
	Non-active travel amount	In development		
	Time spent outdoors	Average number of hours per day children spend outside	1.8 hours	CHMS (2014–2015)
Family/social environment	Parental awareness level	In development		
	Home screen time rules	In development		
Built/society environment	Presence of and access to electronic media	In development		
SLEEP				
Individual	Sleep recommendation adherence	% of children and youth who report meeting sleep recommendations by obtaining adequate sleep: 9 to 11 hours per night for ages 5 to 13 years and 8 to 10 hours per night for ages 14 to 17	70.7%	CHMS (2014–2015)
	Amount of sleep in 24-hour period	Average number of hours children and youth report sleeping in a 24-hour period	9.0 hours	CHMS (2014–2015)
	Daytime napping amount (5 years and under)	In development		
	Nighttime sleep amount	In development		
	Sleep quality—sleep continuity	% of children and youth who report having trouble going to sleep or staying asleep “most of the time” or “all of the time”	10.4%	CHMS (2014–2015)
	Sleep quality—sleep efficiency	In development		
	Sleep hygiene—sleep timing	In development		
	Sleep hygiene—stress	In development		
	Sleep hygiene—physical activity	In development		
	Sleep hygiene—caffeinated beverage consumption	In development		
Family/social environment	Home sleep rules and routines	% of parents who report they set regular bedtimes for their children and enforce them	In development	
Built/society environment	Electronic media in the bedroom	% of children and youth who report they have a television, computer or game console in their bedroom	In development	
	Nocturnal environment noise	In development		

Abbreviations: CCHS, Canadian Community Health Survey; CCHS RR, Canadian Community Health Survey Rapid Response; CHMS, Canadian Health Measures Survey; HBSC, Health Behaviours in School-aged Children; HBSC-Admin, Health Behaviours in School-aged Children Administrator Survey; PAM, Physical Activity Monitor.

Note: “In development” refers to measures that are under development either because a data source is currently not available or because more research has to be done to identify a promising measure and data source.

Correspondence: Behaviours, Environments and Lifespan Team, Centre for Surveillance and Applied Research, Public Health Agency of Canada, 785 Carling Avenue, Ottawa, ON K1A 0K9; Email: chronic.publications.chroniques@phac-aspc.gc.ca

Suggested citation: Public Health Agency of Canada. Physical Activity, Sedentary Behaviour and Sleep (PASS) Indicators: Quick Stats, children (aged 5 to 11) and youth (aged 12 to 17), Canada, 2017 edition. Ottawa (ON): Public Health Agency of Canada; 2017.

Visit the Physical Activity, Sedentary Behaviour and Sleep Indicators online: http://infobase.phac-aspc.gc.ca/

https://doi.org/10.24095/hpcdp.37.8.05

At-a-glance

A contextual analysis of the Suicide Surveillance Indicators

Robin Skinner, MSP; Brittany Irvine, MA; Gabriela Willams, MSc; Caryn Pearson, MA; Jaskiran Kaur, BHSc; Xiaoquan Yao, MSc; Lee Merklinger, MA; Tanya Lary, MA

The Federal Framework on Suicide Prevention[1] was developed by the Public Health Agency of Canada (PHAC) to set out Canada's strategic approach to suicide prevention, in accordance with *An Act Respecting a Federal Framework for Suicide Prevention* ("the Framework"), which became law in December 2012. The Framework included a commitment to publicly report statistics on suicide and associated risk factors. Towards this commitment, PHAC developed a set of indicators necessary for comprehensive suicide surveillance to inform suicide prevention initiatives. These indicators included measures of outcomes and risk and protective factors at the individual, family, community and societal level.

The Suicide Surveillance Indicators (SSI) were selected through a review of relevant literature retrieved from select publication databases (e.g. PubMed) and restrictions on type of evidence were applied: only systematic reviews, meta-analyses, literature reviews or government reports, published in English or French within the last six years, were eligible for inclusion. From this body of evidence, indicators—and data sources to operationalize measurement of indicators—were identified. External and internal stakeholders were asked to comment on the indicators and their operationalization. It is important to note that the literature review focussed on the general population only.

This At-a-glance brief presents the most current statistics available for reporting on the SSI. In addition, there is a brief analysis of select elements of the SSI to present the magnitude of the associations between certain mental illnesses[2,3] and suicide-related behaviours (suicide thoughts, plans and/or attempts) using the 2012 Canadian Community Health Survey—Mental Health Component (CCHS-MH).[4] Further studies should continue to explore and monitor the association between suicide outcomes and other risk and protective factors (e.g. child abuse, social support)[5] listed in the SSI in order to apply this knowledge to suicide prevention initiatives.

Results and discussion

Table 1 displays the SSI Quick Stats and presents current Canadian incidence rates of suicide-related mortality, self-inflicted injury hospitalizations and emergency department presentations, along with prevalence of suicidal thoughts, plans and attempts, and a list of key risk and protective factors. Canadian Vital Statistics indicate the suicide mortality rate was 11.5 per 100 000 people in 2013. Data from the CCHS 2015 indicate 2.5% of the population aged 15 years or older reported having suicidal thoughts (serious thoughts of committing suicide or of taking their own life), 0.8% had made a plan and 0.4% had attempted suicide, in the past 12 months.

With respect to mental illness, data from the CCHS-MH 2012 indicate 6.5% (95% CI: 6.0–7.0) of Canadians aged 15 years and older had symptoms consistent with a mood or generalized anxiety disorder in the past 12 months, 1.3% (95% CI: 1.1–1.5) reported ever being diagnosed by a health professional with schizophrenia or psychosis and 1.7% (95% CI: 1.4–2.0) with posttraumatic stress disorder.

Table 2 displays unadjusted odds ratios calculated from the CCHS-MH between select mental illnesses and suicide-related behaviours. The goal at this phase of analysis was to assess known individual relationships with suicide; however, future work will control for confounding factors. In addition, breakdowns of the proportions by variables such as age and sex will be available on the Government of Canada's Public Health Infobase in the future. Consistent with the literature,[2,3] having symptoms consistent with a mood or an anxiety disorder was significantly associated with suicide-related behaviours (OR = 18.1, 95% CI: 14.3–23.0). In addition, reporting a diagnosis of schizophrenia/psychosis, posttraumatic stress disorder or an eating disorder was also significantly associated with suicide-related behaviours, with odds ratios of 10.6 (95% CI: 6.9–16.1), 15.5 (95% CI: 10.3–23.5) and 13.0 (95% CI: 5.6–30.3) respectively.

The ongoing monitoring and sharing of surveillance data on suicide mortality, suicide-related behaviours and associated risk and protective factors is a foundational element for suicide prevention in Canada.

Author reference:

Public Health Agency of Canada, Ottawa, Ontario, Canada

Correspondence: Robin Skinner, Public Health Agency of Canada, 785 Carling Avenue, Ottawa, ON K1A 0K9; Tel: 613-799-5434; Email: robin.skinner@phac-aspc.gc.ca

TABLE 1

SUICIDE SURVEILLANCE INDICATORS

QUICK STATS, CANADA, 2017 EDITION

INDICATOR GROUP	INDICATOR MEASURE(S)	LATEST ESTIMATE	DATA SOURCE (YEAR)
SUICIDE AND SELF-INFLICTED INJURY OUTCOMES			
Suicide mortality	Mortality rate due to suicide, total population	11.5 per 100 000 people	CVS (2013)
Self-inflicted injuries, hospitalizations	Hospitalization rate for self-inflicted injuries (excluding Quebec)	50.2 hospitalizations per 100 000 people	DAD (2014/2015)
Self-inflicted injuries, emergency department	Emergency department (ED) presentation rate for self-inflicted injuries, Ontario	113.9 ED visits per 100 000 people	NACRS (2014/2015) (ON)
	Emergency department (ED) presentation rate for self-inflicted injuries, Alberta	160.5 ED visits per 100 000 people	NACRS (2014/2015) (AB)
	Proportion of emergency department (ED) presentations for self-inflicted injuries of total eCHIRPP cases among 10- to 24-year-olds	1072.8 ED visits per 100 000 eCHIRPP cases	eCHIRPP (2011–2016)
Suicidal thoughts	% of the population aged 15+ who report ever having serious thoughts of suicide or taking their own life (lifetime)	12.3%	CCHS (2015)
	% of the population aged 15+ who report having serious thoughts of suicide or taking their own life in past 12 months	2.5%	CCHS (2015)
Suicide plans	% of the population aged 15+ who report ever making a suicide plan (lifetime)	4.5%	CCHS (2015)
	% of the population aged 15+ who report making a suicide plan in past 12 months	0.8%	CCHS (2015)
Suicide attempts	% of the population aged 15+ who report ever attempting suicide or to take their own life (lifetime)	3.4%	CCHS (2015)
	% of the population aged 15+ who report attempting suicide or to take their own life in past 12 months	0.4%	CCHS (2015)
INDIVIDUAL-LEVEL RISK AND PROTECTIVE FACTORS			
Health status	% of the population aged 12+ who self-rate their health as *fair* or *poor*	10.7%	CCHS (2015)
	% of the population aged 12+ who self-rate their mental health as *fair* or *poor*[a]	5.9%	CCHS (2015)
	% of the population aged 12+ with moderate or severe disability, as per HUI[b]	31.7%	CCHS (2015)
	% of the population aged 12+ with one or more of these major chronic diseases: cancer, diabetes, cardiovascular and/or respiratory[c]	23.7%	CCHS (2015)
Chronic pain	% of the population aged 12+ who report having moderate to severe pain that *prevents some* or *most* activities	8.3%	CCHS (2015)
Sleep disturbances	% of the population aged 15+ who report having trouble going to sleep or staying asleep *most* or *all* of the time	14.5%	CCHS—Mental Health (2012)
Stress	% of the population aged 12+ who perceive most days as being *quite a bit* or *extremely* stressful in past 12 months	21.4%	CCHS (2015)
Mental illness	% of the population aged 15+ who report symptoms consistent with mood and/or generalized anxiety disorder (GAD) in past 12 months	6.5%	CCHS—Mental Health (2012)
	% of the population aged 15+ who report having been diagnosed with schizophrenia and/or psychosis by a health professional[d]	1.3%	CCHS—Mental Health (2012)
	% of the population aged 15+ who report having been diagnosed with an eating disorder by a health professional[d]	0.4%	CCHS—Mental Health (2012)
	% of the population aged 15+ who report having been diagnosed with posttraumatic stress disorder (PTSD) by a health professional[d]	1.7%	CCHS—Mental Health (2012)
Violence	% of the population aged 15+ who, before age 15, report experiencing at least one: physical or sexual violence by someone 18+ and/or exposure to violence exhibited by parents or guardians	32.9%	GSS—Victimization (2014)
	% of the population aged 15+ who report experiencing physical or sexual violence in past 12 months	4.1%	GSS—Victimization (2014)
	% of Grade 6 to 12 students who report being bullied by other students in past 30 days	25.1%	CSTADS (2014–2015)
Substance use	% of the population aged 15+ whose reported alcohol consumption exceeds Canada's Low-Risk Alcohol-Drinking Guidelines[e]	15.7%	CTADS (2013)
	% of the population aged 15+ who report experiencing at least one harm in past year due to illicit drug use[f]	2.9%	CTADS (2013)
School environment	% of Grade 6 to 10 students who *agreed* or *strongly agreed* that they felt they belonged at their school	63.1%	HBSC (2013–2014)
Personality	In development		

INDICATOR GROUP	INDICATOR MEASURE(S)	LATEST ESTIMATE	DATA SOURCE (YEAR)
FAMILY-LEVEL RISK AND PROTECTIVE FACTORS			
Family relationship	% of Grade 6 to 10 students who report getting the emotional help and support they need from own family	64.9%	HBSC (2013–2014)
	% of Grade 6 to 10 students who report having a lot of arguments with their parents	21.7%	HBSC (2013–2014)
	% of Grade 6 to 10 students who report it is *easy* or *very easy* to talk to their parents about things that really bother them	83.2%	HBSC (2013–2014)
Family mental illness and substance use	% of the population aged 15+ with a family member who has problems with their emotions, mental health or use of alcohol or drugs, and report that their life is affected *a lot* or *some* by their family member's problems	13.7%	CCHS—Mental Health (2012)
Family history of suicide-related behaviour	In development		
COMMUNITY-LEVEL RISK AND PROTECTIVE FACTORS			
Social support	% of the population aged 15+ who report having no family or close friends to talk to about what is on their mind, feel at ease with, or call on for help	6.0%	GSS—Social Identity (2013)
	% of the population aged 15+ who report being *satisfied* or *very satisfied* with the communication frequency with friends and relatives not living with them	91.5%	GSS—Social Identity (2013)
Sense of community belonging	% of the population aged 12+ who report a *somewhat strong* or *very strong* belonging to local community	67.9%	CCHS (2015)
Suicide contagion/clusters	In development		
SOCIETAL RISK AND PROTECTIVE FACTORS			
Mental health service access	% of the population aged 15+ who perceived a need for mental care in past 12 months	17.5%	CCHS—Mental Health (2012)
	% of population aged 15+ who perceived a need for mental health care in past 12 months, but reported it was not met or only partially met	33.3%	CCHS—Mental Health (2012)
Firearm possession	Number of individual firearm licence holders aged 18+ as of December 2016 (% of population aged 18+ possessing a firearm licence)	2 066 961 (7.3%)	RCMP (2016)[g]
Mental health literacy	In development		
Media reporting guidelines (adherence to)	In development		
Stigma	In development		
Poisoning control	In development		

Abbreviations: CCHS, Canadian Community Health Survey; CSTADS, Canadian Student Tobacco, Alcohol and Drugs Survey; CTADS, Canadian Tobacco, Alcohol and Drugs Survey; CV, coefficient of variation; CVS, Canadian Vital Statistics; DAD, Discharge Abstract Database; eCHIRPP, electronic Canadian Hospitals Injury Reporting and Prevention Program; GSS, General Social Survey; HBSC, Health Behaviour in School-aged Children; NACRS, National Ambulatory Care Reporting System; RCMP, Royal Canadian Mounted Police.

Notes: Categories in *italics* are from 5-scale measures (except for Sense of Community Belonging, with a 4-scale measure); "In development" refers to measures that are under development either because a data source is currently not available or because more research has to be done to identify a promising measure or data source.

Estimates with a CV less than 16.6% are considered reliable for general use (no flag). Estimates with a CV between 16.6% and 33.3% should be interpreted with caution due to high levels of error (E). Estimates with a CV higher than 33.3% are not shown since they are deemed to be unreliable (O).[6]

[a] Understanding positive mental health may help to support suicide prevention efforts. For information on measuring positive mental health outcomes, along with risk and protective factors that are associated with them, including spirituality and coping, please refer to the Positive Mental Health Surveillance Indicator Framework: http://infobase.phac-aspc.gc.ca/positive-mental-health/

[b] Health Utilities Index (HUI).

[c] Chronic bronchitis, emphysema or chronic obstructive pulmonary disease.

[d] Conditions diagnosed by a health professional and expected to last or have already lasted 6 months or more.

[e] People who drink within this guideline must drink "no more than two drinks a day, 10 per week for women, and three drinks a day, 15 per week for men, with an extra drink on special occasions." Canadian Centre on Substance Use and Addiction. http://www.ccsa.ca/eng/topics/alcohol/drinking-guidelines/pages/default.aspx

[f] Harm due to illicit drug use includes harm to friendships, physical health, home life/marriage, work, studies, employment opportunities and financial position, as well as legal problems, housing problems and difficulty learning things.

[g] Royal Canadian Mounted Police. Commissioner of Firearms 2016 report. Ottawa (ON): Royal Canadian Mounted Police; 2017 [Catalogue No.: PS96E-PDF].

Suggested citation: Public Health Agency of Canada. Suicide surveillance indicators: Quick Stats, Canada, 2017 edition. Ottawa (ON): Public Health Agency of Canada; 2017.

Visit the Suicide Surveillance Indicators online: http://infobase.phac-aspc.gc.ca/

TABLE 2
Prevalence of select mental illnesses and suicide-related behaviours and bivariate associations, estimates for Canadians aged 15 years and older

Risk factor	Unweighted n[a]	Estimate[b] (%)	95% CI,[b] α = .05	Suicide-related behaviours[c]			
				Estimate[b] (%)	95% CI,[b] α = .05	Unadjusted OR[b]	95% CI,[b] α = .05
Mood and/or generalized anxiety disorder (GAD) symptoms in past 12 months							
Yes	1 748	6.5	6.0–7.0	25.5	22.0–29.1	18.1	14.3–23.0
No*	21 876	93.5	93.0–94.0	1.9	1.6–2.1	1.0	
Reported schizophrenia and/or psychosis diagnosis by a health professional							
Yes	381	1.3	1.1–1.5	25.4	17.8–33.1	10.6	6.9–16.1
No*	23 268	98.7	98.5–99.0	3.1	2.8–3.5	1.0	
Reported posttraumatic stress disorder (PTSD) diagnosis by a health professional							
Yes	425	1.7	1.4–2.0	31.8	23.1–40.4	15.5	10.3–23.5
No*	23 205	98.3	98.1–98.6	2.9	2.6–3.2	1.0	
Reported an eating disorder diagnosis by a health professional							
Yes	102	0.4	0.3–0.5	30.7[E]	14.1–47.2	13.0	5.6–30.3
No*	23 546	99.6	99.5–99.7	3.3	2.9–3.6	1.0	

Source: 2012 Canadian Community Health Survey—Mental Health Component (Statistics Canada share-restricted data).

Abbreviations: CI, confidence interval; GAD, generalized anxiety disorder; OR, odds ratio; PTSD, posttraumatic stress disorder.

Note: Estimates with a coefficient of variation (CV) less than 16.6% are considered reliable for general use (no flag). Estimates with a CV between 16.6% and 33.3% should be interpreted with caution due to high levels of error (E). Estimates with a CV higher than 33.3% are not shown since they are deemed to be unreliable (O).[6]

[a] Count includes only cases where respondents completed survey questions related to both suicide-related behaviours and select mental illnesses.

[b] All estimates, CIs and ORs are weighted.

[c] Suicide-related behaviours include suicidal thoughts, plans and attempts in the past 12 months.

* Reference category for the measure of association.

References

1. Public Health Agency of Canada. Working together to prevent suicide in Canada: the federal framework for suicide prevention. Ottawa (ON): Government of Canada; 2016 [Catalogue No.: HP35-61/2015E-PDF]. 51 p.
2. Li Z, Page A, Martin G, Taylor R. Attributable risk of psychiatric and socio-economic factors for suicide from individual level, population-based studies: a systematic review. Soc Sci Med. 2011;72(4):608-16.
3. Taylor PJ, Hutton P, Wood L. Are people at risk of psychosis also at risk of suicide and self-harm? A systematic review and meta-analysis. Psychol Med. 2015;45(5):911-26.
4. Statistics Canada. 2012 Canadian Community Health Survey—Mental Health Component. Ottawa (ON): Statistics Canada; 2013.
5. Afifi TO, MacMillan HL, Boyle M, Taillieu T, Cheung K, Sareen J. Child abuse and mental disorders in Canada. CMAJ. 2014;186(9):E324-E332.
6. Statistics Canada. 5.0 Data accuracy and quality [Internet]. Ottawa (ON): Statistics Canada; [modified 2009 Sep 21; cited 2017 May 11]. Available from: http://www.statcan.gc.ca/pub/13f0026m/2007001/ch5-eng.htm

Other PHAC publications

Researchers from the Public Health Agency of Canada also contribute to work published in other journals. Look for the following articles published in 2017:

Fu WW, Fu TS, Jing R, **McFaull SR**, Cusimano MD. Predictors of falls and mortality among elderly adults with traumatic brain injury: a nationwide, population-based study. PLOS ONE. 2017;12(4):e0175868. doi: 10.1371/journal.pone.0175868.

Gilbert NL, Rotondo J, Shapiro J, **Sherrard L,** Fraser WD, Ward BJ. Seroprevalence of rubella antibodies and determinants of susceptibility to rubella in a cohort of pregnant women in Canada, 2008-2011. Vaccine. 2017;35(23):3050-5. doi: 10.1016/j.vaccine.2017.04.057.

https://doi.org/10.24095/hpcdp.37.8.07

Erratum

This erratum is being published to correct a data error on page 249 of the following article:

CCDI Steering Committee. At-a-glance – The 2017 Canadian Chronic Disease Indicators. Health Promot Chronic Dis Prev Can. 2017; 37(8):248-51.

Before correction

Smoking	% of population that reports being current smokers (daily or occasional), population aged 15+ years	30.0%	CTADS (2015)

After correction

Smoking	% of population that reports being current smokers (daily or occasional), population aged 15+ years	13.0%	CTADS (2015)

To avoid any confusion, the error was corrected in the article on August 14, 2017, and the PDF versions of the article and the issue were replaced on the same date to reflect the correction.