

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

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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.

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

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

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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 Bernard³² 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 far-fetched. 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 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 an 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 know's' 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 eating⁴⁴⁻⁴⁷ 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.

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Conflicts of interest

The author declares no conflicts of interest.

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