THWARTING THE SILENT THIEF: INFORMING NUTRITION-BASED OSTEOPOROSIS PREVENTION EDUCATION FOR CANADIAN YOUNG ADULTS

By

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A Thesis

Submitted to the School of Graduate Studies

In Partial Fulfillment of the Requirements

For the Degree

Doctor of Philosophy

McMaster University

DOCTOR OF PHILOSOPHY (2016) McMaster University

(Anthropology of Health) Hamilton, Ontario

TITLE: Thwarting the silent thief: Informing nutrition-based osteoporosis prevention education for Canadian young adults

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NUMBER OF PAGES: 216

ABSTRACT

This thesis makes recommendations for the design of future osteoporosis prevention education for young adults through the investigation of the relationship between nutrition knowledge and perceived osteoporosis risk. Osteoporosis is a significant public health issue in Canada and nutrition represents an important component of current osteoporosis prevention education. Most osteoporosis prevention is designed for older adults, excluding young adults who are making decisions that will affect their future disease risk. Designing osteoporosis prevention for young adults means creating tailored prevention programs for young adults. Using a mixed method approach that involved a survey, food frequency questionnaire (FFQ), qualitative interviews, and a pile sort activity, I explored how the interactions between perceptions of nutrition and health, dietary practices, and constructions of disease risk affected participation in osteoporosis prevention behaviors in sixty Canadian young adults (17-30 years). Three research questions represented the core of this investigation: How do perceptions of dietary intake of calcium and vitamin D compare to measured intake? How do perceptions of osteoporosis risk contribute to preventative dietary behaviors? Where and how do young adults acquire knowledge about bone health and nutrition and how can this be used to inform the design of prevention programs? These questions are addressed in this 'sandwich' thesis in three papers that have been submitted for publication.

Canadian young adults have been identified as having low dietary intake of calcium and vitamin D, which are essential nutrients for maintaining bone health. Understanding calcium and vitamin D consumption practices is therefore necessary to create targeted messaging that will result in greater intake of these nutrients. The majority of participants were found to perceive their intake of calcium and vitamin D to be adequate, when in fact they were estimated through the FFQ to be consuming inadequate amounts of both nutrients. Participants explained their perceptions of their diet as adequate due to their belief that their diet was healthy, the perceived absence of any nutrition-related symptoms, and the belief that calcium and vitamin D were present in many foods in their diet. Addressing these assumptions and encouraging young adults to question their intake

is necessary in engaging them with prevention education and modifying dietary behaviors.

Osteoporosis risk is heavily gendered in contemporary prevention programs that primarily target women. This differential focus creates disparities in how risk is understood in terms of perceived susceptibility, severity, and individuals' self-efficacy in undertaking prevention behaviors. The use of the Health Belief Model as a framework to investigate these perceptions of risk revealed that while neither gender was motivated to engage in osteoporosis prevention, beliefs about individual risk of disease were a negotiation between larger gender constructs of osteoporosis and a variety of risk factors. The design of new prevention programs needs to address these differential understandings of risk and create targeted education plans for men and women.

This study shows that designing prevention programs means adopting effective knowledge translation methods that recognize the sources of information that young adults rely on and their nutrition- and health-related interests. Making use of traditional (e.g., parents, doctors) and emerging (e.g., social media) sources, while creating messaging that is short, relatable and linked to current interests will help create prevention programs that engage young adults and motivate them to participate in prevention. The increasing incidence of osteoporosis signals a need for expanded prevention programs that move beyond the current at-risk population. To be effective these new programs need to address both the nutrition beliefs of young adults and the perceptions of disease risk in order to holistically address the barriers to engagement with prevention information experienced by this age group.

ACKNOWLEDGEMENTS

This thesis owes its existence to the support I received from everyone around me. Above all my supervisor Tina Moffat, who agreed to take me on even though I had no background in nutrition and no idea what I was doing, and shepherded me through the process of learning to be a nutritional anthropologist. I would not have been able to do this without her. I also owe thanks to my thesis committee members Stephanie Atkinson, Megan Brickley, and Wayne Warry who provided comments and guidance throughout the last five years and to my MA supervisor Andrew Nelson for continuing to support me even after I went to the 'dark side'. I am especially thankful to my fellow graduate students who were there to read, critique, and commiserate with me. I never would have made it through this process without Maddy Mant, Laura Lockau, Steph Marciniak, Lori D'Ortenzio, or Becky Plett. My friends and family deserve endless thanks. They may not have understood why I was doing this, but supported me throughout this endeavor without questioning my sanity for doing it and were always there with wine and chocolate when the need arose. And finally I would like to recognize my participants, without them there would be no thesis.

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STATEMENT OF ACADEMIC ACHEIVEMENT

I am the main contributor to the three articles presented in this thesis. Chapter 3, "Young adult perceptions of calcium and vitamin D consumption compared to measured intake: Insights for osteoporosis prevention education," is a co-authored submitted to the journal Public Health Nutrition. I am the first author. I designed, conducted, and transcribed the interview sessions and administered the food frequency questionnaire. I analyzed the data and wrote the first draft in collaboration with my co-author Dr. Tina Moffat. Chapter 4, "Gendered perceptions of osteoporosis among young Canadian adults: Implications for the design of prevention education programs" is a co-authored paper that has been submitted to the American Journal of Health Behavior. I am the first author and I designed, conducted and transcribed the interview sessions and administered the survey. I analyzed the data and wrote the first draft. My co-author Dr. Tina Moffat contributed significant editing and revisions to all drafts. Chapter 5, "Osteoporosis knowledge translation for young adults: New directions for prevention programs", is a single-authored paper submitted to the journal Osteoporosis International. I designed and administered the interviews, coded and analyzed the data, and wrote and revised all drafts.

CHAPTER 1: INTRODUCTION

1.1 Introduction and background

Osteoporosis represents a significant public health problem in Canada as disease metabolic bone disease that results from bone formation becoming uncoupled from resorption (Damilakis, Maris, & Karantamas, 2007; WHO, 2003b). This leads to a reduction in overall bone density, which decreases the ability of bone to resist loading. As a result, bone becomes more fragile and prone to fracture, even when subjected to normal levels of stress (Recker, Lappe, Davies, & Heaney, 2004). The gradual nature of bone loss has led to osteoporosis being termed the 'silent thief', since density changes are asymptomatic until a fracture occurs. The threat posed by osteoporosis is its chronicity; since osteoporosis is a disease of insidious onset that causes a long term reduction in quality of life (Braithwaite, Nananda, & Wong, 2003; Cockerill et al., 2004; Johnell & Kanis, 2005; Lips & Van Schoor, 2005). Osteoporosis is a condition of pain, reduced mobility, and in the case of hip and vertebral fractures, increased mortality. The only outward sign are fractures, which typically occur in bones with high metabolic activity, specifically the vertebral body, femoral neck, and distal forearm (Johnell & Kanis, 2005). The fracture itself, while painful, is short-lived and often heals. The sequelae from the fracture, which include pain, reduced mobility, depression, loss of independence and social isolation represent the real long term threat of osteoporosis (Cooper et al., 2011). However, it is the fractures that receive the most attention, and since they are temporally

bounded events, they serve to foster a public perception of osteoporosis as short-term, rather than chronic.

The increasing cost of treating osteoporosis—both the management of bone loss through pharmacological methods and the direct treatment of fractures— has led to a focus on prevention, rather than continued treatment (Tussing & Chapman-Novakofski, 2005; WHO, 2003b). Current treatment options involve pharmacological intervention to prevent new fractures in patients who have had a fracture or are at risk of fractures, and management of existing fractures. Medication is expensive, long term, and many have significant side effects; while fracture management often involves surgery, long recovery times, pain, and specialist care (Burge et al., 2007; Tarride et al., 2012). The economic burden osteoporosis care places on the Canadian heath care system is estimated at $2.3 billion dollars and is expected to grow as life expectancy and comorbidity increase (Tarride et al., 2012). As a result, the current emphasis is on preventing osteoporosis before fractures occur.

Osteoporosis prevention relies heavily on education, specifically about diet and exercise as these are viewed as modifiable factors (Kasper, Peterson, & Allegrante, 2001; Sedlak, Doheny, & Jones, 2000; Tussing & Chapman-Novakofski, 2005). Nutrition is the most heavily emphasized aspect of prevention, since adequate intake of bone-related nutrients is needed for exercise to be effective and diet is perceived as modifiable (Tussing & Chapman-Novakofski, 2005; WHO, 2003a). Prevention programs are managed by the non-profit organization Osteoporosis Canada, in concert with the

provincial and federal governments. Prevention programs are designed mainly for older adult women, who comprise the highest risk group (Osteoporosis Canada, 2010). Since osteoporosis is a progressive disease of decreasing bone density that is heavily influenced by hormonal changes during menopause, women in the fifth or sixth decade of life are most commonly affected (Compston, 2001).

Though osteoporosis emerges in the late decades of life, it is affected by dietary practices and other lifestyle, drug, and disease factors throughout the lifecourse (Uusi-Rasi et al., 1998; Uusi-Rasi, Sievanen, Pasanen, Oja, & Vuori, 2002; WHO, 2003a). Bone growth occurs longitudinally until the late teens to early twenties, where appositional growth continues to the mid-twenties (Burr & Allen, 2014; Currey, 2002; Dempster, 2008; Recker & Barger-Lux, 2002). At this time individuals reach their peak bone mass, and after this point bone is lost at a continual rate of at least 0.5% per year (Glowacki, 2002; Wren, Kim, Janicka, Sanchez, & Gilsanz, 2007). Bone loss can be attenuated or increased through dietary habits and other lifestyle factors throughout the lifecourse. As a result, the risk of developing osteoporosis is established throughout life, not just in the later decades when symptoms actually occur. In light of this risk, reducing the incidence of osteoporosis through prevention requires modifying behaviors at earlier ages to ensure that adolescents reach their peak bone mass and that behaviors that support healthy bones persist throughout life. Young adults represent an important group for targeted prevention. This age group is still building bone, whether longitudinally or appositionally, and they are also beginning to live independently (Kasper et al., 2001). At some point between 17-30 years most young adults leave their parental home and begin

to make independent food decisions. The food habits they develop set the trajectory for their future dietary patterns and have the ability to affect their future health (Neumark-Sztainer, Story, Perry, & Casey, 1999). Intervening in dietary choices and increasing osteoporosis knowledge as it relates to nutrition at this age has the potential to reduce the future incidence of osteoporosis by instigating bone positive heath behaviors that minimize bone loss. As a result, young adults represent an important group for targeted nutrition information.

The focus of prevention education on older women means that the messaging frameworks used are tailored to their interests and needs (Edstrom & Devine, 2001; Hsieh, Novielli, Diamond, & Cheruva, 2001; Hurd, 2000; Manafo, 2012; Roberto & Reynolds, 2001). As a result, osteoporosis prevention information is not reaching other age groups, who are less receptive to the problems and concerns of older Canadian women (Backett-Milburn, Parry, & Mauthner, 2000; Edstrom & Devine, 2001).

To actively reduce the rising incidence of osteoporosis, broader, targeted programs are needed. Designing effective prevention for osteoporosis requires knowledge of the bone health and nutrition beliefs of the population being studied. Individual perceptions of health risk and attitudes toward diet and nutrition influence how individuals understand, internalize, and apply osteoporosis information. While the food behaviors of young adults have been previously explored—including assessing osteoporosis knowledge, and calcium and vitamin D intake (Anderson, Chad, & Spink, 2005; Chang, 2006; El-Sabban & Badr, 2011; Terrio & Auld, 2002; Ziccardi, Sedlak, & Doheny,

2004)—the process by which young adults link their nutrition to their disease risk has not been investigated. Assessing osteoporosis knowledge and dietary intake can be used to identify gaps in information or pinpoint high-risk individuals, but it does not actively increase participation in prevention. Knowledge does not necessarily predict engagement in prevention behaviors and so it is important to explore the motivation behind participation in prevention behaviors and the perceptions young adults have of the role prevention plays in their lives. In order to design prevention that is effective for this age group, it is necessary to first understand how osteoporosis and diet are conceptualized and integrated into the lives of young adults. Before prevention strategies can be employed to effect behavioral change in young adults, it is essential to know if young adults are engaging in prevention activities and their motivations behind these decisions.

The investigation of young adult knowledge concerning osteoporosis education requires exploring where young adults gain knowledge about the relationship between osteoporosis and nutrition, how they use this information to establish their own perceived risk for osteoporosis, and how they apply this knowledge to their own dietary behaviors. Young adults are embedded within complex social networks that serve as a source of education about nutrition and disease, as well as a source of conflicting pressures on health behavior (Gray, Klein, Noyce, Sesselberg, & Cantrill, 2005). Exploring perceptions and beliefs about nutrition provide access to the processes by which young adults integrate nutrition and osteoporosis knowledge into their dietary choices. The purpose of this study was to address three main concerns: 1) the perceived intake of calcium and vitamin D compared to actual intakes and the food beliefs and meanings

associated with nutrition behaviors; 2) perceptions of osteoporosis risk and their relationship to dietary behaviors; and 3) nutrition and health-related knowledge seeking practices of young adults.

1.2 Research questions

The first research question concerns the relationship between perceived nutrient intake and usual intake. Studies investigating nutrient adequacy using dietary assessment tools are commonly used to explore nutrition in populations (Al-Delaimy, Rimm, Willett, Stampfer, & Hu, 2003; Magkos, Manios, Babaroutsi, & Sidossis, 2006; Piaseu, Schepp, & Belza, 2002; Terrio & Auld, 2002; Vatanparast, Dolega-Cieszkowski, & Whiting, 2009). Such studies estimate quantities of intake, but do not consider the role that individual perceptions of intake play in decision-making about food consumption. Nutrition education is based on providing information to individuals on how to increase intake of nutrients limited in their diets, but does not consider if individuals are aware that they have inadequate intakes. An individual who assumes they are consuming adequate amounts of a nutrient is unlikely to internalize prevention information. How do young peoples' perceptions of calcium and vitamin D adequacy influence consumption behaviors? This research question is addressed in the first paper contained within this thesis (chapter 3) that describes the disconnect between perceptions of nutrient adequacy and measured intake, while providing context for these perceptions.

The second research question asks how do perceptions of disease risk affect motivation to participate in osteoporosis prevention and how is this modified by gender? Osteoporosis is a disease that is publicly discussed as primarily a disease of women (Fausto-Sterling, 2005). While the gendered nature of osteoporosis has been addressed in the literature (Fausto-Sterling, 2005; Sedlak, Doheny, & Estok, 2000; Solimeo, 2011), it is not clear how the gendered language used to describe and promote osteoporosis has affected individuals' perceptions of disease risk. This research seeks to examine gender-based differences in the creation of individual risk assessments for osteoporosis. The degree to which people perceive themselves as at risk of osteoporosis affects their motivation to engage in prevention. The focus of this research question is to understand how young adults' gendered perceptions of risk influence attention to prevention information and subsequent participation in prevention activities. This topic is explored in the second paper of this thesis (chapter 4), which uses the Health Belief Model (HBM), a commonly used model to measure disease risk, as a framework for examining the gender-based differences in perceived osteoporosis risk, and the resulting effects on motivation to engage in prevention.

The final research question asks how do young adults acquire knowledge about nutrition and disease risk? The goal is to inform future prevention programs targeted at young adults. Drawing on the principles of knowledge translation (KT) this question explores the sources of information accessed for bone health and nutrition knowledge and the interests young adults have regarding nutrition and bone health. Understanding KT is essential for designing prevention education and successful knowledge translation relies

on creating information that is engaging and relatable for young adults. While young adult consumption practices (Betts et al., 1995; Counihan, 1992; Edstrom & Devine, 2001; Jenike, Lutz, Vaaler, Szabo, & Mielke, 2011; Marquis, 2005; Stevenson, Doherty, Barnett, Muldoon, & Trew, 2007) and health information-seeking behaviors (Bundorf, Wagner, Singer, & Baker, 2006; Skinner, Biscope, Poland, & Goldberg, 2003; Vance, Howe, & Dellavalle, 2009; Ybarra & Suman, 2008) have individually received attention in the literature, there are few data that pertain specifically to osteoporosis or bone health. Before effective prevention programs can be designed, contextual data on information seeking is needed to develop targeted education. This question is discussed in the final paper of this thesis (chapter 5), which investigates the production and application of osteoporosis-related knowledge by young adults and concludes with suggestions for improving prevention education.

1.3 Theoretical framework

Since decisions about nutrition and health result from a combination of social, cultural, biological, and environmental factors, the overarching framework used in the design of this study is the biocultural approach (Goodman, Dufour, & Pelto, 2012). The biocultural approach allows for a holistic understanding of the intersecting socio-cultural and biological factors that inform the nutrition and health practices of young adults. The three research questions discussed in this thesis draw specifically on a variety of theoretical frameworks in order to effectively explore their topic areas, as each question

required a tailored approach. While specific theoretical models are employed, these models are united under the overarching theme of risk. All epidemiological methods are fundamentally organized around the idea of risk, as it has become the language through which health information is expressed and translated to the public. Risk provides a framework for understanding disease because it is used to identify which individuals in a population might be affected by a disease, such as osteoporosis, and to predict the potential harmful consequences. Both members of the public and community of health professionals use risk in discussions of health communication and treatment. The type of knowledge that risk represents is contentious. One understanding of risk views it as produced through the evaluation of scientific knowledge and therefore representing evidence-based, objective truth (Raynor, 1987). However, risk is also seen as a dynamic cultural construct that is influenced by the social, economic and political environment (Lupton, 1993; Petersen & Lupton, 1996).

The perception of risk in a population contributes to how risk factors are applied to daily life. Risk provides the framework for the understanding of all diseases and is based in the information communicated to individuals from health-related organizations and gained through experience (Bunton & Burrows, 1995). Since perceptions of risk drive beliefs and behaviors related to disease, using a conceptual framework to understand the interactions between individuals and risk is essential for explaining perceptions of disease and health behaviors. There are various methods used to frame risk that differ in the theoretical viewpoint they emerge from. Of the existing methods, risk narratives and the Health Belief Model (HBM) can be used concurrently to explore risk holistically. Risk

narratives adopt a phenomenological approach to examine how individuals' experiences of the world produce knowledge of disease and risk, while the HBM uses an epidemiological framework at the population level to explore how external factors come to influence engagement in prevention.

The phenomenological approach incorporates a narrative approach to understand how individuals construct their own conceptions of risk. Panter-Brick and Fuentes (2009) define risk narratives as "story lines or discourses that weave together cultural and scientific accounts regarding the conceptualization and communication of health risks, or relative vulnerability to poor health, in personal lives" (4). A risk narrative is unique to individuals and represents the integration of their own experiences, knowledge, education, and exposure to illness, in order to create a unified concept of risk (Panter-Brick & Fuentes, 2009). Individual conceptions of risk differ from epidemiological ones, as individuals are primarily concerned with their personal risk factors and epidemiology is concerned with population-level risk. While established 'risk factors' are applied on a population level, the meaning that individuals apply to risk factors are the result of their own perceptions of danger (Cook & Bellis, 2001). Exploring risk narratives provides a mechanism for understanding how ideas about risk are produced and applied by individuals. The use of a narrative approach allows the investigation of risk to move beyond the existing epidemiological constructions of a particular disease and its biomedical risk factors and to explore how social, political, economic, cultural and environmental factors influence how an individual perceives risk (Harthorn & Oaks, 2003). Investigating the sources of information on risk and their incorporation by the

individual to create a risk narrative creates a more holistic understanding of how risk ascribes meaning to individuals and is acted out in their daily lives.

A risk narratives lens is used primarily in chapter three to explore the role of perception on nutrient adequacy. A mixed methods approach is employed, as the goal of this study is to understand how measurable nutrient intake is related to perceptions of intake. A dietary assessment tool called a food frequency questionnaire (FFQ) was used to measure usual intake of nutrients, while semi-structured interviews and a pile sort activity were conducted to explore perceptions. The concept of risk narratives was used to frame the analysis of the interviews, as the intent was to understand how perceptions of calcium and vitamin D intake influence beliefs about disease risk as it relates to nutrient inadequacy.

The HBM is based on the idea that health behaviors are the direct result of certain health beliefs (Cadarette, Beaton, & Hawker, 2004; Chan, Kwong, Zang, & Wan, 2006; Sedlak et al., 2000; Shanthi Johnson, McLeod, Kennedy, & McLeod, 2008; Swaim, Barner, & Brown, 2008). The basic idea underlying the HBM is that a person must consider a disease serious and consider him or herself susceptible in order to be motivated to change their behaviors to reduce their risk of developing the disease. Risk permeates this framework, as the concept of disease seriousness and susceptibility relate directly to risk. The degree to which each of these factors influences health behavior varies by group and is the result of the interaction of social constructions of disease risk with other social determinants of health. Good prevention education should convince

individuals that a particular disease is serious and those at risk are susceptible, that the benefits of prevention are great and barriers to prevention activities are minimal, and provide the necessary cues to action. This model is used to predict engagement in prevention and to assess perceptions of disease risk.

The HBM was used to frame the interpretations gained from the data in chapter four. The investigation of this research question also employed a mixed methods approach that relied on a quantitative survey used to assess beliefs about osteoporosis, called the osteoporosis health belief scale (OHBS) and qualitative semi-structured interviews to explore perceptions of osteoporosis risk. The OHBS is based on the HBM model, and is designed to be interpreted following this framework (Kim, Horan, Gendler, & Patel, 1991). The HBM was then applied to the interviews to guide the analysis in a way that generated data that would be compatible with the OHBS results. The use of the HBM allowed interpretation to focus specifically on how beliefs about severity, susceptibility and self-efficacy in relation to osteoporosis are related to motivation to engage in prevention.

Using the HBM as a guiding framework, chapter 4 explores osteoporosis risk perceptions among young adults specifically as they relate to gender. Ideas related to food decisions and risk assessment are heavily influenced by gender (Allen & Sachs, 2011; Counihan, 1997; Wardle et al., 2004). Food is not only perceived differently based on gender, but is itself strongly gendered, with foods split into ‘female’ (lighter foods like salad) and ‘male’ foods (heavier foods like meats) (Counihan, 1998; Pollard, Kirk, &

Cade, 2002). Nutrition choices have also been linked to gender; males stereotypically preferentially choose foods perceived as "robust" and building muscle, while females choose foods that are seen as related to weight-loss (Beardsworth et al., 2002; Germov & Williams, 1996). Osteoporosis too is considered a gendered disease, as it affects almost twice as many women compared to men. The general view of osteoporosis as a disease of women affects risk perception, as males view themselves as less susceptible and therefore at significantly lower risk than women (Burgener et al., 2005). Men who develop osteoporosis experience greater emotional disturbances as a result of having a 'women's' disease, similar to men who develop breast cancer (Solimeo, 2008, 2011). As a result, the role gender plays in the development of young adult risk models related to osteoporosis and diet is significant and requires consideration.

Chapter five focuses on the dissemination of risk information and knowledge seeking and thus relies on the conceptual lens of KT. KT is concerned with how risk information is understood, given meaning, and applied by the public (Gagnon, 2011; Graham et al., 2006). KT can be conceptualized in different ways, but the most common is using the knowledge-to-action model, which constructs information dissemination as a process (Kitson & Straus, 2010). The goal underlying knowledge translation is to identify and address specific gaps in knowledge through the use of new approaches and targeted information (Kitson & Straus, 2010). In chapter 5 the knowledge-to-action framework provided a lens for understanding how information-seeking behaviors and individuals' interests can inform tailored osteoporosis prevention.

Underlying these specific theoretical frameworks is the ever-present influence of cultural constructions of disease. Ethnic and cultural associations are an important influence on disease meanings and dietary choices. Recognizing the role that social and environmental factors play in individual and population-level constructions of disease meaning is essential for contextualizing the attitudes, beliefs and perceptions of young adults within the Canadian health system. Osteoporosis is considered a 'Western' disease because of the considerably higher rate of diagnosis in Westernized countries (Prentice, 2004). Though diagnosis of osteoporosis is becoming more common in non-Western countries, public familiarity with the disease is still low and promotion of osteoporosis-related knowledge by health institutions is eclipsed by other conditions. Even within Western countries, osteoporosis is interpreted within social and cultural networks that fundamentally alter explanatory models of disease. Erol (2011) discusses this concept when exploring beliefs about osteoporosis in Turkey, where osteoporosis is known as *kemik erimesi*, which translates to 'melting bones' (1490). This contrasts with the use of the term 'osteoporosis' in North America, which means 'holes in bones' and is viewed as a fracture disease. While the medical community in Turkey understands osteoporosis and *kemik erimesi* to be the same disease, the conceptual models for how the disease affects individuals are different – melting versus fracturing- and have the potential to affect notions of risk (Erol, 2011). The Turkish example also draws attention to the importance of disease labeling, as the disease of bone density loss has the potential to exist simultaneously under different names. Cultural models may recognize fragile bones associated with fracture as a disease, but will not necessarily call them osteoporosis. As a

result, when interviewing participants for my study, I included a general discussion of bone diseases along with specific questions about osteoporosis in order to account for different cultural models of disease.

The result of these differential views of osteoporosis is that culturally-grounded ideas about disease play an important role in the conceptualization of a disease. Ideas and beliefs about risk, etiology, and treatment are embedded in cultural constructions of disease (Kleinman, 1988; Rosenberg, 1992). Culture serves to mediate the dominant health messages promoted by national health institutions and so shapes individual risk narratives (Kleinman, 1988). Conceptions of disease and risk are the outcome of melding traditional cultural knowledge with dominant scientific discourses. Canada is a multi-cultural nation and so including a diverse sample is necessary to understand the breadth of osteoporosis beliefs of young adults in Southern Ontario.

Cultural models related to consumption also influence diet and nutrition. Food has an important relationship to culture as it has been linked to identity, memory, belonging, relationships, religion/spirituality, the supernatural, politics, economics, and health (Counihan, 1997). Food becomes embedded within value systems and serves as a physical representation of beliefs or ideologies that are held by communities (Pelto, Goodman, & Dufour, 2000; Rozin, Bauer, & Catanese, 2003). National or culturally specific foods serve to bind people together under a shared identity that contributes to a sense of belonging and reinforces specific world views (Leitch, 2003). Ideas about diet and nutrition are products of culturally constructed beliefs about eating intersecting with

health (Bisogni, Connors, Devine, & Sobal, 2002; Johnson & Cappeliez, 2012; Ristovski-Slijepcevic, Chapman, & Beagan, 2008; Rozin et al., 2003). This idea of culture influencing food can be seen in the production of different national food guides throughout the world. While most claim a scientific basis, they promote slightly different ways of eating that are produced by dominant cultural models of food and consumption (Murphy & Barr, 2007). An awareness of the ethnocultural affiliation of individuals is therefore necessary in order to access the complex negotiations related to food choice and nutrition beliefs. Sampling for this study endeavored to produce a multi-ethnic sample that remained representative of the different cultural groups residing in Southern Ontario.

1.4 Thesis format: Chapter outlines

This thesis consists of six chapters, of which three, four, and five are standalone papers formatted and submitted for publication in academic journals, as part of the McMaster University 'sandwich' thesis. Chapter two provides an overview of the methods used to frame and collect the data reported in this thesis. The chapter outlines the design of the study and the qualitative and quantitative methods that were used in data collection. The theoretical basis for the use of a mixed methods approach as well as an overview of the epistemological questions that arise when using a mixed methods approach are also discussed.

Chapter three presents and discusses the disconnect between perceptions of nutrient adequacy and measured nutrient intake in Canadian young adults. Using intake data

collected with a specific calcium and vitamin D FFQ and semi-structured interviews, this paper contextualizes consumption practices within beliefs about nutrition and individual nutrient intake. This paper confirms the overall low intake of calcium and vitamin D by young adults, but indicates that this age group generally perceives themselves as adequate and uses the interview data to explore the rationalizations produced to justify these beliefs. As a result, it becomes clear that increasing nutrition education will not result in increased nutrient intake, as consumption patterns are embedded in more complex ways of producing nutrient knowledge. This paper draws together measured intake data with information on perceptions in a way that, to my knowledge, has not been done for bone-related nutrients to produce a more nuanced understanding of patterns of inadequacy that can be used to inform the design of prevention education.

Chapter four focuses on the relationship between osteoporosis knowledge, perceptions of risk, and engagement in prevention activities. Drawing on data gathered using the OHBS and semi-structured interviews, this paper explores how gendered representations of osteoporosis have come to influence perceptions of risk. Men and women conceptualize osteoporosis severity and susceptibility differently, which then has consequences for their motivation to engage in prevention. Though neither group expressed dedicated interest in participating in prevention, there were clear gender-based differences in how osteoporosis was understood. This affects not only the design of prevention programs, but also reflects the differential internalization of osteoporosis messaging in Canada.

Chapter five explores knowledge about information-seeking behaviors and the nutrition and bone health related interests of young adults can be used to structure more effective prevention. By identifying the roles that traditional sources (e.g., parents, teachers, peers) and emerging sources (e.g., Internet, social media) play in the process of osteoporosis-related knowledge acquisition, this paper shows how existing information networks can be used to deliver osteoporosis prevention information. By contextualizing the information-seeking practices of young adults, new frameworks for messaging can be designed that provide relatable information for this age group. This paper places current young adult behaviors in the context of existing osteoporosis prevention programs and offers new ideas for improving prevention programs.

Chapter six, the conclusion, demonstrates how integrating the results garnered from these three papers can be used holistically to improve osteoporosis prevention programs in Canada. The findings of this research show that while young adults are a group in need of osteoporosis prevention, current prevention education is not designed to address their concerns and interests. This age group consistently overestimates their calcium and vitamin D intake, while underestimating their osteoporosis risk. These opinions are justified through their own beliefs about nutrition and osteoporosis that are reinforced by larger social constructions of nutrients, nutrition, and bone health that minimize risk to young adults. This chapter discusses the directions that new prevention programs need to take in order to begin to address these issues and actively reach young adults.

CHAPTER 2: METHODS

2.1 Introduction

To explore how young adult beliefs about osteoporosis and nutrition shape their consumption practices and frame their understanding of risk, a mixed methods approach is necessary, as these questions must be addressed and interpreted with both qualitative and quantitative data. For example, consumption is measured best by quantitative dietary recall tools, but the meaning and motivations behind food decisions are best explored though qualitative interviews. Similarly, though osteoporosis risk can be assessed and quantified through survey-based instruments, accessing the narratives that form the context for risk analyses require the open-ended format of qualitative interviews. Thus, multiple methodologies pertaining to young adults, diet, and osteoporosis are integrated into this study. Quantitative tools are used to measure nutrient intake and assess beliefs about osteoporosis, including a food frequency questionnaire (FFQ) to measure intake of calcium and vitamin D, and the Osteoporosis Health Belief Scale (OHBS) to measure beliefs about osteoporosis and motivation to engage in prevention. Individual interviews and a pile sort activity represent qualitative approaches to data collection that focus on exploring the contexts of consumption and osteoporosis beliefs. The information derived from these methods are combined in analysis to provide a more holistic understanding of how young adults develop beliefs about osteoporosis, nutrition and the relationship between diet and bone health, and how that is differentially perceived by individuals and by gender group.

2.2 Sampling

2.2.1 Recruitment

All recruitment, interview sessions, transcription, data coding, and analysis was done by me. Recruitment began at McMaster University in September 2013 through the use of posters placed around campus, a Facebook page that explained the study and offered contact detail, and through in-person visits to a small number of first year classes to make short presentations that explained the study and asked for participants. Permission to ask for participants in classes was obtained in August 2013 and early September 2013 and the short, in-class presentations involved displaying a Power Point slide of the poster and explaining the study and the call for participants. The Facebook page was created in September 2013 and shared throughout a number of networks on Facebook including the McMaster University Facebook site (Appendix A). The page included an image of the poster that was placed on campus (Appendix B), a call for participants that included the eligibility criteria, and a detailed explanation of the project that was similar to the information provided in the letter of information for the study.

Recruitment at Mohawk began in November 2013 after the completion of the McMaster interviews. The high volume of volunteers from McMaster in a short period of time led to difficulty collecting data from both campuses simultaneously. Recruitment from the community and from Mohawk did occur simultaneously as recruitment of volunteers was slower. Recruitment at Mohawk began with the use of posters throughout the campus, however, this produced a very low volunteer rate (3 participants over a

month) and so in-class recruitment was initiated. A variety of Mohawk programs were contacted and permission was gained from instructors to recruit in-class using short presentations in January and February 2014. The in-person recruitment in classrooms led to a higher rate of volunteers. All Mohawk interviews were conducted at the Mohawk campus in either a private study area or in the case of one program, in private rooms belonging to the program.

Recruitment from the community began in March 2014. Recruitment was accomplished using posters in public areas, sharing of the Facebook site I created, and word of mouth from previous participants who had peers in the community. Participants contacted me via email (Appendix C) or text message and were given the choice of meeting in a public location of their choosing or coming to the McMaster or Mohawk campuses. Most participants chose coffee shops in the community, but a small percentage elected to come to the McMaster campus. All participants who came to McMaster were interviewed by me in the private office used for McMaster student interviews.

All three surveys, the pile sort, and the interview were conducted in a single session that lasted approximately 90 minutes, though some were as long as 120 minutes. The single session model was chosen to maximize participation and minimize participant attrition and loss of data. Since FFQs do not require multiple administrations and qualitative interview data does not require validation, and this study did not attempt to look at changing attitudes over time, using a single session model did not pose significant limitations. While it is possible that the FFQ does not accurately represent food

consumed in all months of the year, this is a larger limitation of dietary recall tools and was not assessed as serious enough to require a second completion of the FFQ at a later date. Wu et al. (2009) in their validation of the FFQ showed good agreement between a first and second administration of the questionnaire, which indicates that the FFQ fairly consistently represents intake data.

I scheduled participants according to their availability. Written consent was obtained from all participants at the scheduled meeting time and prior to the beginning of the session (Appendix D). Compensation was provided to all participants who arrived for their scheduled session. Compensation was given in the form of $20 gift cards to various grocery stores in the Hamilton area. Completion of all parts of the study was not required for compensation, but no participants elected to withdraw during the process. The decision to offer compensation was based on the recognition that young adults, especially non-university students, are notoriously difficult to recruit as volunteers (Ramo, Hall, & Prochaska, 2010). Busy schedules combined with low motivation, especially related to health and chronic disease, impact recruitment. The combination of compensation and a low time commitment was designed to entice more reticent volunteers in order to create a more representative sample.

2.2.2 Sample inclusion criteria and characteristics

Participation was arranged via email, phone call, or text messages. Participants who met the inclusion criteria were scheduled for interviews. Only participants who were able

to give consent (i.e., over the age of 16 years and mentally able to give consent) and were between 17-30 years were selected.

All participants completed both the survey and interview portions of the study, allowing for cross comparison between methods. No participant who was accepted into the study refused to complete any portion. On-going transcription and attention to saturation identified sixty participants as robust sample for thematic analysis.

The definition of what constitutes a young adult varies depending on the study topic. Generally in North America young adulthood is viewed as beginning between 17-19 years, when adolescents complete high school and enter the workforce or post-secondary education (Geiger & Castellino, 2011). Some studies follow the World Health Organization and Youth Advisory Council definition of young adults (Butow et al., 2010), while others use broader ranges that can include individuals up to 29 or even 39 years (Geiger & Castellino, 2011). Often the range chosen relates to sample access (such as using a college sample for convenience) or to the context of the issue studied.

The age range of 17-30 year olds chosen in this study was designed to include two distinct factors of importance to this study, 1) individuals who are making their own food choices, but 2) who have not attained complete bone growth. This group is most likely to influence their future bone health through their eating habits as appositional and potentially longitudinal (depending on age) bone growth is still occurring (Baxter-Jones, Faulkner, Forwood, Mirwald, & Bailey, 2011). Since bone growth ceases in the early twenties, young adults who are at the lower end of the 17-30 year range studied here will

not have attained their peak bone mass and so their food choices will still be impacting their bone growth to varying degrees (Baxter-Jones et al., 2011). Though young adults have passed out of the rapid period of vertical growth that occurs in adolescence, their dietary decisions retain the potential to affect their future bone health by influencing the final stages of growth, but also through the creation of long term food habits (Haberman & Luffey, 1998; Neumark-Sztainer, Story, Perry, & Casey, 1999; Stevenson, Doherty, Barnett, Muldoon, & Trew, 2007). As young adults move outside of the influence of their parents and begin to make independent food choices, they form behavior patterns that determine the basis for their consumption patterns later in life (Haberman & Luffey, 1998). Though food habits can and will change over the life course, the behaviors they establish as they form their own independent relationship with food influence future interactions with food and establish the role it plays in their lives.

Young adults within the age range of 17-30 years are likely to be making independent food choices as they are spending greater amounts of time outside their parental home (Watt & Sheiham, 1997). While most adolescents experience significant parental control over food, young adults who are attending university, college or employed are responsible for most of their food decisions, even when they are living at home (Counihan, 1992; Watt & Sheiham, 1997). School, employment, and diverse social commitments cause young adults to spend more time eating outside the home and making independent food choices (Counihan, 1992; Marquis, 2005).

Young adults who attended school, worked, or lived in Hamilton were targeted for inclusion in this study. I aimed to recruit equal numbers of males and females between the ages of 17-30 years. The participants targeted for recruitment represented three groups of young adults: McMaster University students, Mohawk College students and non-students. The last category was divided into university and college graduates and young adults who had never attended post-secondary school. Categories would ideally be kept relatively even in order to avoid over-representation by a single group, but sample size was decided using the principle of saturation. Saturation involves continuous assessment of the data until no new themes have emerged (Bernard, 2011). Once theme saturation is reach, the sample size is sufficient.

2.2.3 Young adults as a community

The immediate conception of young adults is of a group that is defined through age, but may not share any other uniting characteristics. Studying young adults as a group therefore does not represent a traditional anthropological study group or site, because they are not a 'community' in the conventional sense. Traditionally, communities have been constructed as spatially bounded entities that are seen as concrete and real. Individuals within communities know each other and experience varying degrees of direct interaction. However, this notion of community has been steadily changing. While anthropological investigations of the spatially and temporally bounded community-as-study-site are still conducted, the changing nature of human social organization and

communication technology has altered the meaning of community. The expansion of the Internet into everyday life gave rise to the presence of online cyber communities; changes in transportation and communication systems has facilitated interaction between spatially distant people (Acquisti & Gross, 2006).

The concept of imagined communities, first described by Anderson (2006) and related to nationalism, has been greatly expanded. Where traditionally communities were defined by territory, imagined communities are linked by common identities through networks of interpersonal relationships that are not always direct or tangible (Calhoun, 1991; Kanno & Norton, 2003). The degree to which imagined communities are real, concrete and bounded is variable. Some imagined communities, such as online cyber communities, are near tangible (Wilson & Peterson, 2002). Following these ideas, young adults can be understood as part of an imagined community of food users. Canada has an official, national food guide, the Canada Food Guide (CFG) that teaches a specific way of thinking about food and the process of consumption. Most young adults have their formal introduction to food-knowledge through the provincial education systems, which teach nutrition education in accordance with the CFG (McClinton, 1971; Ontario Ministry of Education, 2010). As a result, all Canadian children receive the same food education that teaches a specific way of knowing and understanding food, which varies temporally, depending on the version of the CFG that was in use during their education. While other sources of food knowledge do exist, such as family and traditional/cultural food knowledge, the scientifically justified, government-endorsed CFG exerts considerable influence over Canadian food beliefs (Ristovski-Slijepcevic, Chapman, & Beagan, 2008).

The use of the CFG in the school system is what serves to link young, Canadian adults into a food-based community. The CFG is constructed around specific food meanings, which are reflected in the mandate of the food guide (Bush, Martineau, Pronk, & Brulé, 2007) and so it both influences how food is understood, but in itself is a representation of how institutions and governments believe food should be understood. Bush et al. (2007) state that the food guide is "designed to enhance consumer understanding of healthy eating" (94) and specifically focuses on reducing obesity and chronic disease. By endorsing this particular understanding of healthy eating, the Canadian government is teaching a specific understanding of food and eating. The CFG, as a way of teaching the public how to relate to their food, comes to embody differences in the changing conceptualization of food over time. The 1992 CFG mandates that the goal of the guide is to ensure that nutrient intake is appropriate through consumption of a variety of foods (Bush et al., 2007). The 2007 CFG mandate shifted and is designed to promote meeting nutrient intakes and reduce diet related chronic disease and obesity (Bush et al., 2007). This shift in focus not only affects how the Canadian public is educated about food, but also creates temporally bounded groups of people who have been taught about food using a particular food guide. Given the 17-30 year old boundaries of this study, these young adults received most of their food education from the 1992 food guide, which is reflected in their general focus on eating from all food groups (as balanced food groups was the mandate of this food guide). While these young adults were focused on specific nutrients, they did not tie their consumption practices to

avoiding disease, but instead focused on general ideas of maintaining health, though their definitions of health varied greatly.

These temporally bounded groups of Canadians who received their formal food education under a particular version of the CFG create age-related imagined communities of food users. While members of these groups are not homogenous units and most will not interact in tangible ways, they are bound by a system of beliefs and values that frame their food knowledge. The forms of belonging are constructed around a shared food discourse that creates the basis for food meanings and consumption practices (Ristovski-Slijepcevic et al., 2008). A common food identity is legitimated through the authoritative food discourse that advocates a particular way of knowing food. Since food is an essential part of individual identities—because food choices intersect with other related ideologies (e.g. organic, local, vegetarian, or personal tastes)—this school-based food education becomes embedded within emerging individual food identities. Food identities govern food choices and the role that food plays in people's lives, as food is a mechanism to express individual identities and beliefs through actual consumption and beliefs about food (Delormier, Frohlich, & Potvin, 2009).

2.2.4 Representativeness of students

The goal of the sampling strategy employed in this study was to recruit a population that was as representative as possible of young adults living in Southern Ontario. The communication of nutrition education, the types of specific food items available, and the

accessibility of chronic disease healthcare and prevention education vary between the provinces. As a result, this sample was restricted to Southern Ontario, which follows the education curriculum set out by the Ministry of Education and has a number of closely spaced, large urban centers. Hamilton is the fourth largest city in Southern Ontario and contains one university (McMaster) and one public college (Mohawk).

Two thirds of the targeted sample included young adults pursuing post-secondary education. While there is a general concern that the use of university or college students as a study sample is not representative of the larger young adult population, Southern Ontario has a very high rate of post-secondary attendance. Eighty-three percent of southern Ontario high school students attend university or college for at least one year (Norrie & Lin, 2009; Shaienks & Gluszynski, 2007). With such a high rate of post-secondary attendance, sampling from both university (undergraduate and graduate students) and college students creates a more representative sample. Students were recruited from a variety of faculties and programs in order to avoid bias related to specific fields of education.

2.2.5 Sample diversity

In order to create a sample that was broadly representative of the Hamilton young adult population, a diverse sample was recruited. Diversity of gender, age and ethnocultural background were of specific interest. In order to explore the role of gender, both men and women were recruited in equal numbers. Gender parity was originally a

concern, but larger numbers of men volunteered than was expected. When doing in-class presentations, I emphasized my desire for male volunteers. In the end, no targeted recruitment of men was necessary as even numbers were achieved. Participants were not asked to declare their gender at the time of recruitment, but were asked to identify their gender on the sociodemographic survey. The survey provided the option of male, female or transgender, though no participants self-identified as transgender.

A diverse multiethnic sample was achieved without targeted recruitment, as the volunteers were already quite diverse, as McMaster University, Mohawk College and the City of Hamilton have ethnically diverse populations. Participants were asked to self-identify their ethno-cultural background, which results in a broad range of responses from very specific ethnic groups (e.g., Dutch, Chinese) to broad generalizations that could include multiple backgrounds (e.g., Canadian, Human). While this created an accurate picture of how participants self-identified, it made analysis of ethnicity difficult as participants identified a broad range of ethnicities and no specific ethnic group was represented well enough for statistical analysis (Appendix E).

No targeted recruitment was performed for age either. The nature of recruiting college students, university students, and graduated post-secondary students led to a diversity of ages. Since post-secondary students comprised two thirds of the sample, individuals in their early twenties represented a larger portion of the sample, but all ages between 17-30 years old were included in the sample.

2.3 Using a mixed methods approach

Mixed methods research involves the application of qualitative and quantitative methodologies to a single dataset; either through separate multiple methods or the use of an integrated approach. Though the use of mixed methods is increasing, especially in interdisciplinary research projects, the value of this approach is debated. While proponents of mixed methods research support it as a third paradigm that draws on the best traits of qualitative and quantitative research, purists feel that the fundamentally different nature of the two types of data make them difficult, if not impossible, to successfully integrate (Burke Johnson & Onwuegbuzie, 2004). The issues surrounding integration center on the epistemological differences between qualitative and quantitative methods regarding the role of objectivity and overall generalizability of results (Burke Johnson & Onwuegbuzie, 2004; Johnson, Onwuegbuzie, & Turner, 2007; Teddlie & Tashakkori, 2003). These perceived differences are often linked to fundamentally different theoretical frameworks between the so-called soft and hard sciences. The social sciences view behavior and belief as concepts that are in flux, and so they are naturally and necessarily subjective, whereas food and nutrition science must necessarily conceptualize the phenomena they study as static and objective, with the idea that real truths are possible to find (Creswell, 2008). The goal behind most, qualitative approaches to food are to identify and understand the context in which food is used and understood, whereas most quantitative methods attempt to find an empirical answer to a specific question (Burke Johnson & Onwuegbuzie, 2004). Quantitative research methods are

understood to rely on positivism, which is viewed by critics of mixed methods as placing it in opposition to the relativism of most qualitative methods.

It is these differences in the underlying goals of the methods that lead to problems in their evaluation and integration. Quantitative standards of validity and reliability are held as the ultimate tests for all research methods and are applied to both qualitative and quantitative studies (de Garine, 2004). Reliability and validity assume an objective truth that can be identified and is unchangeable, which is fundamentally in conflict with the relativism of qualitative methods (Golafshani, 2003). The purpose of a mixed methods approach, therefore, is to encourage a pragmatic blending of the social and mental reality of qualitative methods with the physical tangible reality of quantitative methods (Burke Johnson & Onwuegbuzie, 2004). Using a combination of inductive and deductive reasoning expands the breadth of data that can be gathered and proposes a more holistic way of approaching and answering research questions that is more akin to how individuals and researchers actually behave (Driscoll, Appiah-Yeboah, Salib, & Rupert, 2007). This means that mixed methods research has the potential to unite multiple lines of evidence to produce more detailed answers to research questions that reflect the complexity that underlies human life and behavior.

A mixed methods approach to anthropological studies of nutrition and disease prevention offers the ability to combine nutrition/health data with social context. Hubert (2004) presents the study of nutrition as a nested process using multiple methodologies, where qualitative interviews are used to elicit the social context of food and foodways,

and quantitative surveys gather information on nutrient intake. Similarly, health studies in disease prevention use biological indicators to identify states of disease or behavioral practices and qualitative interviews to contextualize behavioral or practical differences (Andrew & Halcomb, 2009). Since ideas surrounding food are highly contextualized, Hubert (2004) argues that social data on food is necessary for the interpretation of quantitative variables. Likewise, health behaviors do not exist in a void and are influenced by individual perceptions, beliefs or attitudes related to disease and disease prevention (Andrew & Halcomb, 2009). This means that effective nutrition studies need to include both traditional nutrient intake measurements and beliefs or perceptions about intake (de Garine, 2004; Hubert, 2004), and health studies need to evaluate both specific disease knowledge and behaviors, as well as beliefs and attitudes toward disease. Measuring nutrient intake is generally a quantitative process done using food frequency questionnaires (FFQ), 24-hour food recalls, or food diaries that use recollection or active measurement of intake to provide quantities of foods that are broken down into specific nutrient constituents (Hubert, 2004; Quandt, 1986; Ulijaszek, 2004). These studies produce an intake value for a specific nutrient that can then be compared to the dietary reference intakes (DRI) for that population. Disease prevention studies focus on evaluating individual knowledge of disease or prevention behaviors, most commonly through surveys or evaluation of compliance with prevention behaviors (Andrew & Halcomb, 2009; Krein et al., 2008). Perceptions about food use and disease rely on qualitative approaches that are descriptive in nature and explore the meanings behind food decisions and prevention beliefs, such as focus groups, interviews, or pile sorts

(Edstrom & Devine, 2001; Quintiliani, Campbell, Haines, & Webber, 2008; Vallianatos & Raine, 2008). Uniting these two methodologies creates the potential to either provide social context for observed quantitative trends in food or nutrient intake, or to use qualitative themes to design effective quantitative tools for large populations. Biological measurements of health are used to assess particular disease states or types of knowledge.

2.4 Epistemological questions in mixed methods: Validity and reliability

The standards used to measure the quality of research methods are drawn from the natural sciences (de Garine, 2004). The epitome of an effective scientific study is one that is both valid and reliable (Quandt 1986). The issues of validity and reliability underscore all qualitative and quantitative studies, but represent standards that are much more difficult for qualitative studies to meet. Validity is a measurement of the accuracy of data, which is the degree to which a technique measures what it is designed to measure (Burrows, Martin, & Collins, 2010; Quandt, 1986). From the positivist perspective, validity is the degree to which a method provides the objective truth, which from a scientific standpoint, is understood to both exist and be attainable through the correct methodologies (Golafshani, 2003). Reliability is the ability to obtain the same result every time the method is repeated (Quandt, 1986). Reliability is not equal to validity, as it is possible to reproduce invalid data repeatedly, but reliability guards against inconsistent methodologies being used.

In nutritional anthropology, quantitative methodologies are fairly receptive to tests of validity and reliability (Ulijaszek, 2004). When measuring nutrient intake there is an objective truth that can be found as food was consumed, and contained a finite amount of nutrients. Using quantitative food record methodologies such as the 24-hour dietary recall and food frequency questionnaires, it is possible to know the amount of, for example, calcium consumed and to repeat this measurement successfully as the amount of calcium consumed at that specific time will not change (though it will likely change for subsequent measurements). While these two methods are limited by the potential for retrospective errors and the self-reported nature of the method (Burrows et al., 2010; Johnson, 2010; Krall, Dwyer, & Coleman, 1988), they are still receptive to standard tests of validity and reliability.

Problems emerge when the standards of validity and reliability are applied to qualitative methods, as they focus on the attitudes, beliefs, perceptions, and experiences of individuals and so it becomes more difficult to satisfy validity and reliability (Hart, Bishop, & Truby, 2002; Ulijaszek, 2004). The assumption of an objective truth that underlies validity is more difficult to apply to personal opinions regarding abstract concepts. There is often no knowable objective truth and looking for an objective truth would defeat the purpose of most qualitative methods. Qualitative methods such as interviews and focus groups are concerned with the process of how people create meaning through their experiences and perceptions of the world (Golafshani, 2003; Hubert, 2004; Pope & Mays, 1995; Sofaer, 1999). The goal is to describe these processes and to identify the common themes that underlie them. Using a standard that requires an

objective truth misconstrues the purpose of using a qualitative method (Golafshani, 2003).

A similar problem exists for reliability because people are not static. People live in a state of 'being in' the world, and as a result their perceptions are constantly affected by their experiences (Bernard, 2011). Qualitative data are not designed to be subjected to the same standards of replicability, since individual beliefs and perceptions can change. The experience of the interview itself might alter an individual's perceptions and would therefore influence any future interviews (Bernard, 2011). While this type of data provides essential context to intangible phenomena, its results are less generalizable than those achieved using quantitative data. So while the FFQ data may be replicated in other populations, the interview and pile sort data may differ because populations are different or because perceptions change making its applicability more limited. While these results are not necessarily generalizable and may change with individual experiences, this does not detract from the ability of interviews to explain the context of the specific reported intake values and to aid in drawing conclusions about behaviors.

The predominance of the use of validity and reliability in determining the effectiveness of methodologies, means that qualitative methods are often not considered rigorous enough to create real data (Golafshani, 2003). The solution has been to find a way of externally validating the data collected, often through the use of multiple lines of evidence (Golafshani, 2003; Quandt, 1986; Ulijaszek, 2004). The addition of a second method that measures the same phenomenon is known as concurrent validity, though

when a second qualitative method is used this may be considered pseudo-validity (Quandt, 1986; Ulijaszek, 2004). There is no doubt that multiple lines of evidence are a useful approach, as they allow a single phenomenon to be evaluated from a variety of viewpoints, but engaging in their use as a method to validate qualitative research undermines the importance of qualitative approaches as a research tool.

In mixed methods research, quantitative methods run the risk of being a vehicle for validating the qualitative methods. Instead mixed methods should be employed for their ability to allow the researcher to engage with questions from diverse perspectives (Caracelli & Greene, 1993; Creswell, 2008; Driscoll et al., 2007; Johnson et al., 2007). When applied to the research questions outlined in this study, a mixed method approach allows different perspectives to be incorporated. While the qualitative approaches examine how young adults perceive and describe their diet and osteoporosis risk, the quantitative approaches examine their actual intake and engagement in prevention behaviors. The result is a more nuanced understanding of how young adults negotiate the relationship between nutrition and osteoporosis that not only provides a new type of data, but challenges the assumptions inherent in many current approaches to nutrition and chronic disease research.

2.5 Reflexivity in anthropology

Reflexivity is an important aspect of social scientists' work with living participants. Reflexivity is the process of being self-critical and reflective and involves having

anthropologists consider how their own experiences, beliefs, background, and personal characteristics (e.g., age, gender) can influence or affect their research design, analysis, and presentation of results (Bernard, 2011). Quantitative survey research can be influenced by the researchers in the design of the project itself, but qualitative research by nature is subjective and requires the identification and interpretation of themes from transcribed text. The theoretical framework, questions asked, themes identified, and interpretation of the themes by the researcher are all influenced by the researchers own experience and beliefs (Bernard, 2011). As a result, anthropologists need to be self-critical during the process of developing, conducting, and interpreting their research to try and recognize—and where possible minimize—the influence of their own experiences on their study.

My own background influences how I see, understand, and interpret my study material. My Bachelor's degree was in biological anthropology and in my Masters program I studied the skeletal effects of osteoporosis on past populations. My formative work with osteoporosis was from a biological perspective. My exposure to the lived experience of osteoporosis did not come until I volunteered with Osteoporosis Canada as a support group organizer and public speaker. In this role I both listened to the experiences of women and disseminated information on osteoporosis. This meant that I went into my PhD research on osteoporosis with knowledge gathered from these varied sources and with preconceived ideas about the biological and phenomenological realities of osteoporosis.

My research on nutrition and previous volunteer work with the Daily Bread Food Bank in Toronto influence my understanding of healthy eating and appropriate nutrition. As a result my interpretations of the food behaviors of my participants are made within this pre-existing framework.

My decision to study the beliefs and food behaviors of young adults in Southern Ontario means that I was studying within my own community. When I began my research I was within the 17-30 year catchment range and I had lived most of my life in southern Ontario. While this made it easier for participants to relate to me, it meant that I had to take extra care not to impose my experiences of being a food-consuming young adult from southern Ontario onto their descriptions. For those who were in post-secondary institutions, there was an additional shared experience. My status of graduate student, specifically in a PhD program, also carried implications for power and authority. For the undergraduate university students I interviewed, there was implied power dynamic they had been taught through interactions with teaching assistants and professors that established me as an authority. For college students and non-students who participated in this study this power dynamic was even more pronounced. As a result I needed to recognize my position and the effects it could potentially have on how my participants related to me during the design of the interview question and the interviews themselves. There was an implied knowledge difference that placed me as an authority figure and in some cases made participants reticent about answering for fear of being wrong.

My approach to this topic contains an inherent contradiction. While I use a critical lens to assess food education in Canada, I have designed this study to use the same reductionist, scientific understanding of food that I criticize. The critique of reductionist approaches to food focuses on using nutrients as the sole or most important way of understanding food. Nutrients are important as they contribute to overall health and so a study of osteoporosis needs to include a discussion of calcium and vitamin D. Young adults have a poor understanding of nutrition and so educating them about nutrients is crucial to changing their food behaviors, however, it should not be the entire focus. In my study, by breaking food into its component nutrients, I am encouraging participants to use this dominant model of understanding food. This approach is designed to encourage young adults to talk about food using language that they understand, with the goal of identifying avenues for change. In an education system that has taught young adults about food in a reductionist way, encouraging abstract discussions of food proved difficult. The use of the scientific language of nutrients provided a familiar entry into discussions about food. Through the ensuing discussions it was possible to build an understanding of how young adults related to food in order to propose methods for changing their relationship with food. Nutrients as food components are important aspects of health, but the long-term goal should be to encourage young adults to look beyond food to the sum of its parts. This requires balancing reductionist understandings of nutrients with more holistic notions of food and eating.

2.6 Quantitative survey tools

Three survey tools were used in this study, a sociodemographic survey to gather background information on participants, the osteoporosis health belief scale (OHBS) to investigate beliefs about osteoporosis, and a food frequency questionnaire (FFQ) to assess nutrient intake. All surveys were administered after consent was obtained and before the interview process to avoid biasing responses, since the interviews would involve discussions of osteoporosis, risk, and dietary intake. The sociodemographic survey was completed first, followed by the OHBS, and then the FFQ. Since the FFQ explicitly stated that it was designed to assess intake of calcium and vitamin D and listed a number of foods containing those foods, it was administered after the OHBS to avoid biasing responses, as the OHBS has a section examining diet in relation to osteoporosis risk. While all surveys were self-administered, I provided participants with a detailed description of how to fill out each survey before they began. All surveys were completed in my presence, which provided the opportunity to ask questions throughout the process.

2.6.1 Sociodemographic survey

A sociodemographic survey was developed for this study to collect background information on the participants (Appendix F). Information on age, gender, ethnocultural affiliation socioeconomic status, education, occupation/area of study, participation in physical activity, alcohol consumption, tobacco, and sunscreen use was collected in the 17 question survey. Participants were asked to express their ethnocultural affiliation in

their own words, as the goal was to record how they viewed themselves rather than fitting them into pre-conceived categories. Participants experienced the greatest difficulty with this question, as many had not encountered this term before and so most required clarification of this term. Socioeconomic status is usually assessed through a combination of income, household number, education, and occupation. Participants were asked to report their parent's/guardian's income, if more than half of their monthly expenses were covered by their parents/guardian.

2.6.2 Osteoporosis Health Belief Scale

The osteoporosis health belief scale (OHBS) is a survey used to gain information on osteoporosis knowledge and health behaviors (Appendix G). The OHBS was developed in 1991 and is one of the most common tools used to analyze osteoporosis health beliefs (Kim, Horan, Gendler, & Patel, 1991). The OHBS is based on the Health Belief Model (HBM) and is designed to measure osteoporosis knowledge and beliefs related to the seven sections of the HBM: susceptibility, severity, benefits of calcium, barriers to calcium, benefits of physical activity, barriers to physical activity, and motivation for health behaviors (Kim et al., 1991; Ziccardi, Sedlak, & Doheny, 2004). The OHBS survey has been used previously by Gammage, Francoeur, Mack and Klentrou (2009), Ziccardi et al. (2004) and Wallace (2002) to assess young adult osteoporosis knowledge and beliefs and by Johnson et al.

(2007), Cadarette, Beaton and Hawker (2004) and Carlsson and Johnson (2004) in older adults. The OHBS is designed to be self-administered and involves 42 Likert scale questions that require the participant to respond to statements about osteoporosis by checking 'strongly disagree', 'disagree', 'neutral', 'agree' or 'strongly agree'. The OHBS was chosen for this study because of its predominance in osteoporosis research and previous validation on young adults. Permission to use the OHBS was granted by Dr. P Gendler, Grand Valley State University, Allendale, MI.

2.6.3 Analysis of the Osteoporosis Health Belief Scale

The OHBS was analyzed following the process established by Kim et al. (1991). The OHBS involves calculating a total score and a score for each of the seven subsections (Appendix H). Scores are calculated for each question by assigning a point-value for each potential answer, where strongly disagree is 1 point and strongly agree is 5 points. The total points can range from 42-210 and each subsection can range from 6-30. The calculation of points varies for each section, for the sections on susceptibility, severity, benefits to calcium and exercise and motivation, the greater the number of points means the higher the score, which correlates to an increased knowledge about and participation in positive health behaviors. For the sections on barriers to exercise and calcium the lower the number of points, the smaller the perceived barriers and the more likely a person will engage in positive health behaviors. Based on the number of points per section and in total, the potential for motivation to participate in health behaviors can be

assessed. Statistical comparison across sociodemographic groups and integration with contextual data from interviews on beliefs about risk was then undertaken.

2.6.4 Limitations of the Osteoporosis Health Belief Scale

While the OHBS is a commonly used tool for assessing osteoporosis beliefs, it contains the limitations inherent in a survey tool. By restricting participants to closed questions with preselected response categories the survey tool does not allow for expanded or contextualized responses. As a result, while the data can be examined quantitatively, it is limited in scope. The recognition of this limitation led to the combination of the OHBS with an interview-based approach to allow for greater exploration of the health beliefs being studied, while retaining a measurable assessment of health beliefs that was comparable to previous studies.

The psychometric properties of the OHBS have received limited testing, which has called into question the validity and reliability of the scale. An initial assessment was conducted by Kim et al. (1991), which indicated acceptable validity and reliability. Subsequent analyses by Cadarette et al. (2004) and Shanthi Johnson, McLeod, Kennedy and McLeod (2008) generally supported the previous findings; however, both Kim et al. (1991) and Cadarette et al. (2004) used only elderly persons in their validation. Shanthi Johnson et al. (2008) are the only researchers to assess younger individuals and males as well as females, which suggests the validity and reliability is in need of further testing.

2.6.5 Food frequency questionnaire (FFQ)

FFQs are a type of dietary recall tool that are designed to retrospectively investigate the use and quantity of specific foods and are often used in nutrition science and anthropology to examine dietary patterns (Betts, Amos, Keim, Peters, & Stewart, 1997; Himmelgreen, Bretnall, Perez-Escamilla, Peng, & Bermudez, 2005; Ong, Meng, Wei, Xiawei, & Wang, 2010; Ulijaszek, 2004; Zingoni, Norris, Griffiths, & Cameron, 2009), and assess nutrient intake (Capita & Alonso-calleja, 2005; Keim, Stewart, & Voichick, 1997). FFQs have a low respondent burden, can be administered efficiently and can be tailored to specific study groups or nutrients, such as calcium and vitamin D, an option which is more difficult with other dietary recall methods (Cobanoglu, Warde, & Moreo, 2001; Ulijaszek, 2004; Wu et al., 2009; Zingoni et al., 2009). FFQs record the consumption of a predetermined list of foods over a specific period of time. Food lists are presented to participants who must indicate how frequently they consume the food and often the portion size (Keim et al., 1997; Medina, 2004). Inclusion of portion size allows the calculation of nutrient intake and increases the potential applications of this method.

Dietary recall tools are designed to collect data on actual or usual intake. Actual intake is the specific types and amounts of foods consumed in a specified period of time, such as 24-hours, and may differ based on the day (Ulijaszek, 2004). Usual intake is calculated over a longer period of time and contains data on the foods usually consumed by an individual in a specified period (Ulijaszek, 2004). FFQs are a type of dietary recall that is used to collect information on usual intake. Since it does not record exact amounts

of all foods eaten in a recent period of time, it cannot provide information on actual intake. Thus the goal of the FFQ is to calculate the amount of calcium and vitamin D that is usually consumed by a given individual in order to understand larger consumption patterns over time. Other types of dietary recall tools that measure actual intake are time consuming and must be administered at a number of different points in order to measure usual intake. Since this study was concerned with estimating the usual intake of calcium and vitamin D of young adults, the FFQ was the best instrument to use.

An FFQ developed by Dr. Susan Whiting at the University of Saskatchewan was chosen for this study as it targeted intakes of calcium and vitamin D from both dietary and supplementary sources, included multiethnic foods, and was previously validated using a 7-day food diary and serum 25-hydroxyvitamin D testing (Wu et al., 2009) (Appendix I). The questionnaire was chosen because of the specific targeting of calcium and vitamin D intake and previous validation on Canadian young adults. The FFQ was designed to measure vitamin D and calcium intake from both dietary and supplementary sources. The questionnaire contains 37 food items with nine options for consumption frequency ranging from never to twice a day, with information on frequency collected per month. Serving sizes are represented as small, medium, and large, and are expressed using household measures. Data on supplement use is collected through open-ended questions included in the questionnaire.

2.6.6 Analysis of the food frequency questionnaire

Data collected from the food frequency questionnaire was analyzed following the method established by Wu et al. (2009) and through use of the nutrient calculator provided by Dr. Whiting that was based on the Canada Nutrient File to convert the food frequency data to the actual calcium and vitamin D contributed by the foods, providing a measurement of specific nutrient intake (Appendix J). The calculator consisted of an Excel spreadsheet that contained the nutrient content for each food and for each of the three portion sizes. Once the number of servings per month of the food item is entered, the calcium and vitamin D intake is calculated. Any additional amounts from reported supplement intake is then added to the total for each nutrient.

In order to evaluate whether or not intake of a nutrient is sufficient, it must be compared to the Dietary Reference Intake (DRI) for that specific nutrient. The relevant measurements include the estimated average requirement (EAR), the recommended daily allowance (RDA) and the tolerable upper level (UL) (Atkinson, 2011). The EAR represents the level at which intake of a specific nutrient would be sufficient for 50% of the population (IOM, 2000). The RDA is the level at which intake would be sufficient for 98% of the population, while the UL is the threshold at which intake is considered safe (IOM, 2000). Intake above the UL might be associated with negative health effects.

When analyzing adequacy of intake for groups, it is customary to use the EAR, rather than the RDA, to avoid overestimation of intake requirements. However, use of the EAR as a discriminant threshold is also problematic because of the potential to

underestimate required intake (Murphy, Guenther, & Kretsch, 2006). The Institute of Medicine provides a formula for the estimation of adequacy in the nutrient intakes of individuals (IOM, 2000). The formula involves calculating the observed difference (D) between an individuals' usual daily intake ($\overline{y}$) and the EAR (*r*). If D is large and positive, the individual's diet is likely adequate in the specific nutrient. The value for y is gained from the FFQ for both calcium and vitamin D and the value for the EAR is provided by the IOM (IOM, 2000).

$$D= \overline{y} - r$$

In order to identify how large D must be to accurately predict adequacy, the standard deviation of D has to be calculated and compared to the z-scores provided by the IOM for assessing adequacy (IOM, 2000). Generally if D/SD_D is greater than 1 then there is reasonable certainty the intake is adequate; if it is less than -1 there is reasonable certainty that intake is inadequate. For values between 1 and -1 adequacy cannot be established with certainty. The SD_D for each nutrient is calculated using the following equation: the group,

$$SD_D = \sqrt{V_r + \left(V_{within} / n\right)}.$$

V_r represents the variance of the distribution of the requirements for a group, which is the degree to which individual requirements vary in relation to the EAR in a population. This number is provided by the IOM and is 10% of the EAR for both calcium and vitamin D (IOM, 2000). Calculating V_r involves taking the square of the standard deviation for a group. In the case of calcium, this is 10% of 800mg, so 80 squared is

6400. Similarly, V_{within} represents the variance in individual day-to-day intake of a specific nutrient, divided by the number of observations. This value is also provided by the IOM for calcium, but not for vitamin D (IOM, 2000). As a result, this variable was not included in the calculation and the vitamin D results must therefore be interpreted with caution. Vitamin D calculations instead relied on just the $D= \overline{y} - r$ equation, but incorporated the variance around individual requirements for a nutrient, which in the case of vitamin D is 40 IU (10% of 400 IU).

The use of V_{within} is designed to improve the accuracy of the prediction of nutrient intake adequacy by using the most accurate value for usual intake. The results of this equation allow for D/SD_D to be calculated, which produces a z-score.

2.6.7 Limitations of the food frequency questionnaire

There are limitations associated with all dietary recall methods because they are retrospective and therefore rely on memory. Retrospective errors can result in foods being accidently omitted as well as intentionally omitted to report a diet that is perceived as 'healthier' (Becker & Welten, 2001; Beerman & Dittus, 1993; Rennie, Siervo, & Jebb, 2006; Westerterp & Goris, 2002). The problems resulting from omission are compounded with a 1 month-FFQ, as participants are required to recall foods eaten over a 30-day period. The longer time period creates an increased potential for misremembering both foods eaten and portion sizes. Problems emerge with recall of both frequently and infrequently consumed foods, leading to potential misreporting of intake data and

subsequent over- or under-representation of calculated nutrient intakes (Becker & Welten, 2001; Cook, Pryer, & Shetty, 2000; Quandt, 1986; Rennie et al., 2006; Westerterp & Goris, 2002).

Alternate types of dietary recall tools are associated with greater accuracy, but are time-intensive and difficult with a poorly motivated population. 24-hour dietary recalls are associated with reduced problems with recall as they require remembering only the past 24 hours, but require multiple administrations over a period of time to obtain an average intake (Ulijaszek, 2004). Similarly, weighted food measurements are considered the most accurate of all dietary recall methods, but require a highly motivated sample population as they are time-consuming (Marr, 1965; Tucker, 2007).

The FFQ used here was validated by (Wu et al., 2009), but was found to slightly overestimate nutrient intakes for vitamin D. This overestimation suggests that results based on the FFQ should be interpreted with caution and the knowledge that they may be under-representing inadequate intakes.

Since the food frequency questionnaires are generally only administered once, there is the potential that they are not capturing true dietary variability. While there are problems associated with 24-hour recalls, using a monthly questionnaire minimizes daily or weekly variation, though diet varies by season (Fowke, Schlundt, & Zheng, 2004). As a result the food frequency questionnaire may be influenced by the month in which they were given, especially as this study was conducted over an 11-month period.

FFQs are designed to be self-administered and as such they often suffer from the problem of self-administration. Serving sizes are difficult to estimate, instructions can be confusing and foods misinterpreted (Cade, Burley, Warm, Thompson, & Margetts, 2004). The problems related to self-administration were reduced in this study through administration of the questionnaire while the researcher was present in the room. The instructions were discussed in detail, with completion of an example question in order to ensure participants understood the questionnaire. Clarification of the meaning of particular food items (e.g., the definition of hard and soft cheese) and discussions of serving sizes were the most common issues that arose.

FFQs are also limited in the type of data they can collect. The survey-based nature precludes the more complex questions regarding dietary behavior that can be accessed through a narrative approach to dietary recall (Kristal, Peters, & Potter, 2005). Food categories are pre-set, as are the three serving sizes, a problem that has been noted as unrepresentative of the breadth of current North American serving sizes (Cade et al., 2004; Kristal et al., 2005). However, by combining the FFQ with the qualitative interview and pile sort methods, the issue of scope was mediated.

The accuracy of FFQs in Canada can potentially be compromised by discretionary fortification laws. Since Vitamin D is present in only a small number of foods, additional foods are fortified with vitamin D. There are no requirements about which foods must be fortified or by how much and so there is variation between food items in their vitamin D content (e.g., cereals) depending on the brand or company. This lack of consistency

creates the potential to underestimate the amount of vitamin D in specific food items, as the FFQ is not designed to collect information on food brands consumed.

The final limitation related to FFQs is the method of analysis. The use of current DRIs to examine calcium and vitamin D sufficiency presents problems related to the ability of the RDA and EAR to adequately assess population nutrient intakes. Since the EAR represents the amount needed to satisfy the nutrient needs of only 50% of the population, it is possible that up to 50% of those who reach the EAR are still not consuming intakes that are sufficient (Murphy et al., 2006). Since the gap between the EAR and the RDA is significant, the lack of an intermediate measurement makes accurate prediction of the nutrient sufficiency difficult.

2.7 Qualitative tools: Pile sort and interview

2.7.1 Pile sort

The development of the pile sort technique is credited to the field of anthropology and is commonly employed with other techniques in anthropological studies about nutrition, including interviews, focus groups, food record methods and anthropometry (Bourey, Stephenson, Bartel, & Rubardt, 2012; Brieger, 1994; Cortes, Gittelsohn, Alfred, & Palafox, 2001; Creed-Kanashiro et al., 2003; Gittelsohn et al., 2000; Jenike, Lutz, Vaaler, Szabo, & Mielke, 2011; Kumanyika, Tell, Shemanski, Martel, & Chincilli, 1997; Newkirk, Oths, Dressler, & Dos Santos, 2009; Quintiliani et al., 2008; Thompson,

Blunden, Brindal, & Hendrie, 2011; Williams, 1997). A pile sort is a participatory activity that provides qualitative information about how informants perceive relationships between objects (Boster, 1994; Bourey et al., 2012; Brieger, 1994). Pile sorts involve providing participants with a series of items written or visually depicted on cards and to observe how they are used to create categories (Bourey et al., 2012; Collins & Dressler, 2008; Cortes et al., 2001; Kumanyika et al., 1997; Quintiliani et al., 2008). Pile sorts can be structured or unstructured; structured pile sorts involve participants being given specific categories and asked to place items into them, while unstructured pile sorts allow participants to create their own categories (Bourey et al., 2012; Newkirk et al., 2009; Quintiliani et al., 2008).

Pile sorts provide a limited type of data, but are especially useful in studies of food because they allow visualization of how participants perceive the relationships between foods. Pile sorts also provide a mechanism for eliciting how foods are conceptualized, by examination of food groupings. Questions can be open ended, such as those used in a study by Creed-Kanashiro et al. (2003), who asked participants to group foods according to similarities, or they can involve specific categories, such as those designed for a study by Newkirk et al. (2009), where participants were asked to group foods in categories of 'more' or 'less' healthful. Similarly, Thompson et al. (2011) used the categories of 'good' and 'bad' for their structured questions about food categories. Pile sorts can also be adapted to specific research objectives or populations. The pile sort has been adapted to function as an FFQ by having participants sort foods into categories of frequency and

further into portion sizes. In two studies participants were asked to explain how they made their groupings and to discuss the meanings behind the piles.

In my study the pile sort was used to examine how young adults viewed the relationship between food and calcium and vitamin D (Creed-Kanashiro et al., 2003; Quintiliani et al., 2008). A series of 28 cards containing foods that contained varying amounts of calcium and vitamin D were provided to participants (Appendix K). The cards contained both an image of a food and the word, in order to help guide participants who may not be familiar with the foods, but recognizing that visual cues are important for classifying foods. Foods were chosen based on reported calcium and vitamin D content in the Canada Nutrient File. Not all foods contained calcium and vitamin D, and a selection of typically healthy and typically unhealthy foods chosen from previous studies into the healthy/unhealthy food dichotomy were also presented to participants to investigate how nutrient content was related to perceived healthiness/unhealthiness of food. No complex foods that consisted of multiple parts (e.g. hamburger) were included, as classification becomes more difficult when each component could fall into a different category. Participants were asked to perform two sorting activities: the first was to sort the foods into piles representing high, low, and no calcium; the second was to sort cards into piles of foods that contained and did not contain vitamin D. Participants were then asked to go through each pile and explain why they had placed the food into that pile.

The purpose of the pile sort activity was two-fold: it examined participants' knowledge of calcium and vitamin D containing foods, while also exploring the

reasoning that underlies their perceptions of calcium and vitamin D containing foods. By having participants explain their choices the pile sort became a mechanism for delving into the production of food knowledge and decisions by examining the characteristics that were used to classify food as rich or poor in calcium and vitamin D. The pile sort was conducted after the quantitative questionnaires were administered, but before the interview in order to serve as a lead-in to the interview process and to avoid biasing the classifications with information from the interview. The classifications provided by the participants were occasionally used to guide the probes used later in the interview, especially when calcium or vitamin D containing foods were seen as having specific characteristics

2.7.2 Limitations of the pile sort

Pile sorts are limited in the type of data they can collect. The unconstrained nature of the activity, which allows individuals to make their own choices about the number and content of groupings, can make comparability difficult (Boster, 1994). A modified version of the pile sort, the successive pile sort, has been adapted in order to increase comparability, as it requires piles to be sorted and merged then sorted again in order to detect hierarchical clustering (Boster, 1994; Brieger, 1994).

The use of a pile sort method is limited by the question, as pile sorts are designed to help the researcher understand how participants perceive the interrelationships between particular objects. The pile sort works well when used to augment interviews and to aid in

guiding later interview questions. The use of images on cards is also problematic as they could potentially bias the participants' response. Participants may be influenced by the specific image chosen (e.g., color, label, preparation) or the image could replace their previous interpretation of the food. Take for example choosing an image to represent milk; milk can be represented in a glass, carton, jug, bag, carafe or mixed with another food (e.g., cereal). The context the food item is placed in can affect the interpretation of the item by the participant. Being aware of the potential confounding options and discussing the different categorizations with the participant can aid in identifying potential confounding factors.

2.7.3 Interviews

Interviews are one of the most commonly used methods in anthropology due to the large quantities of detailed and in-depth information they produce about complex phenomena (Britton, 1995; Sofaer, 1999). Interviews provide the social context for food and nutrition through a dialogue between the researcher and the informant (Barriball & While, 2006; Bernard, 2011; Dearnley, 2005; Edstrom & Devine, 2001). The information provided by interviews in this study is unique in that it allowed the participant to explain their beliefs about risk, osteoporosis, diet, and nutrition in their own words and as it pertains to their own lives, which allows the researcher greater context for interpretation (Edstrom & Devine, 2001; Millwood & Heath, 2008).

Semi-structured interviews were used in this study as they allow for researcher flexibility by permitting the addition of new questions that arise from the dialogue (Barriball & While, 2006; Bernard, 2011). The ability of interviews to promote discussion and generate detailed descriptions leads to the emergence of identifiable themes, such as those seen in Stevenson et al.'s (2007) study of the factors that affect healthy eating in adolescents. This type of qualitative, descriptive data is especially useful in building answers to questions that are difficult to quantify, such as those surrounding perceptions, beliefs and attitudes (Bernard, 2011; Medina, 2004). All interviews were led by the researcher and included only the researcher and participant. All participants consented to have their interviews recorded. Questions were designed to investigate a variety of topics related to diet and osteoporosis, including food meanings, general dietary patterns, beliefs surrounding nutrition, perceived nutrient intake of calcium and vitamin D, general knowledge on calcium and vitamin D, osteoporosis knowledge and perceptions, beliefs and narratives about risk, and sources of information on nutrition and bone health. Open-ended questions were used to promote discussion by the participant and to allow for divergence into new topics (Appendix K). Examples of questions included: What does nutrition mean to you? What can you tell me about osteoporosis? How do you know that you get/do not get enough calcium? The questions were designed to stimulate discussion and create smooth transitions between topics, with the researcher only using additional verbal prompts when necessary.

2.7.4 Limitations of interviews

Interviews provide access to a select type of information, but they also have limitations. Interviews require people to remember past events, beliefs and feelings and because of this they can be affected by retrospective event errors, which occur when events from the past area misrepresented or omitted (Bernard, 2011). These errors can be intentional or accidental and can include informants forgetting events, which lead to omission, or telescoping. Telescoping involves mistakes in the temporal placement of events, causing them to be remembered as occurring earlier or later than they did (Gaskell, Wright, & O'Muircheartaigh, 2000; Loftus & Marburger, 1983). These types of recall problems are especially relevant when discussing food practices and nutrition, which like the food frequency questionnaires, requires participants to recall their previous and current practices and motivations.

Interviewers and participants can also influence each other within the interview. Since I was asking my participants about their dietary practices, there was the potential for participants to feel consciously or subconsciously judged. The presence of a dominant scientific food discourse within Canadian culture creates the pressure to eat a particular way and participants that did not do so felt guilty about it had the potential to change their answers to more closely fit the accepted way of eating. Changing answers to fit a perceived socially acceptable response or viewpoint is a problem within interviews that can be introduced unintentionally through questions by the interviewer and perceived by the participant based on their reaction to the question (Bernard, 2011). While I tried to

remain neutral in the wording of my questions, I was asking for details on how they made food choices that could influence participant responses. A similar issue can be seen with osteoporosis, which is a disease that is not on the radar of young adults. By conducting an interview based around osteoporosis, I was priming my participants to see osteoporosis as serious. When discussing the seriousness of osteoporosis I found I had to adjust my questions to take into account their desire to see osteoporosis as serious because it was the subject of a research study.

The desire to create more socially acceptable answers was linked to the position of authority I had as a researcher, especially with the McMaster and Mohawk students. The constant exposure that university and college students have to authoritative professors created participants that, for the most part, were deferential. My position as a graduate student, especially to the Mohawk students, aligned me with their instructors, which reduced participant's willingness to discuss topics with which they were unfamiliar. Since my study was not based around speaking with individuals that had significant investment in nutrition, attempting to elicit participants' views on nutrition when they felt uninformed on the topic posed significant challenges and required longer periods of rapport-building to make participants comfortable enough to share their opinions.

Participants' discomfort with being perceived as uninformed by an authoritative figure was mediated by the fact that I was a young woman who many viewed as a peer. Often when speaking generally about young adult beliefs, they would employ the pronoun "we" or "our" and indicate that they included me in their discussion. For

example one participant indicated when discussing osteoporosis, "*You know what it's like, we are young, we don't need to worry about bones*" (participant) and gestured to indicate he included me in this generalization. Viewing me as a peer had the potential to simultaneously increase their comfort level, but also invoke new concerns over judgment by a peer.

2.7.5 Analysis of pile sort and interview data

I transcribed and analyzed all interviews following the process for qualitative content analysis outlined by Bernard (2011). This method involved using a small number of broad a priori codes that were guided by the research questions. These codes provided a framework for the initial coding process that allowed for related themes to be separated from the larger transcript. A second round of coding involved a more grounded theory approach, as codes were generated from a close reading of the transcripts. All codes were then organized using NVIVO 10 software in order to create hierarchies, merge duplicates, and examine relationships between themes. The final themes were identified through this process and reflect the collapsing of multiple codes into larger overarching categories representing viewpoints held by multiple participants. The pile sort activity was analyzed following the same method as the interviews. Pile sort categories were recorded by hand and the explanations for the categorizations provided by the participants were audiotaped and coded as part of the interviews. Since the purpose of the pile sort was to explore the

meanings behind the perceived nutrient content of food, thematic analysis presented a useful tool. The categorizations of food were compared in order to examine the frequency with which foods were placed into each of the categories. The pile sort data were combined with the interviews in each transcript and analyzed as part of the thematic analysis.

2.8 Summary

This chapter summarizes the data collection methods used to investigate the relationship between osteoporosis risk and nutrition in young adult participants in this study. A mixed methods approach was used that combined quantitative surveys with interviews and a pile sort activity in a complimentary fashion to investigate how ideas about disease and nutrition relate to beliefs about, and engagement in, health behaviors. The specific combination of methods chosen was designed to produce a holistic view of how food and risk decisions are enacted by young adults. The sampling strategies chosen reflected an attempt to create a representative sample of young adults in Southern Ontario and the protocols used in the administration of the surveys and interviews reflect commonly used practices in the social and nutrition sciences. While all methods have limitations, attempts were made wherever possible to mediate problems and the integration of multiple lines of evidence provided the examination of phenomena from alternate angles.

CHAPTER 3: YOUNG ADULT PERCEPTIONS OF CALCIUM AND VITAMIN D CONSUMPTION COMPARED TO MEASURED INTAKE: INSIGHTS FOR OSTEOPOROSIS PREVENTION EDUCATION

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Article submitted to the journal Public Health Nutrition on March 27, 2016 and is currently in review.

ABSTRACT:

A mixed methods approach was used to investigate the effect that perceptions of calcium and vitamin D had on usual intake in a group of 60 young adults (17-30 years) to inform the design of nutrition education for osteoporosis. Nutrient intake was measured using a food frequency questionnaire (FFQ) and contextualized using interviews. The majority of participants were deemed to have inadequate Vitamin D and calcium intake, according to the FFQ; however, those same participants described their intake as adequate in interviews. Thematic analysis revealed that misconceptions about correct diet, absence of symptoms, and confusion over nutrient sources led participants to perceive their intake as adequate.

KEY WORDS:

Nutrition; food frequency questionnaire; young adults; interviews; osteoporosis

INTRODUCTION

Osteoporosis is one of the most common metabolic diseases, affecting 90 million people worldwide and two million in Canada alone [1]. The current economic cost of osteoporosis is $2.3 billion, a number that is expected to steadily increase with an aging population that is living longer. The difficulty of arresting bone loss and building bone mass has led to a focus on osteoporosis prevention, rather than treatment [1,2]. Prevention includes pharmacological and education based components designed to avoid the onset of clinical symptoms of osteoporosis. Nutrition education is a cornerstone of prevention, which is designed to modify food behaviors to increase intake of calcium and vitamin D, as these nutrients are essential for bone development and growth [3]. Prevention education is aimed primarily at older adults in an attempt to attenuate loss, meaning that other age groups, such as young adults (broadly defined as 17-30 years), are underrepresented in the osteoporosis literature [3]. Peak bone mass is achieved in the late teens to early twenties [4], so young adults represent an important group in the study of osteoporosis prevention because they are currently building bone and developing long term food habits, so their food consumption behaviors have the potential to influence their long term bone health [5–7].

Tailored prevention education is needed for young adults, as their priorities and perceptions of their own risk for developing osteoporosis differ significantly from older age groups [7–9]. Risk is an important framework for understanding engagement in prevention activities, as it is determinations about individual risk of osteoporosis that

guide decisions to engage in prevention. The concept of risk narratives is used here to provide a framework for exploring how beliefs about nutrient adequacy can relate to actual nutrient intake [10].Risk narratives are explanatory models, unique to each individual, that are constructed using the knowledge, experiences and beliefs about risk and health that an individual is exposed to throughout their life [11]. As individuals encounter new knowledge and experiences, their risk narratives change. Narratives are therefore dynamic and fluid, but essential in understanding young adult decisions related to risk mitigation, such as engagement in osteoporosis prevention activities [10]. Using a narrative approach allows a more complex and realistic understanding of perceptions of risk to be gained, as individuals are able to describe the process by which they make risk judgements and assess themselves as at risk or not at risk [12]. Young adult attitudes and beliefs about nutrition and osteoporosis can influence their perceptions of calcium and vitamin D requirements and their own intake, which in turn can influence the effort placed on changing their eating patterns [13].

Previous research concerning osteoporosis and nutrition has focused on assessing intake of calcium and vitamin D or intake in relation to disease knowledge and health behaviors [3,7,13–15]. Intake data allow the prevalence of nutrient inadequacy to be calculated for a specific group or population, which helps to identify where intervention is needed to increase adequacy. Nutrient adequacy is the set amount of a nutrient required by an individual or population. In North America the Institute of Medicine (IOM) has established Dietary Reference Intakes (DRIs) for specific nutrients using Recommended Daily Allowances (RDAs - an estimate of the amount of a nutrient required for 95% of

the population) and Estimated Average Requirements (EARs - a more conservative measurement that estimates the amount of a nutrient required for 50% of the population) [16]. The IOM established these DRIs on the evidence for bone health outcomes associated with intake of calcium and vitamin D [16]. Intakes, the reported or measured amount of a nutrient consumed, that fall under these RDAs are considered inadequate. Young adult EARs have been established for both calcium (800 mg) and vitamin D (400 IU) to maintain bone density for prevention of osteoporosis [16]. Calcium consumption in Canadian young adults falls above the EAR. Females consume an average of 867mg, which falls just above the EAR, and males consume an average of 1107mg, which is above the EAR [17].

Though related to calcium, trends in vitamin D consumption are less clear, as vitamin D is not only consumed, but produced through synthesizes after sun exposure [18]. A number of factors influence vitamin D synthesis including skin color, sunscreen use, and seasonality, meaning that the degree to which dietary sources of vitamin D affect overall vitamin D concentrations in the body can vary greatly [19]. Data on vitamin D status were collected by the Canadian Health Measure Survey and indicated that Canadian adults aged 19 to 30 years old consume inadequate amounts of vitamin D. The average intake was 200 IU, which falls below the EAR [20].

Individual perceptions of disease and risk play an important role in perceptions of the risk of nutrient inadequacy and the subsequent interest in prevention education. The purpose of this study was to compare perceptions of intake to usual measured intake of

calcium and vitamin D in order to investigate young adult awareness of their individual nutrient intakes. A risk narratives framework is used here to identify new directions for prevention education that can be tailored to young adult understandings of their own nutrition and consumption to create more effective prevention education.

METHODS

A mixed methods approach was used to compare actual intake to perceived intake of calcium and vitamin D in a sample of young adults. Ethics approval was received from the McMaster University and Mohawk College research ethics boards and written consent was obtained from all participants before data collection began. Data were collected from 60 multiethnic participants, consisting of 30 men and 30 women, who were living in the Hamilton, Ontario area. All participants were between the ages of 17-30 years, following a broadly inclusive definition of young adults that includes both students and young professionals [21,22]. The majority of participants fell into the 19-24 year old range, due to the high number of University and college students surveyed. Participants were recruited from McMaster University (4-year degree program), Mohawk college (2-year degree program), post-secondary graduates who were no longer attending any educational institution, and individuals who did not attend any post-secondary education. Recruitment was accomplished using posters placed around campus and in the Hamilton community as well as through the use of a social media page designed for this project (Facebook). In order to be included in the study participants were required to be

within the age range of 17-30 years, living or studying in Hamilton, and capable of providing consent. No participants who volunteered for the study were later excluded and none chose to withdraw. All participants were provided with a grocery store gift certificate for participation. Sample size was driven by the qualitative methods, as these were the most time intensive for the researcher and participant, and relied on the principle of saturation [23]. Continual transcription allowed for monitoring of themes and when theme saturation was achieved (no new themes emerging), recruitment was arrested.

Participant interviews were conducted between October 2013 and April, 2014 by the first author. All participants completed a sociodemographic questionnaire that collected data on education, socioeconomic status, age, and gender. Nutrient intake data were collected using a food frequency questionnaire (FFQ) that was designed to estimate usual intake of calcium and vitamin D over the previous one-month period from dietary and supplement sources. Supplement sources were included only for those participants who could recall the exact amount or detailed information on the brand. This FFQ has been previously validated in Canadian young adults [19]. The participants were asked about 37 food items with nine options for consumption frequency related to serving size [19]. Intake was measured using a nutrient calculator based on the Canada Nutrient File provided by Dr. Susan Whiting at the University of Saskatchewan. Nutrient intake adequacy for individuals was assessed using the equation to assess individual intake provided by the Institute of Medicine (IOM) [24], which utilizes the EAR for calcium and vitamin D in combination with known day-to-day variation. A modified assessment of intake for individuals was conducted for vitamin D, as the estimate for day-to-day intake for

individuals was not provided by the IOM. The FFQ and sociodemographic questionnaire were completed before the pile sort and interview in order to avoid biasing the FFQ.

Qualitative data on beliefs about adequacy were explored using a pile sort activity followed by individual semi-structured interviews. The purpose of the pile sort activity was to investigate perceptions of the calcium and vitamin D content of food. A series of 28 cards with images and labels of foods that contained varying amounts of calcium and vitamin D were provided to participants. Participants were asked to first sort foods into groups containing calcium and then re-sort them into groups containing vitamin D. After this activity, they were asked to explain their choices. The pile sort activity was adapted from other studies that used pile sorts for food related questions [25–27]. The goal of the pile sort in this study was to use images of food to stimulate conversation about the characteristics of calcium and vitamin D containing food, not to specifically evaluate knowledge.

Interviews lasted 60-90 minutes and included questions about daily dietary practices, defining nutrition and health, beliefs about calcium and vitamin D intake, dietary and non-dietary sources of calcium and vitamin D, and calcium and vitamin D knowledge. The interviews included specific questions such as, “Do you feel you are at risk for osteoporosis?” and broader questions related to bone heath such as, “How often do you think about your bones?” and “What can you tell me about osteoporosis?” All interviews and pile sorts were transcribed and analyzed by the first author following the process for qualitative content analysis outlined by Bernard (2011). This method involves using a

small number of broad a priori codes guided by the research question and related to risk narratives. These codes provided a framework for the initial coding process that allowed for risk-related themes to be separated from the larger transcripts. A second round of coding involved a more grounded theory approach, as codes were generated from a close reading of the transcripts. All codes were then organized using NVIVO 10 software in order to create hierarchies, merge duplicates, and examine relationships between themes. The final themes were identified through this process and reflect the collapsing of multiple codes into a larger overarching category representing viewpoints held by multiple participants. All analysis was conducted by the first author. The pile sorts were combined with the interviews in each transcript and analyzed as part of the thematic analysis.

RESULTS

Empirical Measures of Calcium and Vitamin D Intake

The socio-demographic distribution of the sample can be seen in Table 1. Assessment of nutrient adequacy indicated that 55% of participants were found to have inadequate intakes of calcium and 61% were found to have inadequate intakes of vitamin D, when compared to the EAR for age (Table 2).While both males and females had mean intakes of calcium that were above the EAR, this was due to five individuals who had exceptionally high intakes (>1500mg for females and >2000mg for males). When these

outliers were removed, the mean for females was 716±343 and for males was 787±470, both of which fall below the EAR.

Socio-demographic Variable	**Number of Participants (%)**
Age	
17-19	15 (25%)
20-22	17 (28.3%)
23-25	12 (20%)
26-28	10 (16.6%)
29-30	6 (10%)
Gender	
Male	30 (50%)
Female	30 (50%)
Education	
No Post-Secondary	6 (10%)
College Student	20 (33.3%)
University Student	20 (33.3%)
Post-Secondary Graduate	14 (23.3%)
Annual Income	
<$24 999	16 (26.7%)
$25 000-49 999	16 (26.7%)
$50 000-74 999	9 (15%)
$75 000-99 999	8 (13.3%)
>$100 000	11 (18.4%)

Table 1: Demographic characteristics of sample for age, gender, education, household income (N=60).

	Mean Overall Intake (mg/IU) +/- SD		**Number deemed as having inadequate intake as measured by FFQ**		**Number who perceived themselves as having adequate intake when deemed as having inadequate intake (as measured by FFQ)**	
	Calcium mg/day	Vitamin D IU/day	Calcium	Vitamin D	Calcium	Vitamin D
Male (N=30)	1005±714	384±326	18 (60%)	20 (66%)	12 (66%)	16 (80%)
Female (N=30)	841±445	426±360	15 (50%)	17 (56%)	7 (46%)	13 (76%)
Total (N=60)	923±595	405±341	33 (55%)	37 (61%)	19 (57%)	29 (78%)

Table 2: Mean overall intake, number (%) inadequate intake and number (%) of the sample that perceived themselves as having adequate intake when they were deemed to have inadequate intake by FFQ.

As seen in Table 2 when perceptions of intake adequacy were compared to the results from the FFQ, 57% (19 out of 33 individuals) of the individuals who fell below the EAR for calcium intake believed that their intake was adequate. Males were slightly more likely to perceive themselves as consuming adequate calcium even when their intake fell below the EAR as compared to females (see table 2), though this difference was not statistically significant. For vitamin D intake, 78% (29 out of 37 individuals) of the individuals who fell below the EAR believed their intake to be adequate. Males and females were fairly similar in their likelihood of perceiving their intake of vitamin D as adequate, despite being inadequate.

Qualitative Analysis

Thematic analysis of the qualitative interview and pile sort data resulted in the identification of three major nutrition discourses that participants expressed to explain their belief in the adequacy of their diets. Participants indicated that they relied on their perceptions of their diet as healthy, the perceived absence of any nutrition-related illnesses, and the belief that calcium and vitamin D were present in many of the foods they ate to support their conviction that their intakes of calcium and vitamin D were adequate.

The Correct Diet

Participants consistently expressed the idea that they knew their intake of calcium and vitamin D was adequate because of the types of food they consumed. *"[I get enough] because it's in everything I eat. It's in the cheese that I have on everything. It's in milk that I drink straight. It's in vegetables when I eat them." (Male, 29, Graduated, P#50).* Specifically, they referred to eating the correct foods, which were foods that were viewed as good, healthy, and nutrient-rich. Healthy eating was understood as consuming many fruits or vegetables, while restricting 'bad' foods or nutrients. *"If I'm making a meal for dinner time [I'm] consciously ensuring that there are vegetables, that there's not too much fat." (Male, 25, Graduated, P#86)* The focus on specific foods as being healthy led participants to view typical healthy foods as being rich in all the nutrients they needed. As a result, vegetables and fruits were referenced as a source of all nutrients. "*Yup. I think*

[I get enough]. Because I eat my greens and I eat my veggies and I get enough sun." (Male, 26, College, P#49)

While the need to consume good foods was discussed by most participants, many tied their perceptions of adequacy directly to their consumption of dairy, or more specifically milk. "*I guess maybe I'm biased. I feel like there is a pervasive, which I'm kind of susceptible to, a pervasive feeling that if you drink milk you have healthy bones and that's like the end of the story." (Female, 30, University, P#3)* As illustrated by this participant, daily consumption of milk was enough to satisfy nutrient requirements for bone health. Similar sentiments were expressed by other participants: "*I know that I get more than enough calcium because I have a lot of dairy in my everyday meals" (Female, 18, University, P#2).*

Young adult perceptions of the adequacy of their intake were tied to their beliefs about the required amounts of calcium and vitamin D. Eating enough of the correct foods (e.g., vegetables, dairy, milk) was all they needed to do and their determination of enough ranged from their 'feeling' that the amount they consumed was satisfactory to a reliance on practiced behaviors.

> Because that's exactly what I've been having all my life. Two glasses of milk every day. I have a glass of milk in the morning and I have a big glass of coffee with milk of course and just instant coffee just before I go to sleep, like just enough time before I go to sleep, like half an hour. And I haven't really had any problems with my bones, so I think it is good enough. (Male, 28, College, P#73)

This participant's assessment of their diet echoes what many expressed, that they continued to replicate the intake that was set for them as children and the lack of negative physical effects reinforced that their consumption was adequate. This quote also introduces a second theme that appeared in many of the explanations provided by the participants, the lack of noticeable symptoms of deficiency.

Absence of Illness

Participants relied on their perceived lack of illness to rationalize their belief in their calcium and vitamin D adequacy. There was an underlying conviction that nutrient inadequacy would have obvious physical symptoms. The nature of these symptoms was defined individually by each participant, depending on how they felt calcium and vitamin D could affect the body. Commonly cited was an absence of bone pain or fracture. "*If something were to happen to me. Maybe, like if I were to break a bone or get some kind of infection." (Male, 22, non-student, P#81)* To these participants, the absence of fractures or bone diseases indicated that their intake was adequate and that obvious physical problems would arise if they were under-consuming.

The body was viewed as the best indicator of nutrient inadequacy and paying attention to the body and the signs it provides was repeatedly mentioned as an important way of ensuring calcium and vitamin D adequacy. One participant expressed the need to pay attention to overall health. "*I have energy to do things, like I'm not tired. I'm not like out of shape even though I am, I'm not like excessively out of shape. Mostly like I know*

that I'm like a decently healthy person, not like the most healthy person. I'm not like that two percent body fat type person. But like decently healthy." (Male, 21, College, P#57)
To this individual having energy and not being tired reinforced his beliefs that he was healthy and taking in adequate nutrients. Another participant identified a more visceral reaction to nutrient inadequacy.

> If I don't feel good or I feel dizzy or something. I know sometimes when I don't feel good I'll be like 'oh mom, I don't feel good. I just ate, but I feel dizzy, I don't feel like myself.' She'll be like 'oh, have a banana or oh, have some almonds.' Or just have whatever it is that she tells me to have and then I'll eat it and then like 10 minutes later I'm like, 'oh I feel so much better now.' So I think your own body tells you that you're lacking something. (Female, 20, College, P#63)

For her, there was a clear and immediate connection between physical symptoms of illness and inadequacy. As long as she felt fine, she assumed she was consuming adequate amounts of nutrients.

Confusion over Sources

Perceptions of adequacy were affected by young adult beliefs about sources of calcium and vitamin D, which were related to ideas about consuming the correct diet. The sources of calcium and vitamin D that participants discussed were varied and were based on a myriad of criteria that included the color, texture, origin, value, and composition of food. One participant focused extensively on the color/texture of food to identify calcium. *"Tofu it's got to be [high in calcium] because it was white, so just by*

association. I guess avocado and hummus are similar. I guess it's just the creaminess. Like chickpeas and avocado are creamy and I associate that with calcium." (Male, 29, Graduated, P#50) Using these characteristics led him to identify calcium in more foods than actually contain the nutrient. Calcium-containing foods were identified as: healthy foods, dairy foods or dairy alternatives, milk, white or creamy foods, good foods rather than junk foods, and foods that are high in other vitamins. One participant stated: *"Bananas, I know bananas have potassium in them. I don't know of anything else, but I figured because maybe it has one thing, it has another." (Male, 19, College, P#47)* Milk was most commonly associated with calcium, often it was the only food that participants felt they were sure contained calcium. *"My only familiarity with calcium is that it's contained in milk. And I know, and so by association any type of dairy products." (Male, 28, University, P#30)* Alternatives to dairy (soy, coconut, almond, and rice milk) were also viewed as high in calcium, though the reasons for this varied; some participants felt that dairy alternatives would be naturally high because they could be used in place of milk. *"Soy, I just kind of figured it's the alternative to milk so I just figured most of the products would be a similar replacement for dietary needs." (Male, 21, University, P#6).*

While participants expressed confidence in their assessment of calcium-containing foods, identifying vitamin D sources produced confusion. Though participants correctly identified the sun as a source, understanding how vitamin D was obtained was more difficult. *"To be honest vitamin D is the one thing that has confused me so much. Because I hear it comes from the sun and I don't understand how that happens. I don't understand, because I see vitamins as more of a physical substance." (Male, 20, College,*

P#69) While calcium was understood as a physical substance that existed as a component of food, vitamin D was less tangible and so more difficult to locate in specific foods. Participants drew associations between vitamin D and foods they perceived as natural or those that grew in the sun. *"Oranges, obviously. That's what they're really known for, their vitamin D." (Male, 19, College, P#45*). This led to the misidentification of specific foods as containing vitamin D, even when they did not.

DISCUSSION

Overall participants in this study perceived themselves as consuming adequate amounts of calcium and vitamin D, although they did not define the concept of adequate amounts. In contrast, the majority of participants, as measured by the FFQ, were deemed to be consuming inadequate amounts of both nutrients.

The three nutrition discourses raised by the interviews and pile sort serve to aid in explaining and contextualizing the results from the FFQ. Young adults developed risk narratives to address their own potential for nutrient inadequacy. The justifications they presented to explain their own adequacy, as reflected in the nutrition discourses identified here are a product of the influence of cultural, educational, and governmental spheres, as well as family and peer groups. Their perceptions of calcium and vitamin D adequacy reflected a combination of their own experience as food consumers throughout their lives, their general knowledge of health and healthy eating, their specific experiences with calcium and vitamin D, and the larger cultural nutrition narratives they are taught. Each

theme contributed to their overall understanding of their perceived risk and relied on specific narratives they had constructed. The concept of healthy eating was viewed as a binary, either they ate healthy or unhealthy. This binary view reflects how mainstream discussions of consumption are structured into the healthy/unhealthy dichotomy [28–30]. The dominant food discourse that is entrenched in food guides and expressed through nutrition education produces a nutrition narrative that focuses on the attainment of a prescriptive healthy diet [31]. 'Eating healthy' comes to mean an individual is providing the body with all the nutrients that it needs, in the correct amounts, which means consuming adequate nutrients. As a result, the narrative of nutrient adequacy woven by participants comes to reflect the viewpoint that consumption of calcium and vitamin D does not necessarily require intentional choices related to those nutrients, but only mindful eating of generally healthy foods.

The existence of the healthy body presupposes the correct consumption of nutrients. The conviction that nutrient deficiency would produce illness served as a way of rationalizing this belief in the healthy diet as protective. Participants drew on their knowledge that some nutrients (such as iron) produced specific negative health effects when an individual is deficient, and applied it widely to all nutrients. The knowledge participants had gained about healthy eating through their own experiences as consumers, along with the absence of illness, allowed them to construct a risk narrative that placed them at low risk of nutrient inadequacy. While a broad age range was surveyed, it is worth noting that the same nutrition discourses were found at both ends of the age range.

While motivations toward consumption were different for 30 year olds than 17 year olds, the rationalizations behind perceptions of adequacy were not substantially different.

The problem for designing prevention that arises from this situation is that most existing prevention education programs on bone health, such as through Osteoporosis Canada and the Dairy Farmers of Canada's "get enough" campaign, focus on educating those who perceive themselves at risk. People who believe their own intake to be adequate do not consider themselves at risk and consequently will not actively engage with prevention education. The individuals who would benefit from prevention education are likely not receiving it as their explanatory models and individual risk narratives minimize the importance of nutrition while assuming adequate intake of calcium and vitamin D. Cultivating young adult interest in information on calcium inadequacy first requires individuals to recognize their own need to increase calcium.

Increasing decision making related to calcium therefore requires making calcium and vitamin D larger players in the Canadian nutritionscape. The minimization of bone health and its relegation to the domain of older adults and growing children leaves a gap for young adults that is filled with concern over 'bad' nutrients (fats, carbohydrates, sugars, and salts) and inadequately defined notions of nutritional health. Nutrition education needs to direct young adults in consciously considering their own intake of nutrients, beyond the "bad four". Engaging young adults with osteoporosis prevention information is a more complex process than simply presenting information. It requires consideration of the social and cultural environment in which young adults come to think about their

own nutritional health to create interventions that counteract the justifications they use for rationalizing beliefs about their own nutrient adequacy.

Limitations

Due to the inclusion of qualitative results along with the intake data, the sample size (n=60) was smaller than in other nutrition studies, which limits the generalizability of the results to the larger Canadian population. There are problems inherent in the use of FFQs, most notably that usual intake is difficult to capture and they are reliant on self-reported data. While the FFQ was designed to account for intake over a month in order to more closely estimate usual intake, all intake data were self-reported and subject to intentional and unintentional misreporting. Since the FFQ was only administered once, it was not possible to account for variation over time, though validation of the FFQ by Wu et al. (2009) showed good agreement with previous administrations. The DRIs for calcium and vitamin D are based on a small number of studies, so thresholds for adequacy must be interpreted cautiously. Additionally, assessing adequacy of vitamin D from diet is problematic, since vitamin D is also synthesized from exposure to UV radiation, meaning that dietary estimates might underestimate intake. Collecting data during the winter months when diet was the only source of vitamin D (as the angle of the sun toward the northern hemisphere causes UVB to be blocked in the atmosphere [19] minimized this problem, but did not eliminate the fact that vitamin D intake data must be interpreted with care.

CONCLUSION

The results of this study reveal a disconnect between calcium and vitamin D intakes and individual perceptions of these intakes. Young adulthood represents an important age for intervention as this age group is establishing food consumption behaviors and building or maintaining bone. Young adults are under-consuming calcium and vitamin D and therefore increasing their potential future risk for osteoporosis. In order to rectify this problem, the delivery of prevention information needs to be adapted to young adults who are not engaged with nutrition self-care. Depictions of osteoporosis prevention with respect to calcium and vitamin D inadequacy should be distanced from a focus on the elderly and address the prevalence of inadequacy in younger life stages as well as the consequences of inadequacy, such as the development of osteoporosis. Greater information on food sources of calcium, and particularly vitamin D, is needed as young adults appear to have generally poor knowledge on where these nutrients can be found. However, before young adults can be engaged in a discussion about sources of nutrients, they must first be made aware of the need for calcium and vitamin D. Linking vitamin D to bone health in the minds of consumers and promoting awareness of calcium means encouraging young adults to question their own intakes rather than simply providing ways of attaining these nutrients. This involves increasing the profile of bone health, potentially through linking it to the areas of consumption that are important to young adults, such as convenience, taste, cost, and their appearance [32–36]. By reframing messages to deliver calcium and vitamin D information that is tailored to young adults, there is a greater potential for developing risk narratives to more accurately reflect the

importance of nutrition and a focus on inadequacy, as it pertains to bone health, an approach that is recognized in the literature [26]. Additionally, further research is needed to explore perceptions of the role of these nutrients in young adults' diets to confirm the generalizability of these results in the greater Canadian population and other populations worldwide to inform osteoporosis prevention and education programs.

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CHAPTER 4: GENDERED PERCEPTIONS OF OSTEOPOROSIS: IMPLICATIONS FOR YOUTH PREVENTION PROGRAMS

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Submitted to the American Journal of Health Behavior on May 30, 2016.

ABSTRACT

Objectives: The presentation of osteoporosis as a disease of women influences how osteoporosis is perceived and how prevention information is internalized and applied. Using the health belief model (HBM) as a framework, gendered perceptions of osteoporosis were investigated in Canadian young adults to inform the design of prevention programs.

Methods: A combination of the Osteoporosis Health Belief Survey (OHBS) and semi-structured interviews were used to explore participants' perceptions of osteoporosis severity, susceptibility, and motivation to engage in prevention activities. Sixty multiethnic, male and female young adults (17-30 years) living in Hamilton, Ontario, Canada participated in the study.

Results: While the OHBS suggested that both genders scored high for self-efficacy, the qualitative interviews indicated ambivalent attitudes to prevention behaviors, indicating a disconnect between quantitative and qualitative findings. Perceptions related to severity and susceptibility revealed that while osteoporosis was generally viewed as a women's disease, individual risk of disease was a negotiation between larger gender constructs of osteoporosis and a variety of risk factors.

Conclusions: Osteoporosis prevention programs need to actively acknowledge these gendered, age-based conceptions of osteoporosis in order to increase prevention behaviors to reduce future disease.

Keywords: osteoporosis; prevention education; gender; Health Belief Model

Introduction

Osteoporosis prevention represents the cornerstone of current public health policy surrounding osteoporosis in Canada, as treatment is both difficult and costly [1]. Young adults are in a key life stage for prevention as they are beginning to live independently and establish lifelong health behavior patterns [2–4]. Young adulthood is especially important in regards to osteoporosis, as bone growth is completed in the early-to mid-twenties and the window during which overall bone mass and density can be increased is closing [5]. Young adults often perceive themselves as being in a liminal growth state and as a result they do not consider themselves in need of prevention information and are unaware of or disinterested in prevention information [6].

Research on osteoporosis prevention has been based on the Health Belief Model (HBM). The HBM, outlined by Rosenstock [7], is based on the idea that health behaviors are the result of certain health beliefs [6,8,9]. The goal of the HBM is to predict engagement in prevention activities by considering the influence of beliefs about disease severity and individual susceptibility in relation to existing cues-to-action (e.g., personal experience or education) and modifying factors (e.g., age, gender, family history of disease). The HBM, as it pertains to osteoporosis, contains seven key factors that are considered to predict engagement in disease prevention: perceptions of disease severity, susceptibility, benefits and barriers to calcium intake, benefits and barriers to physical activity, and self-efficacy [10]. The basic premise behind the HBM is that if a person considers a disease to be severe and themselves to be susceptible, then they are more likely to want to engage in

prevention behaviors [7]. In the case of osteoporosis, the degree to which the disease is viewed as severe and individuals perceive themselves as susceptible is influenced by the presence of cues to action and modifying factors in their environment (Figure 1).

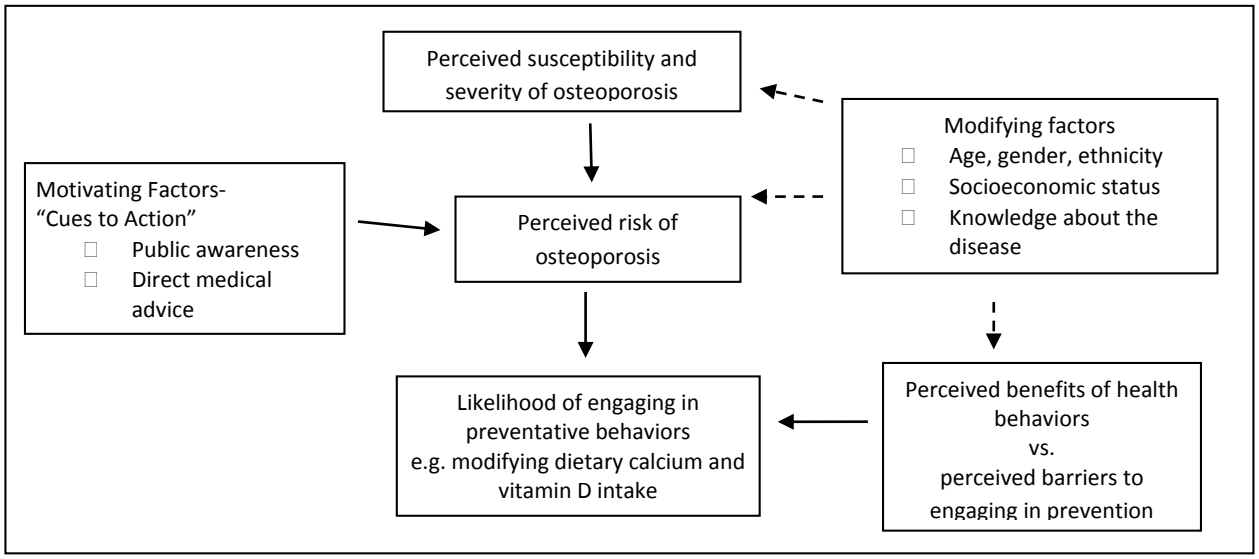

Figure 1: Health Belief Model (HBM) for Osteoporosis. Solid arrows indicate the relationship between different factors in the HBM and broken arrows indicate potential modifying factors that may act to varying degrees on factors to influence preventative behaviors *(Adapted from Glantz et al.*[11])

Osteoporosis prevention education has been heavily gendered [12], with a focus on women to the near-exclusion of men. Research on osteoporosis has generally been women-centered [13–16], though studies that include men are growing [17–19]. Though osteoporosis is viewed as a women's disease, men are susceptible to osteoporosis and the number diagnosed is steadily increasing [1]. Of concern, men and women exhibit differences in perceived severity, susceptibility, and self-efficacy in relation to

osteoporosis as shown with use of the HBM [6,20,21]. While these studies have shown the degree to which gender differences exist, quantitatively they do not reveal how they are expressed or how men and women conceive of osteoporosis differently. This study builds on the quantitative results of these previous studies by using mixed methods to combine qualitative, semi-structured interviews with findings from a quantitative survey to explore underlying perceptions and beliefs about osteoporosis severity, susceptibility and self-efficacy among young men and women. The goal of this research is to provide more insight into gender differences in osteoporosis risk perceptions for the design of tailored youth prevention programs.

Methods

Young adults, defined as being between 17-30 years old, were recruited from among students, non-students and post-secondary graduates. The age range of 17-30 years was chosen to represent young adults as it captures the large variety in studies focusing on young adults and aligns with previously employed definitions [22,23]. Ethics clearance was granted by the McMaster University and Mohawk College Research Ethics Boards and written consent was obtained from all participants prior to participation in the study. Recruitment occurred on campus and in the community through response of participants to the use of posters and a social media page (Facebook) that advertised the study. In order to be included in the study participants were required to be within the age range of 17-30 years, resident in Hamilton, ON, and capable of providing consent. The sample

size was determined by the interviews using the principle of saturation, and participants were added until saturation of themes was reached [24]. No participants who expressed interest in the study were refused and none withdrew from the study. Sixty men (n=30) and women (n=30) participated in the study. All participants completed both the survey and the interview portion of the study.

A mixed methods approach was employed that used a quantitative survey, the Osteoporosis Health Belief Scale (OHBS), followed by qualitative interviews to investigate attitudes to osteoporosis prevention. The OHBS, based on the seven key factors of the health belief model (HBM), was developed by Kim, Horan, Gendler and Patel [25] to evaluate the potential for behavioral change in individuals. The OHBS consists of 42 Likert scale questions divided into seven subscales. The questions are designed to be self-administered and to produce a numerical measure of likelihood of engagement in prevention.

All qualitative interviews with participants were semi-structured and lasted 60-120 minutes. Interviews were audio-recorded and transcribed verbatim. The participants were first given the OHBS before qualitative interviews were conducted in order to ensure the OHBS answers were not influenced by the qualitative interviews. Interview questions focused on encouraging participants to describe their beliefs about osteoporosis and their motivation in relation to prevention. Questions such as “How often do you think about your bones?”, “What can you tell me about osteoporosis?”, and “How likely are you to actively choose to do things to help your bones?” were used to initiate discussion about

osteoporosis prevention behaviors. The first author conducted all interviews, transcription, and analysis.

All seven subsections of the OHBS were analyzed to create a total prediction for engagement. Gender differences in the three subscales—severity, susceptibility, and self-efficacy—were analyzed in SPSS 20 using an unpaired t-test (P=0.05). Cronbach alpha was used to examine internal consistency within the subscales of the OHBS, with consistency obtained at 0.70 or higher. Interviews were transcribed and analyzed following the process for qualitative content analysis outlined by Bernard [24]. The major themes of severity, susceptibility, and self-efficacy were used in the initial round of coding as broad a priori codes that served as a framework for the coding process. Once all transcripts were coded using these themes, a second round of coding was employed, where all themes were generated using a grounded theory approach from a close reading of the transcripts. NVIVO 10 software was used to assign, visualize, and arrange codes into hierarchies and related themes in order to conceptualize the relationship between themes. All participants completed the qualitative interviews as well as the OHBS and a short questionnaire to collect basic sociodemographic information.

Results

The socio-demographic variables of the sample are shown in Table 1. All participants self-identified as either men or women (no one identified as trans-gender).

The majority were university or community college-educated and of multi-ethnic affiliation.

Socio-demographic Variable	Number of Participants (%)
Age	
17-19	15 (25%)
20-22	17 (28.3%)
23-25	12 (20%)
26-28	10 (16.6%)
29-30	6 (10%)
Gender	
Male	30 (50%)
Female	30 (50%)
Education	
No Post-Secondary	6 (10%)
College student	20 (33.3%)
University student	20 (33.3%)
Post-Secondary Graduate	14 (23.3%)
Annual Income (CAD)	
<$24 999	16 (26.7%)
$25 000-49 999	16 (26.7%)
$50 000-74 999	9 (15%)
$75 000-99 999	8 (13.3%)
>$100 000	11 (18.4%)

Table 1: Demographic characteristics of sample for age, gender, education, household income.

Quantitative OHBS Findings

There was good internal consistency for the susceptibility and severity subscales of the OHBS (Table 2), which indicates that the subscales are measuring the same concepts.

The internal consistency for the self-efficacy scale is slightly lower, but still acceptable, and overall the entire 42-item scale for assessing health beliefs is consistent according to the Cronbach alpha (Table 2). According to the OHBS results for this sample, young adults show a moderate likelihood of engaging in prevention behaviors when all seven subscales are included. As a group these participants consider osteoporosis to be a moderately severe disease and identify themselves as moderately susceptible; their self-efficacy, in contrast, is perceived to be high. Women have a significantly higher mean score than men (p=0.027), indicating that they are slightly more likely to engage in prevention. When each of the subscales are analyzed by gender, however, the only significant difference is for susceptibility; women view themselves as more susceptible to osteoporosis than men (p=0.019).

Subscales of OHBS	**Women**	**Men**	**Total**	**Cronbach alpha**
Severity (30 points)	19±5	18±4	18±5	0.816
Susceptibility (30 points)	16±6*	12±4	14±5	0.919
Self-efficacy (30 points)	22±4*	21±4	22±4	0.745
Total (210 points)	154±13	147±11	151±12	0.770

Table 2: OHBS results for entire sample and separated by gender. Asterix (*) denotes significant differences, $p<0.05$.

Qualitative Interview Findings

While the interview data are similar to the OHSB results, in that they confirm that participants view osteoporosis as a severe disease to which they are susceptible, qualitative findings placed their perceptions of severity in a context relative to other diseases. In their discussions of osteoporosis risk participants revealed the ways in which they mediated their perceived susceptibility to osteoporosis. Moreover, qualitative interviews revealed more gender variation in perceptions of severity and susceptibility than found in the OHBS. Qualitative discussions of self-efficacy did not correlate with the OHBS findings of high self-efficacy and instead indicated that the majority of participants were not motivated to engage in osteoporosis prevention.

Severity

Participants of both genders generally judged severity by both the effects a disease could have on daily life and the potential for mortality. Osteoporosis was viewed as a non-fatal disease of older adults that could have varying effects on quality of life. "*I wouldn't say you had a timeline on your life, like two years left to live. But I think you have to think about it on a daily basis and be very conscious of what you're eating and your physical activity (Female, 23, university, P#15).* While all young adults indicated that osteoporosis was severe when asked directly, the perceived severity was reduced when compared to other diseases commonly discussed in the media, such as cancer, heart disease, diabetes or Alzheimer's. *"I think some aspects of it are pretty serious. But when*

it comes to serious diseases, like life-threatening ones, I think osteoporosis is pretty low on the list of life-threatening diseases. Like you can die from it probably, but I don't think it's as dangerous as say multiple sclerosis or other stuff like that" (Male, 19, college, P#47). Mortality was identified as the most important factor in determining the severity of a disease, with cancer and heart disease being perceived as highly fatal and therefore more severe.

While men and women generally expressed similar perceptions of osteoporosis severity, there were some differences related to their assessment of quality of life. Women were more concerned about deformity and pain in the daily lived experience of osteoporosis than men, who rarely mentioned deformity, but did make reference to pain. *"Well a tell-tale sign is they have a bit of a hump. I think it's called a dowager hump" (Female, 22, graduated, P#43).* Women indicated that the hunched appearance caused by osteoporosis was undesirable and served as a clear indication that a person had the condition.

When identifying factors that contributed to the severity of osteoporosis, men were more focused on the physical limitations posed by weakened bones. Osteoporosis was considered serious because it was perceived as restricting mobility and participation in physical activities.

> I would say it would suck. I couldn't do half of the things that I enjoy or want to do. I would be more afraid of things and more cautious. Something as simple as going down a set of stairs would scare me. I would not want to go camping as much. I certainly couldn't train as much as I do. I would worry about bumping into things. I would be freaked out and almost live in a bubble. (Male, 20, college, P#69)

Young adult men were overwhelmingly concerned with the inability to engage in an active lifestyle, which was of primary importance to their lives. *"Being limited actively, that's like 25% of my life gone. That's like a big chunk, just being able to walk from one place to another for hours. If I knew that I wasn't able to do that because my bones were too weak then my explorative nature would be compromised" (Male, 26, college, P#49).* They drew heavily on their own life experiences and the activities they placed primacy on when envisioning the experience of older adults living with osteoporosis.

Susceptibility

Gender differences in the perception of susceptibility to osteoporosis were more complex than indicated by the OHBS findings. Men showed a more consistent pattern in their beliefs about their susceptibility, with only two of thirty men interviewed identifying themselves as possibly at risk for osteoporosis. Women were more equally divided into those who felt they were at risk, those who felt they were not at risk, and those who were unsure.

Both men and women saw gender as an important determinant of risk. Women identified osteoporosis as primarily a disease of women, which they attributed to biological differences between the sexes. "*I think estrogen and like going through menopause and like having childbearing has a bigger impact on female bones. And males obviously don't have to deal with that." (Female, 19, university, P#20).* Participants' opinions were also influenced by media depictions of osteoporosis as a disease of

women. They indicated that commercials for supplements, medications, and overall bone health preferentially showed women rather than men. "*Again it's one of those things where I've always heard more cases of osteoporosis with women. You see more of the commercials with osteoporosis with women" (Female, 23, graduated, P#55).* As a result, female participants felt that women had increased susceptibility to osteoporosis, relative to men.

The majority of men felt that women were at greater risk for osteoporosis and offered similar biological and media-based explanations. However, seven of the thirty men interviewed felt that men were actually more at risk for osteoporosis than women and six men believed that there was no difference in risk related to gender. Those respondents who deemed men at higher risk linked osteoporosis to greater physical activity and men were seen as more active. "*I think men probably get it more than women. Because men are usually more associated with labor and the workforce and eventually just wears down on them" (Male, 19, college, P#47).* In contrast the male respondents who perceived no gender difference in osteoporosis risk saw susceptibility as due to poor physical activity, poor diet, and a family history of the disease.

When participants were asked to describe their beliefs about their own personal risk, these individual risk assessments were interwoven with their gendered perceptions of osteoporosis. While most female participants indicated that their susceptibility to osteoporosis was higher because they were women, this did not translate into higher

perceived individual risk because they felt that the susceptibility associated with gender could be offset by other behaviors.

> Yeah I do feel because I am a woman and I'm not like, I'm more on the thinner end of the spectrum and I know that women who have a lower BMI and are more frail have a higher chance of osteoporosis. I also don't do a lot of weight-bearing, I haven't done weight-bearing exercise throughout my life so I know that is also a risk factor, but I do try get my calcium intakes, I wouldn't say a high-risk. (Female, 23, graduated, P#43)

Rather than focusing on gender as an important factor in susceptibility, women emphasized the importance of other risk factors that were modifiable, such as diet, physical activity, and family history. Women especially focused on risk factors that they felt they were already mediating in their daily lives, which allowed them to rationalize their belief that their own risk was low. This created a continuum of risk beliefs in women, ranging from those who felt they were at risk because they were women, to those who felt their risk was low because of their participation in preventative activities.

A similar pattern was observed in men, where men who identified males as being at higher risk of osteoporosis did not self-identify as personally at greater risk of osteoporosis. These participants had confidence in the adequacy of their diet and physical activity, and indicated that if they were lacking in one area, they made up for it in the other. *"Partly because of the amount of calcium I take in. Partly because of the amount of exercise and training I've done and in history I've never broken a bone, and I don't know anyone in my family who has had a bone disease." (Male, 20, college, P#69)* However, since the majority of men viewed women as having a greater risk of osteoporosis, they focused on gender as a major factor in determining susceptibility.

Self-efficacy

While young adults perceived themselves as able to make lifestyle changes, as reflected in the quantitative OHBS scores, qualitative interview discussion revealed that they were not motivated to do so. This was not related to accessibility or availability of prevention tools, but was located in a lack of perceived need for interventions. While they acknowledged osteoporosis was a serious issue, they did not actively attempt to mediate their own risk. "*Like I want to have healthy bones. But I don't actively do anything to have healthy bones." (Male, 29, university,P#08)* Osteoporosis was viewed as undesirable, but was not perceived as severe enough to enact a change in health behaviors. "*No. I mean I can honestly say that I wouldn't want osteoporosis, but I've taken no steps to guard myself from it." (Male, 24, graduated, P#79)*

No clear gender differences emerged from the qualitative data regarding motivation to participate in prevention. Participants attributed their lack of motivation to the perceived moderate-to-low severity of osteoporosis and to an overall low awareness of the disease. Most had received very little, if any, direct information on osteoporosis. In addition, the time constraints present in their daily lives meant they placed a low priority on future disease risk, especially diseases that were not perceived as severe. "*I think it's just in the back of our minds, there are so many other things in our daily life, just life in general, just you know caring about this person, caring about this person, typhoons, there is just so much stuff going on, we don't think about ourselves, sometimes we think about other people first." (Male, 19, college, P#45)*

Four of the participants did indicate that they made conscious choices to avoid osteoporosis, usually related to diet. This minority was almost entirely composed of women (n=3) who had family members with osteoporosis or who had experienced previous health problems related to bone. "*Yes because I fear osteoporosis. Not fear, but I know that it's out there and I know that one in four women get osteoporosis and I know it's a very painful disease. If I can prevent it, of course I'll do what it takes to prevent it." (Female, 22, graduated, P#43)* These participants were motivated to ensure their bones remained healthy, as they were knowledgeable about the effects of osteoporosis on quality of life. They made conscious choices about their diets and actively attempted to engage in physical activity. "*I'm active in deciding to try and stave that off. I do actively try and make sure that I consume enough dairy. Knowing that my grandmother is going through this, it is in the back of my mind." (Female, 27, graduated, P#72)* For these participants, osteoporosis was considered to be a serious impediment to their future quality of life and they perceived themselves as highly susceptible, and therefore they were highly motivated to practice prevention.

Discussion

In contrast to the quantitative results from the OHBS, data from the qualitative interviews indicated that most of the young adults in the sample did not participate in osteoporosis prevention behaviors and expressed little motivation to do so. The OHBS results revealed that osteoporosis was considered to be moderately severe and participants

felt they were moderately susceptible. While self-efficacy appeared to be high from the quantitative survey, qualitative results indicated that even if participants perceived their self-efficacy to be high, they were not motivated to change their lifestyle to prevent osteoporosis.

The differences in gauging motivation to engage in prevention between the OHBS survey tool and the interviews are significant, because they reveal the need to integrate qualitative methods with quantitative surveys to attain more detailed and nuanced results. While the results obtained through the OHBS in this study were similar to other studies using the OHBS of mostly female, young adults [6,10,16], the actual practices and perceptions of young adults in regards to their true motivation and participation in prevention were revealed through the qualitative interviews and overestimated by the quantitative survey.

Young adults clearly stated they were not motivated to engage in prevention for osteoporosis, as osteoporosis was not part of their disease awareness. This contradicts studies that use quantitative surveys of young adult women to predict fairly high engagement in prevention [14,26], but is in agreement with Ziccardi et al. [16] whose results indicate that college age women do not participate in prevention. Osteoporosis is an invisible disease, though the physical manifestations of it were mentioned by some participants (e.g., dowagers hump, frailty). This invisibility places it at odds with the focus on appearance that captures the attention of young adults, and there is little media awareness of osteoporosis [27,28].

Overall the qualitative findings revealed that participants considered osteoporosis to be moderately severe with low perceived susceptibility. Constructing themselves as unsusceptible – or for those who considered themselves susceptible, but did not view osteoporosis as serious – allowed them to rationalize their lack of motivation. Though young adults indicated they were capable of engaging in prevention, the majority did not believe they needed to practice preventative behaviors at this time in their lives. Those who had previous experience with medical problems or a family experience with osteoporosis placed a greater importance on both its severity and susceptibility. This speaks to the importance of actual experience as a cue-to-action. Those who had experienced being ill were better able to conceptualize the experience of osteoporosis and the problems with having a chronic illness than those who had not, an observation that is consistent with other chronic disease studies [29].

Gender differences were revealed in how severity was conceptualized. This speaks to differences in gendered values among young adults. Where women were concerned with physical deformity and pain, men were concerned with the degree to which osteoporosis would impede their ability to participate in activities. Women were more likely to characterize osteoporosis as a pain disorder that could be disfiguring, which represented the lived experiences of women with osteoporosis [30]. Men understood osteoporosis as a degenerative condition, but in interpreting how osteoporosis would affect their lives if they had it, they drew on what was important to them currently. Since many of the men in the study were very physically active, this was a significant concern for them. While they were correct in identifying the mobility limitations of osteoporosis, they placed it in the

context of sports rather than daily activities, which is the reported limitation of many individuals with osteoporosis [30].

The gendered differences in the perceived consequences of osteoporosis speaks to their varied sources of knowledge. Women tended to have greater awareness of osteoporosis and drew from the lived experiences of those around them, whereas men attempted to construct the experiences within their own lives. Motivating young adults to engage in prevention needs to take into account these differing gendered behavioral practices and create interventions that are tailored to the varied sources that young adults relate to.

The interviews revealed a more nuanced understanding of the gender differences observed in the susceptibility subscale of the OHBS. While participants of both genders constructed osteoporosis as primarily a women's disease, a small percentage of men saw osteoporosis as a men's disease. This is an interesting departure from the literature, where men are generally reported to identify osteoporosis as a woman's disease [9,31,32]. The large percentages of both men and women who saw osteoporosis as a woman's disease, however, reflects the gendered nature of osteoporosis promotion in Canada, as public health education and medical professionals characterize osteoporosis as a disease of aged women. Young adult women in this study had definitely internalized this gendered message, though the divided response of the male participants suggests they either received less osteoporosis information overall or had not internalized the messages to the same degree as the female participants.

Though these larger gender constructs shaped general beliefs about susceptibility, they were not applied by individuals in constructing perceptions of their own risk. Women did not necessarily perceive themselves as personally at risk of osteoporosis, even when they considered osteoporosis to be a woman's disease. Instead, gender as a risk factor was mediated by other modifiable lifestyle behaviors in a way that allowed participants to rationalize their perception of themselves as unsusceptible to osteoporosis. These responses draw attention to the complexity that underlies the broad category of gender and suggests that increased susceptibility as measured by the OHBS does not necessarily translate into greater participation in prevention because the larger gender constructs are not directly translated into perceived individual risk. Creating tailored, gender-based education programs needs to focus on how beliefs about personal risk are constructed and mediated, as well as breaking down gendered conceptions of disease.

Conclusion

Ultimately, further qualitative research is needed to investigate perceptions of osteoporosis in multiple settings in order to generate population specific results. This study expands on previous work concerning gendered perceptions of osteoporosis [6,20,21] and argues that gendered differences in disease perceptions are located primarily in constructions of severity and susceptibility that contribute to engagement in prevention behaviors. This study also highlights the difficulty in capturing detailed results to explain behavior through the exclusive use of quantitative tools and advocates a mixed methods approach that includes a qualitative component. Effective prevention programs require

tailored, gender-specific approaches that address the deficits in gender and age-based understandings of osteoporosis, particularly for beliefs about susceptibility in men, but also targeted to gender-based differences in concerns about the impact of the disease. Young men and women in this study approached the issue of osteoporosis differently and these constructions affected the importance they placed on disease risk. Reducing the future prevalence of osteoporosis requires programs that aid young adults in assessing their own risk of osteoporosis by modifying their beliefs about severity and susceptibility, rather than just delivering information.

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CHAPTER 5: OSTEOPOROSIS KNOWLEDGE TRANSLATION FOR YOUNG ADULTS: NEW DIRECTIONS FOR PREVENTION PROGRAMS

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Submitted to the journal Osteoporosis International on May 31, 2016.

ABSTRACT:

Purpose: 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 with 60 male and female, multiethnic, Canadian young adults were conducted 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 indicate that prevention programs should make use of traditional networks, such as peers, family members, and medical professionals, as well as emerging technologies, such as social media. Messaging should be relatable and integrated with fitness and food information that young adults are already seeking, rather than embedded within specific osteoporosis awareness materials. Young adult interests are not strongly health-oriented and they are consistently exposed to disease-specific messaging, which has decreased the effectiveness of these types of messages.

Conclusions: Creating short, action-oriented messages that are designed to encourage small changes in behavior and are packaged with information that they are actively seeking is more likely to result in active engagement in prevention behaviors.

Key words: osteoporosis; prevention education; young adults; qualitative

INTRODUCTION

Osteoporosis is the most common metabolic bone disease, affecting almost 2 million people in Canada and close to 200 million worldwide [1, 2]. The serious consequences of osteoporosis, specifically fractures and chronic pain, make it a significant public health concern [3]. The difficulty and high cost of managing osteoporosis, 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 [4, 5]. Nutrition information and physical activity form the majority of prevention education, with nutrition being promoted as a relatively simple lifestyle modification [6].

Prevention education in Ontario, Canada is designed primarily for older adults, as they are the demographic that experiences symptoms related to osteoporosis [7]. The Ontario Osteoporosis Strategy disseminates prevention education that focuses on mediating older adult lifestyles, such as fall prevention, dietary changes for comorbid conditions or age-related decreases in food consumption, pharmacological interventions, and low impact physical activity [8]. Young adults, defined here as those between 17-30 years old, who are developing their adult food behaviors and who are either building ormaintaining bone, are not being targeted by this prevention information, as their concerns and interests are very different from older adults [4, 9, 10]. Financial constraints on non-profit organizations, which bear the majority 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 at high-risk of developing osteoporosis, their food consumption behaviors can affect their future risk of osteoporosis, meaning that early prevention targeted at this group is necessary to reduce the future prevalence of osteoporosis [11]. The lack of emphasis on osteoporosis education for young adults by government institutions is less clear as the Ontario Osteoporosis Strategy recognizes the importance of education at all ages for future bone health, but has only implemented programs for fourth grade students [12].

Current dietary patterns in young adults are focused on avoidance and restriction of specific nutrient groups (e.g., the 'bad four' fats, carbs, sugars, and salts) rather than on maintaining balance [13, 14]. These dietary patterns are the result of a dominant Canadian food discourse that conceptualizes food in reductionist, scientific ways [15]. Since current nutrition education is primarily delivered through government institutions, like Health Canada, these reductionist approaches form the basis of how young adults come to know their food [16]. Reducing food to its nutrient content often means divorcing it from its social context, which serves to ignore the realities of how food is consumed by Canadians. Young adults use food as a mechanism for facilitating social interactions, manipulating their physical bodies, negotiating emotional experiences, and identity-creation [11, 17]. The reductionist, nutricentric approach seen in current nutrition education deprives food of these important contexts, which ultimately makes it less successful, since it is not geared to the realities of its target audience [15].

The Canadian Community Health Survey indicated that young adults are consistently consuming inadequate amounts of the bone-related nutrients, calcium and vitamin D, which raises their future risk of osteoporosis and other bone problems [18]. 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 [10]. While the knowledge base of young adults exists in the literature [19–21], 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 recommendations for the design of more effective osteoporosis education programs.

KNOWLEDGE TRANSLATION

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 [22]. 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 [23, 24]. The knowledge-to-action cycle consists of identifying gaps in knowledge, understanding the knowledge-seeking practices and barriers of the target audience, and designing

information that fills gaps, but is accessible, desirable and sustained by the target audience [24].

The role of information users in the knowledge-to-action cycle is paramount and the design of successful interventions requires identifying how knowledge is gained and applied in a specific local context. This means that successful osteoporosis prevention education programs require the identification of information-seeking behaviors for target groups in order to create effective delivery of prevention education [25]. Targeting Ontario young adults first requires understanding how they acquire and apply nutrition and bone health information. This process involves identifying the nutrition and bone health-related interests of young adults and their criteria for selecting sources of information.

METHODS

This study involved the use of in-depth semi-structured interviews to explore the osteoporosis information-seeking behaviors of Canadian young adults. Interviews were conducted with 60 multiethnic, male and female (30 of each) young adults between the ages of 17-30 years who were living in the Hamilton, Ontario area. This age range represents a broad interpretation of the term young adult as found in the literature [26, 27] and was chosen as it allows for inclusion of students and young professionals who are establishing their own food behaviors as independent adults, while also still experiencing bone growth [9, 11]. Participants represented varying levels of education and

socioeconomic status. Recruitment occurred at McMaster University (4-year degree program), Mohawk College (2-year program), and from the community, which included post-secondary graduates and students who had not attended any post-secondary education. Participants were recruited by responding to 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 IRBs and written consent was obtained before participation in the study.

Participants were asked to complete a sociodemographic questionnaire and to participate in an 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 60-90 minutes. All interviews were conducted, audiotaped, and transcribed verbatim by the researcher. Participants were asked questions relating to their participation in nutrition and bone-health prevention activities (e.g., "How important is nutrition/bone health to your daily life?"), information-seeking behaviors (e.g., "Where do you look for information on bone health/nutrition?"), and interests (e.g., "What interests you about bone health/nutrition?"). Participants were also asked to suggest ways that health messaging for young adults could be improved.

Analysis of the interview transcripts was completed using NVIVO 10 for organization of codes and identification of relationships between themes. Identification of themes was accomplished following the process outlined by Bernard [28]. The initial process of coding was guided by the research question, as this study was part of a larger study and extraction of material relevant to sources of information was required. The second round of coding did not employ any a priori codes, but instead followed a grounded theory process, where themes were identified and coded as they emerged in the text [28]. Each transcript was read through twice by the author to ensure all possible codes were assigned. Codes were then organized using NVIVO 10 into hierarchies reflecting overarching themes and merged to eliminate duplicate concepts.

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 they 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. 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. Participants' beliefs about nutrition

replicated the reductionist discourses of authoritative government bodies, 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 involve 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. *"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." (Male, 19, College, P#45)* The most commonly cited sources were doctors, friends, parents, the government and the Internet (Table 1); most participants listed two or three sources that they regularly consulted.

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

Table 1: The number of participants that raised each source as one they used for health information

The assessment of sources by participants was highly subjective and related to preconceived beliefs that they already held: *"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." (Female, 28, Graduate, P#77)* Sources that provided information that supported the opinions and behaviors of participants were preferentially chosen. This led to contradictions between participants over sources and generated a large number of potential sources. Sources were judged by participants based on their reliability, validity, and authority. Sources that were viewed as authoritative and reliable, such as parents, were seen as implicitly trustworthy and participants were less likely to require evidence or additional fact-checking. *"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'." (Male, 28. University, P#28)* The intimate knowledge parents had of their children and

their long-term role as sources of knowledge made them a commonly chosen source by participants. Health professionals were given a similar status based on their assumed knowledge. *"My doctor just tells me the stuff so I just do what he says because he's a doctor." (Male, 18, University, P#14)*

Friends and non-parent family members were required to present evidence (either scientific or anecdotal) in order to be treated as a reliable source. Participation in behaviors perceived as healthy/nutritious or professional training in a health field was desired 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." (Female, 23, University, P#15)* Government and non-governmental associations were viewed as official sources and therefore both authoritative and valid.

> Most of my information comes through either the workout regimens that I'm following or from the Heart and Stroke Foundation. Those are kind of the two that I look at. And I guess the food guide, the Canada Food Guide, as well. So I kind of generally try and stick with sources that I trust, which I think is important. You know steering clear of the fad diets, just sticking with stuff that is scientifically researched and backed. (Male, 30, Graduate, P#38)

The need for evidence and professional affiliation were commonly raised as necessary for sources. Online sources were especially subjected to this and were required to provide evidence, be endorsed by a health professional, or be associated with a government institution. However, there were participants 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." (Male, 20, College, P#69)* Social media, as on online source, was treated slightly differently. All but four participants indicated they did not use social media as a source of nutrition or health information. For those who did look to social media, it was viewed as a passive source that they would read if it was presented to them. *"I think it gets spread around [on social media]. Like everyone can see it in and read about it, so like it's easier to access it there. Rather than going through Google and like never getting to the page sometimes." (Female, 19, College, P#44)* While the Internet was the most commonly cited source of health and nutrition information, most participants did use social media, but it was not seen as a reliable, valid, or authoritative source.

Health and Nutrition-Related Interests

Participants indicated they only searched health information when they were checking symptoms. *"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." (Male, 18, University, P#14)* Health sites were viewed as fear mongering and there was a general belief among participants that there was no reason to look up health questions unless there was a specific problem. Reasons behind nutrition searches generally fell into three groupings: learn what to eat to achieve a specific outcome; learn what is in their food; or following catchy titles or food

facts. Food information was infrequently actively sought by participants and was the by-product of other information-seeking behaviors. Participants researched food to achieve fitness or weight loss goals, increase overall health, create a healthier diet, reduce food costs, find recipes, and mitigate 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?" (Male, 22, College, P#42)* Participants were more likely to search information or follow links that lead to increased strength or weight loss. Searches for healthy diets were also linked to creating thinner or stronger bodies.

Participants were also interested in the contents of the foods they consumed. Research into the ingredients in prepared foods or nutrients in whole foods was motivated by an interest in food politics or food science, but also by a desire to achieve fitness, weight loss, and healthy eating. 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 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. (Female, 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. By doing their own research,

these participants feel they are actively engaging in their own healthcare. Participants were interested in going beyond knowing which foods to eat and were instead searching for information on why. *"[I want to know] how certain foods would benefit me and why it's important to get certain things." (Female, 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 food information was a passive interest in following catchy titles or food facts. These participants generally clicked on weblinks 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." (Female, 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." (Male, 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

When asked about how to improve nutrition messaging for young adults, participants suggested that information should be relatable, explanatory, and consequence-focused. "*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." (Female, 17, Non-student, P#85)* 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 behaviors 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." (Female, 18, University, P#2)* Participants expressed the desire for information provided to include explanations, rather than just lists of foods and behaviors. At the same time they thought that the types of changes suggested need to fit into the busy lives of young adults. Rather than advocating large scale changes, 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." (Male, 28, University, P#30)*

In order to accomplish this, participants supported greater awareness of osteoporosis and bone-related nutrition information by increasing public information in communities,

schools, and online. *"I think definitely just having, I guess, more evidence, more things putting it out there. Just things that someone can see. When anyone sees that this way is more healthy for you, it just seems like a more logical way to do something in general.*" *(Male, 18, University, P#10)* However, there was a lack of agreement on how messages should be framed. Participants were divided over the use of fear messaging as a tool as opposed to the use of incentives or more positive messages. "*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." (Female, 22, College, P#43)* Another believed the use of fear would not be more 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." (Male, 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 plethora of health information available to young adults makes filtering information difficult. As a result, 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." (Female, 21, University, P#18)* Social media was raised as an important source by a majority of participants. 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." (Female, 27, College, P#23)

Technology or media-based approaches were commonly cited as the main way of accessing information. The importance of celebrity endorsements was also suggested by participants, 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." (Male, 26, College, P#49)*

DISCUSSION

The current prevention program that is delivered through Osteoporosis Canada as part of the Ontario Osteoporosis Strategy is targeted at older adults and focused on fall prevention and calcium and vitamin D consumption [7, 29, 12]. The images, information sheets, and public speaking presentations are all designed to appeal to the lifestyles of older adults [29]. They link osteoporosis to the health seeking behaviors of older adults who are often on multiple medications and have other comorbid conditions, while using images that older individuals can identify with. Reworking osteoporosis education to be age appropriate involves repackaging these programs into information that is disseminated online and moves away from identifying and reacting to the symptoms of

osteoporosis, such as broken bones that are associated with old bodies, and instead focuses on bone health as part of a healthy, fit body to bring bones into the forefront of young adult concerns.

When compared to the current osteoporosis prevention education in Ontario, the results of this study indicate opportunities for creating targeted messaging for young adults. As found in other studies, most information seeking by young adults in this study occurs online [30, 31]. However, participants indicated that influence is still exerted by parents, doctors, educators, and peer communities. These results diverge slightly from previous studies that indicate young adults look to medical personnel, magazines, and brochures [32]. Active information gathering from these sources involved asking specific health and nutrition questions. Even older young adults who were no longer living in their family home turned to their parents as a source of information. 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 focuses 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 raising young adult awareness, as participants are attuned to the concerns that medical professionals raise. Information exists that family physicians in Ontario have significant knowledge gaps about osteoporosis [8]. 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 [33, 34]. 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. 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 make 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 [35]. 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 [35]. However, the benefits of these types of peer sharing systems can be seen in the recent success of the Amyotrophic Lateral Sclerosis (ALS)[1] ice bucket challenge [36, 37], 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

[1] The ALS ice bucket challenge was a video campaign that encouraged the public to experience the effects of ALS on the body by pouring ice-cold water over their head. The idea was to raise awareness about ALS, while also fundraising, as 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 [48].

emulation [38]. Designing prevention information for online consumption requires a greater focus on titles and images to 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. 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 [39–42] and is not surprising, considering that the Canada Food Guide is designed to promote nutrition as a mechanism to avoid chronic illness and obesity [43]. Nutrition education needs to be divorced from disease-specific contexts and instead be integrated into the diverse uses that young adults have for food. Since their choices are not driven by nutrition or health seeking behaviors per se, osteoporosis information needs to be embedded within the information that young adults are seeking. Rather than focusing on raising disease awareness, information should be placed into fitness and weight loss contexts as health facts that contribute to 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. For those who are interested in the nutrient content of food or who are concerned with larger food systems, integrating bone health information into relevant knowledge sources would help deliver it to young adults. Incorporating short and simple facts about calcium, vitamin D, and bone health that are interesting and easy to integrate into daily

activities, such as increasing the intake of dairy or dark leafy vegetables, is more appealing to young adults who view themselves as too busy to make major modifications.

Transitioning away from specific disease messaging means also focusing less on scare tactics and promoting incentivizing. 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. Participants indicated they were overwhelmed with disease information that made it difficult to decide which campaigns were the most important to attempt to integrate into their lives. 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.

Limitations

Due to the qualitative nature of this study, it employed a small sample size, which makes the results difficult to generalize to the larger population. 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. Interview data relies on participants to self-report, which can result in omissions and problems with memory recall.

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 [5]. Creating effective osteoporosis prevention education programs for young adults means ensuring that information is being translated to them in ways that they can identify, access, and apply to their own lives. The exploration of information-seeking behaviors in young adults in this study revealed that while they had extensive networks for this, they rarely actively sought nutrition prevention information for osteoporosis. Raising awareness of osteoporosis to increase engagement in prevention behaviors would be facilitated by embedding osteoporosis education into the types of information that young adults are currently seeking. Translating 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—while also focusing information on more traditional networks (parents, physicians) that might be devalued in the digital age. Osteoporosis prevention information needs to build messages that encourage small scale, convenient lifestyle modifications that are young adult-centric 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 their effectiveness.

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CHAPTER 6: DISCUSSION AND CONCLUSION

6.1 Introduction

The purpose of this study was to explore how young adults understand the relationship between nutrition and osteoporosis, with the goal of designing more effective prevention education. This project was conceptualized as a biocultural approach to understanding nutrition education as part of osteoporosis prevention, in that it approaches nutrition decisions as an intersection of biological, socio-cultural and environmental factors (Goodman et al., 2012). This broad question was explored through three specific research areas: 1) the perceived intake of calcium and vitamin D compared to actual intakes and the food beliefs and meanings associated with nutrition behaviors; 2) gendered and age-based perceptions of osteoporosis risk and the relationship to dietary behaviors; and 3) nutrition and health-related knowledge seeking behaviors. Together the answers to these questions reveal underlying beliefs and perceptions that young adults hold toward nutrition and osteoporosis, which can be used to guide the development of new osteoporosis prevention programs that are tailored toward young adults. Prevention programs only work when the populations they target are motivated to participate in prevention. Engaging these target groups means providing prevention programs that align with their current beliefs, interests, and concerns.

The methodological approach used in this study involved collecting both qualitative and quantitative data and underscores the value of a mixed methods approach to gain

information on nutrition behaviors and osteoporosis engagement, as well as highlighting the importance of focusing on the role perceptions play in influencing behaviors. This represents a true mixed methods approach, where both qualitative and quantitative methods are employed with the sample of participants, as opposed to a parallel mixed methods design, where the samples are different. To my knowledge, no other studies have evaluated nutrient intake combined with frequency data on consumption to explore the role of perception in determining beliefs about nutrient adequacy. Similarly the use of the quantitative OHBS survey in combination with qualitative interviews reinforces the need for multiple lines of evidence when exploring disease prevention motivation. The detailed information gathered from the interviews served to guide the interpretation of the survey results and reveal the complexity behind the responses.

6.2 The role of osteoporosis prevention in Canada

Education is the forefront of osteoporosis prevention in Canada, both in the management of existing patients and prevention of new cases (Dontas & Yiannakopoulos, 2007; Osteoporosis Canada, 2010; PHAC, 2010; Tarride et al., 2012; Tussing & Chapman-Novakofski, 2005; WHO, 2003b). This reliance on education emerges from the challenges in treating osteoporosis once bone loss has occurred (Lentle et al., 2011; Tarride et al., 2012; WHO, 2003b). Though bone can be rebuilt, the process is difficult, costly, and time-intensive. As a result, prevention becomes almost synonymous with education; however, education is preferentially designed for older

adults (Jaglal et al., 2012; Osteoporosis Canada, 2010). On the surface that choice is justified; the majority of osteoporosis diagnoses are in women over 50 years old, and risk is associated with gender, age, and frailty (Dontas & Yiannakopoulos, 2007; Kanis, 2007). However, the development of osteoporosis is a process that begins much earlier in the lifecourse, since specific behaviors that involve bones at younger ages can increase the rate of bone loss throughout the later decades or even influence the amount of bone that is formed in the first place (Baxter-Jones, Faulkner, Forwood, Mirwald, & Bailey, 2011; Saggese, Baroncelli, & Bertelloni, 2001). In both cases, this causes individuals to reach the threshold for fracture faster than they might have. Peak bone mass is attained by the late teens to early twenties, but the process of bone maintenance continues throughout life and contributes to osteoporosis risk. Encouraging the adoption of food behaviors that include adequate consumption of calcium and vitamin D can contribute to reducing the future incidence of osteoporosis.

A large portion of osteoporosis prevention information is focused on nutrition and physical activity because these are perceived as modifiable aspects of individuals' lives. While the development of osteoporosis is a complex process that is linked to a variety of factors (e.g., genetics, body mass, skin color, family history, sex and gender, age, fall risk), nutrition provides the building material for constructing and maintaining healthy bone. Though nutrition information represents only one aspect of overall osteoporosis prevention education, it is an essential element that requires tailored prevention.

Canada has been accused of having an osteoporosis care gap, where people are diagnosed, but not properly treated and educated (Fraser et al., 2011; Papaioannou et al., 2004). The intensity of prevention information aimed at older adults and the near absence of prevention for younger ages suggests that there is also a gap in prevention. This silence surrounding prevention for this age group means that the intention of prevention, which is to reduce the future incidence of osteoporosis in all age groups (Wallace, 2002; WHO, 2003b), is not being carried out. Focusing attention on those who are already at high risk might serve to lower the incidence of fractures, but it does not reduce the overall number of people who are falling into this high-risk category. Bone loss is a silent, long-term problem that needs to be addressed throughout the lifecourse, rather than once bone density has fallen below threshold levels.

The need for more widespread prevention has not gone unnoticed. The Ontario Osteoporosis Strategy and Osteoporosis Canada, the main purveyors of osteoporosis prevention information in Ontario, both indicate the importance of good bone health throughout life (Jaglal et al., 2012; Osteoporosis Canada, 2010). However, Osteoporosis Canada, as a volunteer organization, suffers from a chronic lack of volunteers and limited resources, which leads to a pooling of resources to reach the highest risk individuals. The Ontario Osteoporosis Strategy has also put bone health information into grade four curriculum, to start the process of raising awareness about bone (Jaglal et al., 2012). This places prevention information in the sphere of the very young and the elderly, but does not reinforce it between these ages. As the results in this study attest to, without constant

reinforcement, these messages are simply not retained. Though young adults may remember being provided with this information, they do not actively engage with it.

To resolve this gap and place bone health on the radar of young adults, specific prevention education is needed. There has been some attention in the literature to developing education packages for young women that are designed to improve osteoporosis knowledge, but they have relied heavily on evaluating performance on osteoporosis knowledge tests rather than assessing if behavioral changes occur (Chang, 2006; Ford, Bass, & Keathley, 2007; Gammage, Francoeur, Mack, & Klentrou, 2009; Jung, Martin Ginis, Philips, & Lordon, 2011; Ziccardi et al., 2004). The development of education packages has also been designed around identified gaps in knowledge, rather than assessing the role that perceptions about osteoporosis play in participation in prevention (Chan et al., 2006; Chang, 2006; Ford et al., 2007; Kasper et al., 2001). Even young adults who are well educated on osteoporosis will not participate in prevention if they construct osteoporosis as a disease of minor concern. Young adult lives are focused around education, social and professional commitments. The decision to make changes in their lives to incorporate prevention is weighed against the perceived benefits and consequences of that decision. They are unlikely to direct time and energy that must be taken from another interest to prevention of a disease they do not perceive as serious.

The results of the research presented in this thesis underscore the importance of understanding the interaction between young adult perceptions of disease and their motivation. Being knowledgeable about osteoporosis does not mean that young adults

perceive it as serious or a risk to themselves, so knowledge is not necessarily a predictor for engagement. While young adults scored well on osteoporosis knowledge, they clearly expressed low motivation or interest in the disease. Not only does this raise questions about the survey tools being used to assess participation in osteoporosis health behaviors, it also calls into question the information that is being used to design prevention programs. The focus should be on finding ways to engage with young adults and their perceptions and constructions of the disease and disease prevention, rather than simply increasing their knowledge.

6.3 Building narratives of disease and risk

The perceptions held by young adults about nutrition and its relationship to osteoporosis are rooted in the narratives they build to explain and understand disease. These narratives are constructed from the knowledge they have about nutrition and osteoporosis and their own experiences to form their personal beliefs about risk (Panter-Brick & Fuentes, 2009). Deconstructing their perceptions entailed probing these narratives to understand how young adults created linkages between concepts related to nutrition and osteoporosis. The narratives they produced during this study speak directly to their motivations to participate in prevention education, because they describe the process by which they rationalize their lack of interest in osteoporosis or preventative nutrition. These narratives provide the starting point for designing prevention education because they identify where interventions are needed to redirect perceptions in ways that

bring osteoporosis knowledge together with the actual reality of osteoporosis risk. Since young adults build their narratives through integration of information from their own lives, they have little experiential knowledge of osteoporosis to draw on. The result is that osteoporosis and the nutrition-based behaviors related to preventing it are interpreted through the lens of limited young adult experiences with this chronic illness. Compiling narratives for osteoporosis shows the importance of social, cultural, and environmental factors in the production of osteoporosis knowledge and illuminates the barriers to modifying behaviors. By targeting these beliefs, with the aim of attempting to modify or simply working with them, the design of effective prevention education can begin.

6.3.1 Narratives of nutrition

Young adults spoke about food and nutrition with a confidence that was not seen in their discussions of osteoporosis. Nutrition is viewed as familiar because they have spent their lives eating and making choices about their food, so they feel as if they know food intimately. Nutrition has also been taught to them through schools, their parents, television, and their peers, which has provided them with greater surety in their nutrition knowledge (Ristovski-Slijepcevic et al., 2008). This confidence allowed them to rationalize their admitted lack of engagement with nutrition concepts relating to bone health. To most young adults, nutrition was viewed as a mechanism for altering their body image, which is consistent with previous work concerning this age group (Betts, Amos, Keim, Peters, & Stewart, 1997; Ousley, Cordero, & White, 2007; Rozin et al.,

2003). A small number drew connections between food and health, but had often experienced some previous health crisis that was a motivating factor. Even in these cases, though nutrition was of interest, it was oriented toward the goal of avoiding a particular disease.

The concept of nutrition as a tool for achieving protection against various health problems is not surprising, as it aligns with the larger Canadian discourse on nutrition and eating. Food and nutrition education that is disseminated through schools and public health education treats nutrition as goal oriented (Bush, Martineau, Pronk, & Brulé, 2007; Ristovski-Slijepcevic et al., 2008; Scrinis, 2013). The mandate of the most recent Canada Food Guide is to promote healthy eating to reduce obesity and chronic disease (Bush et al., 2007; Health Canada, 2011). The dissemination of an overarching reductionist discourse that encourages individuals to view their food as a collection of nutrients is shaping how food is understood and given meaning in health contexts (Scrinis, 2013). Young adults have internalized these goal-oriented ways of knowing food and so the role nutrition plays in their lives is tied to their feelings about their bodies. The absence of concerns related to chronic disease and the emphasis on the connection between food consumption and body image leads young adults to associate nutrition with manipulating bodies.

Nutrient adequacy is important because low intakes of some nutrients have been associated with diseases (WHO, 2003a). In the context of osteoporosis, low intake of calcium and vitamin D over the lifecourse has been linked to increased risk of

osteoporosis through lower bone density (Daly & Kukuljan, 2010; Garriguet, 2011; Kanis, 2007; Uusi-Rasi et al., 2002). When nutrition is understood in its most reduced form, as a collection of nutrients, not all nutrients are treated equally. Micronutrients like calcium and vitamin D are not at the forefront of young adult nutrition narratives because they are not promoted in the same way as the macronutrients, protein, carbohydrates, and fats. Nutrition information also features the bad four, carbs, fat, sugar, and salt and young adults become focused on these elements of their diets (Oakes, 2004). In this study nutrients that contributed to healthy bone were overshadowed by other 'dietary' diseases, such as diabetes and cardiovascular disease, which received greater attention because they were perceived as more concerning. As a result, young adults were not particularly concerned with their adequacy of micronutrients, like calcium and vitamin D.

When considering intake, young adults focused on overconsumption, rather than considering under-consumption. They tended to assume they were consuming enough 'good' nutrients – a category that was poorly defined by participants – and located their concerns in potential overconsumption of 'bad' nutrients. The participants in this study believed that they had moderately healthy diets that included vegetables and other 'good' foods, which by nature of being healthy would include an adequate amount of micronutrients. The participants were often unable to quantify the amounts of these nutrients that would be adequate, but were nonetheless convinced that they received adequate amounts.

What is concerning about these perceptions is that nutrient adequacy was overestimated by the majority of participants, when compared with the actual intakes of inadequacy estimated from the FFQ. The large amount of this sample that were assessed as inadequate is not surprising, since inadequate intakes of calcium (Health Canada, 2012; Vatanparast et al., 2009) and vitamin D (Health Canada, 2012; Vieth, Cole, Hawker, Trang, & Rubin, 2001; Wu et al., 2009) have been consistently reported in adults. The problem with young adults perceiving themselves as adequate when they were not, is that their risk narratives about their nutrient intake did not construct them as at risk for inadequate intake and instead placed them in perceived compliance with the prevention education being provided for osteoporosis. Any osteoporosis prevention information that these young adults were exposed to would therefore be viewed as irrelevant, because they were not currently at risk, since they perceived their intake to be adequate. Their risk narratives were directly influenced by their perceptions of their calcium and vitamin D intake, which in turn came to influence their interactions with osteoporosis prevention education. Not only would they fail to seek out osteoporosis education, but they would dismiss it if it was presented to them, since they viewed themselves as already engaging in the suggested bone healthy consumption patterns.

Young adults did not just rely on their perceptions of diet to support their belief in their own calcium and vitamin D adequacy. They also held misconceptions on the calcium and vitamin D content of foods and believed that low intake of both nutrients would cause obvious physical illness. Having a variety of evidence for perceiving their intake as adequate made it easier for young adults to rationalize their perceptions of their

intake as adequate and to dismiss any risk associated with potential inadequacy. Young adults drew on their experiences with other nutrients, specifically iron, to build their nutrition narratives for calcium and vitamin D. Since iron deficiency was associated with known physical ailments, such as weakness and fatigue, they rationalized that calcium and vitamin D would be too. The narratives they constructed were a product of their own knowledge and experience with nutrition, that was imposed onto two nutrients they had little familiarity with, in order to reduce their risk for inadequacy and justify their lack of engagement with osteoporosis prevention. Thus, it is not just the lack of knowledge that is problematic, but the context in which young adults are interpreting their knowledge.

The role that osteoporosis plays in the lives of young adults is an important part of this context. Narratives about calcium and vitamin D adequacy are entangled with perceptions of osteoporosis as a disease. Young adult perceptions of the seriousness of and their susceptibility to osteoporosis framed their assessment of the importance of having adequate calcium and vitamin D intake. If osteoporosis was not viewed as a significant disease and nutrition was not a priority, then the need to focus on calcium and vitamin D intake was greatly reduced. The narratives that young adults described regarding calcium and vitamin D reflected these views.

6.3.2 Narratives of osteoporosis

Narratives surrounding osteoporosis were interpreted using the Health Belief Model (HBM), which provides a framework for understanding how information and experience

become translated into beliefs about risk and ultimately into prevention information. The HBM uses specific constructs to model the process of decision-making about participation in prevention (Gammage & Klentrou, 2011; Rosenstock, 1974; Shanthi Johnson et al., 2008; Wallace, 2002).

The quantitative and qualitative results indicated some agreement, n. however, the interviews showed that participants had difficulty applying their contemporary experiences to their potential future risk, making clear risk assessments difficult. This is not surprising, as the ability of young adults to conceptualize future or even current risk has been shown to be poor (Cook & Bellis, 2001; Johnson, McCaul, & Klein, 2002; Millstein & Halpern–Felsher, 2002). Previous research into young adult beliefs about osteoporosis have focused heavily on assessing knowledge (Chang, 2006; Ford et al., 2007; Gammage et al., 2009; Jung et al., 2011; Ziccardi et al., 2004). Young adults have a fair amount of osteoporosis knowledge; however, their application of that knowledge is often variable and stems from their perceptions of the lack of importance of osteoporosis as a health concern.

Social and cultural constructions of disease influence how young adults come to construct risk. Public health information on disease focuses heavily on associated mortality. Cancer, cardiovascular disease (and associated complications), and diabetes often dominate health news, because of the potential for early death. Degenerative neurological conditions, such as Alzheimer's or Parkinson's, associated with a type of social mortality (loss of the self), are also at the forefront of public health discussions.

The frequency with which these diseases are presented to the public and the emphasis on their consequences have led young adults to use these 'big ones' as a measuring stick for all other conditions. Mortality becomes the marker for a serious disease. Placed in this context osteoporosis is viewed as less serious than other diseases, because it is chronic and not perceived as fatal.

Part of the problem with general osteoporosis awareness is that bone is not promoted in the same way as circulatory, respiratory, or neurological health. Bone is depicted as a frame for the body, which leads to conceptions of it as static and invisible. At the same time public health depictions of osteoporosis construct it as a disease of the elderly and the symptoms of osteoporosis are confused with those of 'natural' aging (Backett-Milburn et al., 2000; Grob, 2011; Wilkins, 2001). This results in osteoporosis becoming a disease of expected decline, rather than a preventable problem with a silent progression (Reventlow & Bang, 2006). As a result, young adults are not socialized to think about bones or be concerned about osteoporosis, which means it is often entirely absent from their risk narratives. When questions about bone are raised, bone health is rationalized through discourses on age that locate bone problems in later decades and allow young adults to reduce their own perceived susceptibility.

Engaging young adults with osteoporosis is also difficult because of the gendered nature of public health and academic discourses about osteoporosis. Like breast cancer, osteoporosis is a disease that is generally associated with women, specifically elderly women (Fausto-Sterling, 2005; Solimeo, 2011). The increased messaging about

osteoporosis to women causes them to perceive themselves as more susceptible to osteoporosis. Men have complex reactions when diagnosed that range from shame and emasculation to disbelief at having a 'women's' disease (Sedlak et al., 2000; Solimeo, 2008, 2011). Young adult men's beliefs about osteoporosis are complex and often contradict these commonly held gendered conceptions. A minority of men in this study viewed themselves as more susceptible to osteoporosis, but their beliefs were based on incomplete knowledge of the mechanism of osteoporosis. These differing beliefs speak to the lack of consumption by young adults of osteoporosis messaging, as these young men have not absorbed the gendered discourse on osteoporosis. However, their contradictory views have also not served to increase their own perceived susceptibility.

The personal narratives of women, in contrast, strongly referenced the gender-based narratives of female susceptibility found in public health. Depictions of osteoporotic patients as older women resonated with these young women, who viewed themselves as at increased risk. Women did not critically assess this gendered presentation of osteoporosis, but instead viewed their risk as inevitable. Gender became the most important marker for susceptibly and required women to compensate for this increased risk with other activities, such as diet and exercise. Discussions of susceptibility were generally combined with seriousness and because osteoporosis was not serious, their increased susceptibility did not markedly change their overall risk narratives.

Risk narratives surrounding osteoporosis interact with those surrounding prevention. In the case of nutrition, which is the major focus of osteoporosis prevention in Ontario,

perceptions of osteoporosis as a minor condition with low susceptibility discourage active thinking about prevention activities. Focusing on calcium and vitamin D intake is not viewed as necessary or productive by young adults, as they feel that their nutrition can be sacrificed when they are younger and 'caught up' when they are older and perceive themselves as actively at risk. When combined with the lack of attention paid to nutrition in general, these two narratives reinforce a lack of interest in osteoporosis prevention.

6.4 From narrative to action: Invoking knowledge translation

The purpose of osteoporosis prevention is to deliver information to at-risk individuals that will be internalized and enacted through participation in prevention behaviors, such as increased calcium and vitamin D intake. The narratives young adults express regarding nutrition and osteoporosis indicate that they are not engaged with discourses on osteoporosis prevention or nutrient adequacy. They have complex patterns of rationalization that reinforce their lack of need for prevention information or participation in prevention activities. This means that the first step in the process of translating osteoporosis knowledge is to identify how to engage young adults.

The perception of osteoporosis as unimportant means that the traditional models of osteoporosis prevention that are being used now are unlikely to work on young adults. The solution is to repackage osteoporosis prevention messaging in ways that appeal to young adults. Current osteoporosis messaging in Ontario is delivered by Osteoporosis Canada in partnership with the Ontario Osteoporosis Strategy. The 2015-2016 prevention

strategy is called “make your first break your last” and is focused on high risk individuals, which are those who have or are at high-risk of having an osteoporotic fracture (Osteoporosis Canada, 2010). This is generally older adult women, often with comorbid conditions. The information presented is tailored to the lives of older adults and includes suggestions for increasing calcium and vitamin D intake in restricted diets, fall prevention, and low impact physical activities (Osteoporosis Canada, 2010).

The interests and concerns of younger adults differ from older adults. Older adults tend to be more mindful of health and wellness and actively seek out health information (Manafo, 2012). Such behaviors are stimulated by physicians and public health representatives, who are constantly reminding them of the importance of ‘healthy aging’. Whereas the role that health seeking behaviors play in young adult lives is quite different. Young adult health and nutrition motivations are often located in their physical bodies and center around appearance and fitness, though convenience and cost are also important factors (Davy, Benes, & Driskell, 2006; Neumark-Sztainer et al., 1999; Rozin et al., 2003). Information-seeking by young adults is goal-oriented and often views food as a mechanism for achieving certain effects, while food use focuses on restricting or eliminating problem nutrients, such as fats or carbohydrates.

The places that young adults look for information also differ from older adults. While young adults gather information from parents, medical professionals, and peers, the majority of their information seeking is done online. The increasing number of health and nutrition-related websites, as well as the growing role of social media in producing

and disseminating health information have expanded the breadth and availability of information and misinformation (Vance et al., 2009). While the Internet has created an ease of access to medical knowledge that was previously held by professionals, the amount of information available and the requirement to evaluate all facts can be overwhelming (Vance et al., 2009). Attracting young adults to reputable, official sources becomes paramount in delivering accurate and understandable information on osteoporosis.

The framing of messages therefore becomes important in how knowledge is translated. Most of the information on the Osteoporosis Canada website is for older adults who suspect or know they are at risk. Information for young adults needs to motivate them to question their risk of osteoporosis or their intake of calcium and vitamin D. Using osteoporosis messaging to push young adults to question their assumptions about their nutrient intakes and their perceptions about osteoporosis can help engage young adults with osteoporosis information seeking behaviors. Rather than simply presenting them with osteoporosis facts or using disease scare tactics, young adults need to be motivated to seek out prevention information because they believe it will be relevant to them. While fact-based disease information works for diseases that young adults already fear, such as cancer or cardiovascular disease, young adults already have risk narratives that minimize the importance of osteoporosis and bone health-related nutrition. The overwhelming amount of disease messaging that young adults receive makes it difficult for a single disease to stand out, unless there is significant fear associated with it. Moving

away from fear-based messaging and implementing strategies that make osteoporosis risk relevant to young adults has a greater chance of achieving change.

Rather than drawing young adults to search for osteoporosis information, it would be beneficial to place this information where they are already looking. Packaging information requires appealing to their interests, such as using catchy titles and claims. A large amount of information is taken in subconsciously through Internet browsing and using these practices to embed information on increasing calcium and vitamin D intake, correcting perceptions of osteoporosis, and encouraging active engagement with bone health would increase uptake. Using suggestions that do not require large behavioral modifications and can be embedded in daily activities are more likely to be embraced by young adults.

6.5 Conclusion

The intended outcome of this project was to identify how nutrition-based osteoporosis prevention information could be improved for young adults. In doing so, this project highlighted the importance of perception in influencing behaviors and explored the role that social and cultural constructions of disease play in framing concepts of risk. These findings were then combined with information on knowledge-seeking behaviors to develop recommendations for how to move forward with designing prevention education for young adults. Creating prevention programs is a complex process that needs to be biocultural in its design. Effective prevention education must consider not just the

knowledge gaps that exist, but more broadly, how young adults understand osteoporosis. Changing behaviors means engaging young adults and convincing them to care. By making osteoporosis relevant to their lives, they will be more willing to modify their actions.

The role of perception is an important one that is often missed when considering prevention programs. Or if it is considered, is not built into research design. Perceptions are entangled in social and cultural constructions of chronic disease and draw on personal experience to create a system for responding to a particular disease risk. Young adults who are knowledgeable about osteoporosis, but perceive it as non-threatening and low risk are not going to enact their knowledge through their lives. The discussion of nutrition in this thesis demonstrated the power that perception has in directing the health behaviors of young adults. Intervention is needed to alter perceptions, in order to make it possible to then alter behavior.

The importance that socially constructed ideas of osteoporosis have on influencing personal perceptions was highlighted by the discussion of gendered responses to osteoporosis risk. The gendering of osteoporosis in the public sphere has constructed it as a woman's disease, which changes how young adults come to perceive it. Part of the challenge in building prevention information is getting young adults to look beyond the common constructions of osteoporosis in order to start questioning their own risk. Deconstructing these depictions of osteoporosis as female- and age-centric is needed before young adults will see it as a relevant condition. These representations of

osteoporosis are embedded in a larger North American health discourse that teaches young adults to think about and interpret health and nutrition information in a reductionist way that leaves little space for bone health in a sea of other diseases all vying for attention. Guiding young adults toward more holistic notions of health creates space for discussing bone health as part of a healthy body and encouraging healthy behaviors.

What emerges from this discussion of osteoporosis and nutrition is the complexity in designing prevention information for young adults. Young adults require tailored prevention that addresses their interests, beliefs, and influences. They interpret prevention programs through a variety of social lenses, meaning that prevention program design must recognize the biocultural factors that influence young adult behaviors. While young adults have knowledge of both nutrition and osteoporosis, they have difficulty bringing these concepts together to link their consumption behaviors to their osteoporosis risk. Delivering osteoporosis prevention to young adults involves creating linkages between nutrition adequacy and osteoporosis knowledge, while also encouraging them to alter their perceptions of osteoporosis as a negligible concern.

The ability to change behaviors therefore lies in the delivery of prevention education and the messaging framework used. Drawing young adults into the conversation on osteoporosis means creating information that catches their attention and is relevant to them. This can be accomplished through linking osteoporosis to young adult bodies and building messages that focus on encouraging them to question their own risk, rather than using fear-based messaging. Communicating with young adults using online sources,

such as social media, and placing osteoporosis information alongside the types of information they actively seek makes them more likely to build positive associations with osteoporosis. Identifying the easiest nutrition behaviors to change and clearly outlining the integration of these modifications into their lives and the expected outcomes provides the greatest chance at effecting change. Rethinking and carefully structuring these approaches can lead to greater engagement by young adults.

Fundamentally, prevention education is a form of knowledge translation—the synthesis, dissemination, exchange and ethically sound application of knowledge to improve individual health and the effectiveness of the health system (Canadian Institutes of Health Research, 2009)—and redesigning prevention education requires combining information from a variety of sources. The role that beliefs play in health information seeking behaviors and the perceptions young adults hold regarding nutrient adequacy and osteoporosis risk influence their participation in prevention. Successfully influencing young adults to modify their behaviors is both difficult and necessary if the future incidence of osteoporosis is to be reduced. The first step is to develop an understanding of the target audience, which this study has begun. The next is for programs like the Ontario Osteoporosis Strategy to initiate the process of building and integrating new types of prevention into their current programs that target those at future risk of osteoporosis.

6.6 Future directions

This study provided interesting insights into the design of prevention education for young adults, though it was limited by a small and localized sample. Expansion to include a province-wide sample of young adults is needed to assess the generalizability of these results to all of Ontario. A larger sample size would also allow for more complex quantitative analysis of the food frequency questionnaire and the OHBS to explore the effects of different demographic categories (age, income, gender, education) on osteoporosis beliefs or nutrient adequacy.

The design of this study focused on the role that nutrition plays in osteoporosis prevention. The development of osteoporosis is a complex process that involves a variety of factors that can, to some degree, be mitigated. Further work should expand the design of tailored prevention beyond nutrition to include physical activity and to raise awareness of non-modifiable risk factors.

The suggestions made in this study relating to prevention only begin to assess the steps needed in redesigning prevention information. A careful assessment of the current osteoporosis strategy and information provided by Osteoporosis Canada is needed to identify clear steps in creating prevention programs for young adults. Reconstructing the old strategy and adapting the findings of this and future studies to the delivery of prevention information is necessary for future integration of prevention. Finally, the importance of online sources for young adult health seeking behavior emerged as a significant factor in the design of prevention programs, specifically the contradictory role

of social media. Social media represents an emerging and understudied branch of online messaging and more research is needed to understand social media use patterns and the long term implications of using it as a messaging platform.

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Appendix A – Facebook Information

Information That Will be Presented on the Facebook Page for This Study

Young Adult Perceptions of Osteoporosis

Dr. Tina Moffat
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Alyson Jaagumagi
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Hamilton, Ontario, Canada
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Title/Username: Do you know how your nutrition affects your bone health?

Short Description:

Participants are needed for research in nutrition and bone health!

contact: Alyson Jaagumagi - jaagumae@mcmaster.ca

Description:

THE STUDY:

If you are a student between the ages of 17 and 30 at McMaster or Mohawk this study on beliefs about nutrition and bone disease is for you!

All you need to do is participate in a single 90 minute session on at McMaster, at the Hamilton Public Library location closest to you or at a community center close to you. During this session you will be asked to fill out 3 questionnaires and participate in a sorting activity and a face-to-face interview.

The questionnaires will ask you some background information about you, your beliefs about osteoporosis and the foods you eat. They are short surveys and will take only half an hour.

The interview will focus on your ideas about health, nutrition and bone disease and will include questions such as:

- What does nutrition mean to you?

- What can you tell me about osteoporosis?

- Where would you go to get information about your bones or bone diseases?

In appreciation for your time, you will get a $20 gift certificate.

This study contains the possibility for minimal risks to the participant as you will be asked to discuss your personal opinions. It is not likely that there will be any harms or discomforts associated with participating in this study, though you may feel like I am criticizing your diet or you may worry about getting osteoporosis. There are no right or wrong answers, and I will not be determining whether or not you will get osteoporosis. I will be able to tell you based on your answers to the food questionnaire, how much calcium and vitamin D you consume, on average, and I can give you those results if you wish. I will also give you some information about osteoporosis at the end of the interview, so you can research it further or talk with your doctor about it if you have concerns

It you choose to participate you do not need to answer any questions in the surveys or interview that you do not want to answer or that make you feel uncomfortable. You can stop taking part in the study at any time.

For a more detailed description of this study, including the potential risks, you can view the letter of information in the notes section of this page.

WHY IS THIS IMPORTANT?

Osteoporosis is a serious bone disease in Canada that affects 1 in 3 women and 1 in 5 men. Osteoporosis has life-changing consequences for those who develop it and is extremely expensive to treat. Because of this preventing osteoporosis has become very important.

A person's diet affects their bones. Since osteoporosis affects the bones, nutrition and osteoporosis risk are related. This means that a person's diet is really important to their risk of bone disease.

In order to lower the risk of osteoporosis, people need to eat food that is good for their bones. Getting people to eat food that is good for their bones means giving them

information in a way that they will use. But at the moment it is not clear how young adults think about their nutrition and bone health. Asking young adults to talk about their beliefs and attitudes toward nutrition and bone will help in finding ways to encourage them to eat for their bones.

THIS PAGE:

This page was designed to provide you with information on the study. You are under no obligation to make comments, 'like' this page or interact with the page in any way that will reveal your identity. As the administrator of the page and the researcher conducting the study I guarantee that I am making no attempt to track who visits this page.

For more information or to volunteer for this study, please contact:

Alyson Jaagumagi

Email: jaagumae@mcmaster.ca

Department of Anthropology

McMaster University

Appendix B: Recruitment Poster

DO YOU KNOW HOW YOUR NUTRITION AFFECTS YOUR BONES?

PARTICIPANTS NEEDED FOR RESEARCH IN NUTRITION AND BONE HEALTH!

If you are between the ages of 17 and 30 this study on beliefs about nutrition and bone disease is for you!

It will only take 90 minutes of your time to fill out 3 questionnaires and participate in a sorting activity and an interview.

In appreciation for your time, you will get a **$20** gift certificate.

For more information or to volunteer for this study, please contact:

Alyson Jaagumagi
Department of Anthropology
Email: jaagumae@mcmaster.ca
(289) 880-9783

Additional information is available on facebook!
www.facebook.com/nutritionandosteoporosisresearchproject

This study has been reviewed by, and received ethics clearance by the McMaster Research Ethics Board.

Appendix C – Email Information Script

EMAIL INFORMATION SCRIPT

Young Adult Perceptions of Nutrition and Osteoporosis

Dr. Tina Moffat
Department of Anthropology
McMaster University
Hamilton, Ontario, Canada
905-730-9657
E-mail: moffatcs@mcmaster.ca

Alyson Jaagumagi
Department of Anthropology
McMaster University
Hamilton, Ontario, Canada
(289)880-9783
jaagumae@mcmaster.ca

E-mail Subject line: McMaster Study – Beliefs and attitudes toward nutrition and osteoporosis

Dear _____,

Thank you for your interest in my study. In this email I will provide you with some background information about the study as well as attaching a document called a Letter of Information, which gives detailed information on the study.

As part of the PhD program in anthropology at McMaster University, I am carrying out a study to learn about how young adult nutrition is (or is not) influenced by beliefs about bone health and osteoporosis. Nutrition is a major factor in maintaining health and the development of future bone disease and it is important to understand how ideas about bone health affect decisions about nutrition. No previous knowledge of osteoporosis is required for this study, as I am interested in learning about how young adults connect their own ideas about nutrition to bone disease.

This study will involve a single 90 minute session during which you will be asked to fill out a survey about osteoporosis, a questionnaire on specific foods you eat, a short questionnaire collecting background information on you and participate in an interview that has an interactive component where you will sort cards into categories.

This study contains the possibility for minimal risks to the participant as you will be asked to discuss your personal opinions. However, you are not obligated to answer any questions you do not wish to and may stop at any time.

If you are still interested in participating in this study please reply to this email to arrange your interview session. Interviews will be conducted at a time that is convenient for you, so in your reply, please indicate the day and time that would work best for you. Interview sessions will be conducted in Chester New Hall room 418, the Hamilton public library location closest to you or a community center close to you.

Thank you very much,

Alyson Jaagumagi

PhD Candidate

Department of Anthropology

McMaster University, Hamilton Ontario

jaagumae@mcmaster.ca

Appendix D – Letter of Information/Consent

DATE: _____

LETTER OF INFORMATION / CONSENT
Young Adult Perceptions of Nutrition and Osteoporosis

Investigators:

Faculty Supervisor:
Dr. Tina Moffat
Department of Anthropology
McMaster University
Hamilton, Ontario, Canada
(905) 525-9140 ext. 23906
E-mail: moffatcs@mcmaster.ca

Student Investigator:
Alyson Jaagumagi
Department of Anthropology
McMaster University
Hamilton, Ontario, Canada
(289)880-9783
E-mail: jaagumae@mcmaster.ca

Purpose of the Study

You are invited to take part in this study that looks at attitudes and beliefs about nutrition and osteoporosis in young adults. Osteoporosis is a common bone disease in Canada and nutrition is an important factor in preventing osteoporosis. Osteoporosis results in thin, weak bones that are prone to breaking (fracture) and can have severe consequences to the daily lives of affected people. While osteoporosis is a disease that is most often seen in older people, osteoporosis risk is the result of behaviors throughout a person's life. This means that prevention is important for all ages, but especially for young adults whose bones are still growing. In order to design useful prevention programs it is important to understand how young adults think about nutrition. This study will discover the attitudes and beliefs that young adults hold about nutrition and its relationship to osteoporosis by asking young adults to talk about their opinions on a variety of topics relating to nutrition and bone disease. The information gathered can be used to create better education programs about osteoporosis that are designed for young adults.

Procedures involved in the Research

With your consent, you will be asked to participate in a number of activities that include a short background survey, two questionnaires, a food sorting activity and an interview. You will only need to meet with me once as all activities will be conducted in a single meeting. The entire time commitment will be an hour and a half (90 minutes). We will meet on campus in a private room at your convenience. You might be asked if you would be willing to participate in a focus group at a later date. You are not required to

participate in the focus group and can decline to participate in the focus group, but still do the interview.

The socio-demographic survey will ask you for some demographic/background information like your age and university/college program, as well as some lifestyle information like how often you exercise The questionnaires include a food frequency questionnaire and an osteoporosis knowledge survey. The food frequency questionnaire will ask how often and how much you eat of certain foods. The osteoporosis knowledge survey will be a series of multiple choice questions that ask you to express your beliefs about topics related to osteoporosis. These questions have no right or wrong answers and are designed to allow you to express your opinions concerning osteoporosis.

I will also be asking you to complete a sorting activity. You will be given a number of cards with labelled pictures of foods on them and you will be asked to sort them into categories based on how much calcium you think is in the food on the card.

Lastly, I will be doing an interview about your views on nutrition and osteoporosis. With your permission I will audio-tape the interview and take hand-written notes. I am going to ask questions like:

1) What does nutrition mean to you?
2) What can you tell me about osteoporosis?
3) How important or unimportant is the risk of osteoporosis to you personally or for family members or friends?

Potential Harms, Risks or Discomforts

It is not likely that there will be any harms or discomforts associated with participating in this study, though you may feel like I am criticizing your diet or you may worry about getting osteoporosis. There are no right or wrong answers, and I will not be determining whether or not you will get osteoporosis. I will be able to tell you based on your answers to the food questionnaire, how much calcium and vitamin D you consume, on average, and I can give you those results if you wish. I will also give you some information about osteoporosis at the end of the interview, so you can research it further or talk with your doctor about it if you have concerns

It you choose to participate you do not need to answer any questions in the surveys or interview that you do not want to answer or that make you feel uncomfortable. You can stop taking part in the study at any time. I describe below the steps I am taking to protect your privacy.

Potential Benefits

The research may not benefit you directly, but it will give you the opportunity to be part of an initiative to reduce the future burden of a serious debilitating disease. I hope to learn more about how young adults make decisions about their nutrition and how these

decisions are influenced by their attitudes and beliefs about bone disease. The results of this study will give insight into the design of osteoporosis prevention programs that are aimed at young adults in order to provide effective education and lower the future risk of osteoporosis.

Payment or Reimbursement

Compensation will be provided for your participation in this study. A $20 grocery gift certificate will be given at the end of the interview session. If you choose to withdraw from the study part-way through or after the interview session you may keep the $20 gift certificate.

Confidentiality

You are participating in this study confidentially. I will not use your name or any information that would allow you to be identified in the interview transcript, thesis manuscript or any presentations. All participants will be assigned an ID number, rather than your real name and will only be additionally identified by your gender (eg. male), school (McMaster University or Mohawk College), year of study or occupation.

The information you provide will be kept on a password protected laptop computer in my possession and all data files will additionally be password-protected. The paper copies of surveys will be kept in a locked filing cabinet that only I and my supervisor have access to. Once the study is complete the research data, including audio files and paper copies of surveys, will be maintained for five years and then destroyed.

Participation and Withdrawal

Your participation in this study is voluntary. If you decide to be part of the study you can withdraw from the surveys or interview at any time, for whatever reason, up until **March 15, 2015**, when I expect to be submitting my thesis manuscript. If you decide to withdraw, there will be no consequences to you. In cases of withdrawal, any data you have provided will be destroyed unless you indicate otherwise. If you do not want to answer some of the questions you do not have to, but you can still be in the study.

Information about the Study

I expect to have this study completed by approximately **March 2015.** If you would like a brief summary of the results, please let me know how you would like it sent to you.

Questions about the Study

If you have questions or need more information about the study itself, please contact me at **jaagumae@mcmaster.ca**

This study has been reviewed by the McMaster University Research Ethics Board and received ethics clearance.
If you have concerns or questions about your rights as a participant or about the way the study is conducted, please contact:

McMaster Research Ethics Secretariat
Telephone: (905) 525-9140 ext. 23142
c/o Research Office for Administrative Development and Support
E-mail: ethicsoffice@mcmaster.ca

CONSENT

- I have read the information presented in the information letter about a study being conducted by Alyson Jaagumagi**,** of McMaster University.
- I have had the opportunity to ask questions about my involvement in this study and to receive additional details I requested.
- I understand that if I agree to participate in this study, I may withdraw from the study at any time or up until approximately **March 2015.**
- I have been given a copy of this form.
- I agree to participate in the study.

Signature: _____

Name of Participant (Printed) _____

1. I agree that the interview can be audio recorded.

[ ] Yes [ ] No.

2. [ ] Yes, I would like to receive a summary of the study's results

Please send them to this email address

_____

Or to this mailing address: _____

_____

_____

[ ] No, I do not want to receive a summary of the study's results.

3. I agree to be contacted about a future focus group that will explore issues raised during the interviews, and understand that I can always decline the request.

[ ] Yes. Please contact me at: _____

[ ] No.

Appendix E: Sociodemographic Data

Table 1: Sociodemographic Characteristics of the Study Participants

	Gender	Age	Education	Year of study	Program of study/Occupation	Ethno-cultural Affiliation	Living situation	Annual Income ($)
1001	M	23	University	2	Biomedical Engineering	East Asian	Roommates	<25 000
1002	F	18	University	2	Life Sciences	Tamil/Sri Lankan	Residence	50-75 000
1003	F	30	University	Postdoc	Biology	Caucasian	Spouse	25-50 000
1004	F	24	University	3	Psychology	None (Caucasian)	Spouse	25-50 000
1005	F	21	University	2	Econ/Social Science	Chinese	Parents	50-75 000
1006	M	21	University	4	Medical Physics	Canadian	Parents	100-125 000
1008	M	29	University	1	Business	Caucasian	Spouse	75-100 000
1010	M	18	University	1	Engineering	Pakistani	Parents	75-100 000
1011	F	21	University	4	Psychology, neuroscience and behavior	Indian	Roommates	75-100 000
1013	M	20	University	4	Mechanical Engineering	African American	Roommates	<25 000
1014	M	18	University	1	Political Science and Economics	Italian	Residence	100-125 000
1015	F	23	University	5	Communication studies/Theatre & film	Canadian	Roommates	25-50 000
1016	M	19	University	3	Information Science	Chinese	Roommates	50-75 000

1018	F	21	University	4	English	Afro-Canadian/Caribbean	Roommates	<25 000
1019	F	20	University	3	Life Sciences	Chinese-Canadian	Roommates	25-50 000
1020	F	19	University	3	Kinesiology	French Canadian	Roommates	<25 000
1021	M	19	University	2	Math and Stats	Asian	Roommates	<25 000
1022	F	22	University	5	Chemical and Bioengineering	Chinese	Roommates	<25 000
1023	F	27	College	2	Cardiovascular technology	Canadian/Portuguese	Parents	50-75 000
1028	M	20	University	2	Anthropology and Political Science	Caucasian	Parents	50-75 000
1030	M	28	University	3	Anthropology	South Asian - Bengali	Parents	75-100 000
1039	F	23	College	1	Nursing	Kurdish	Spouse	25-50 000
1040	F	29	College	2	Business Financial Services	Black	Alone	>125 000
1041	F	23	College	2	Office Admin	Chinese-Canadian-British	Parents	50-75 000
1042	M	22	College	1	General Arts and sciences	Hispanic	Parents	<25 000
1043	F	22	Graduated	n/a	Research Assistant	South Asian	Parents	>125 000
1044	F	19	College	1	Social Services Worker	White	Residence	>125 000
1045	M	19	College	2	Advertising	Canadian	Parents	75-100 000
1046	F	23	College	1	Biotech(Health)	Hindu	Parents	25-50 000

1047	M	19	College	1	Social Services Worker	Caucasian	Roommates	<25 000
1048	F	21	College	2	Office Administration (executive)	Caucasian	Parents	100-125 000
1049	M	26	College	2	Civil engineering technology	Canadian East Indian	Parents	>125 000
1050	M	29	Graduated	n/a	TD bank financial services representative	Anglo-Saxon - mixed	Roommates	25-50 000
1054	F	27	Graduated	n/a	Research Engineer	Polish	Spouse	25-50 000
1055	F	23	Graduated	n/a	ODSP program support clerk	White	Parents	100-125 000
1057	M	21	College	3	Architecture	Caucasian	Roommates	<25 000
1059	M	19	College	2	General Arts and sciences	Irish	Roommates	25-50 000
1060	M	28	College	1	General Arts and sciences	Nordic	Parents	100-125 000
1063	F	20	College	2	Social Services Worker	Latin American	Parents	25-50 000
1065	F	26	College	2	Social Services Worker	Latin/Hispanic	Alone	<25 000
1066	M	26	No post-secondary	n/a	cook	Caucasian	Parents	<25 000
1069	M	20	College	3	Computer Networking and Security	White African	Roommates	100-125 000

1070	F	24	Graduated	n/a	Research Assistant	Caucasian	Roommates	<25 000
1071	M	24	Graduated	n/a	Archaeologist	Caucasian	Alone	25-50 000
1072	F	27	Graduated	n/a	Archaeologist	European	Alone	25-50 000
1073	M	28	College	2	Health, Wellness and Fitness	Indian	Roommates	<25 000
1074	M	25	Graduated	n/a	General Labour (construction)	Caucasian	Parents	<25 000
1075	M	29	College	2	Social Services Worker	African (Nigerian)	Roommates	<25 000
1076	F	22	Graduated	n/a	Medical Office Admin	White	Spouse	50-75 000
1077	F	28	Graduated	n/a	Lab tech/Clinic Manager	Caucasian	Alone	25-50 000
1079	M	24	Graduated	n/a	Electrician	Caucasian	Parents	75-100 000
1080	M	18	No post-secondary	n/a	High school student	Caucasian	Parents	50-75 000
1081	M	22	No post-secondary	n/a	Self employed	Caucasian	Parents	75-100 000
1082	F	17	No post-secondary	n/a	High school student	Canadian	Parents	75-100 000
1084	F	19	No post-secondary	n/a	day care/teacher	White	Spouse	<25 000
1085	F	17	No post-secondary	n/a	High school student	Canadian	Parents	50-75 000
1086	M	25	Graduated	n/a	Barista/Manager	Canadian/Person	Alone	25-50 000
1087	M	22	Graduated	n/a	CPA student	Lebanese	Roommates	25-50 000

Appendix F – Socio-demographic Questionnaire

Study ID:_____

Socio-demographic Questionnaire

1. What is your gender?

   [ ] Male
   [ ] Female
   [ ] Transgender

2. What is your age?

   _____

3. Please indicate your highest level of education.

   [ ] high school [ ] some high school
   [ ] college [ ] some college
   [ ] university [ ] some university

4. If you indicated university/college what program or major were you currently registered in?
   (If undecided pleased write undecided)

   _____

5. What is your occupation?

   _____

6. What ethno-cultural group(s) do you identify as belonging to?

   _____

7. Please check the box that best describes your current living situation:

   [ ] With one or more parents/guardian
   [ ] In university/college residence
   [ ] Off-campus with one or more roommates
   [ ] Off-campus without roommates
   [ ] Off-campus with spouse/partner

[ ] Off-campus with spouse/partner and children
[ ] Off-campus with children or dependents

8. Please check the box beside the range that best describes your annual household income:
(if more than half your monthly expenses are covered by a parent, guardian or other family member please indicate their annual income)

[ ] Less than $25 000
[ ] $25 000 – $49 999
[ ] $50 000 – $74 999
[ ] $75 000 – $99 999
[ ] $100 000 – $124 999
[ ] $125 000 or more

9. How many people are supported by the household income indicated in question 7? (meaning it supplies more than half of their annual income)

_____

10. Which of the following best describes your average physical activity patterns in a typical week?

(Physical activity does not include walking)

[ ] **Less** than 2.5 hours of physical activity
[ ] **Approximately** 2.5 hours of physical activity
[ ] **More** than 2.5 hours of physical activity

11. Which of the following best describes the average intensity of your physical activity?

[ ] No increase in breathing or heart rate
[ ] Noticeable increase in heart rate and breathing (can talk but not sing)
[ ] Substantial increase in heart rate and breathing (limited talking possible)

12. In the last 12 months, how often have you engaged in weight-bearing physical activities (e.g., running, team sports, resistance training)?
(Walking, bicycling and swimming are not considered weight-bearing activities)

[ ] Never
[ ] Sometimes (once a month)
[ ] Often (1-3 times a week)
[ ] Always (4 or more days a week)

13. On average, in the last 12 months how often did you usually consume alcoholic beverages?

    [ ] Never – skip to **question 14**
    [ ] Once a month
    [ ] Once a week
    [ ] More than once a week
    [ ] Prefer not to say

14. When you do consume alcoholic beverages, on average, how many drinks do you have in one sitting?

    [ ] 1-2
    [ ] 3-4
    [ ] 5 or more

15. Do you use tobacco products (eg. cigarettes, cigars)?

    [ ] Yes
    [ ] No

16. On average, how much time do you spend outdoors in a typical week during the summer months (April-September)?

    [ ] **Less** than 1 hour
    [ ] **Approximately** 1 hour
    [ ] **More** than 1 hour

17. Do you wear sunscreen greater than spf 8 during the summer months (April – September)?

(Please include skin care products that include sunscreen greater than spf 8)

    [ ] Never
    [ ] Sometimes (at least once a month)
    [ ] Often (at least twice a week)
    [ ] Always (daily)

Appendix G: Osteoporosis Health Belief Scale Survey

ID NO: _____

OSTEOPOROSIS HEALTH BELIEF SCALE

Osteoporosis (os-te-o-po-ro-sis) is a condition in which the bones become excessively thin (porous) and weak so that they are fracture prone (they break easily).

Below are some questions about your beliefs about osteoporosis. There are no right or wrong answers. We all have different experiences which will influence how we feel. After reading each statement, circle if you STRONGLY DISAGREE, DISAGREE, are NEUTRAL, AGREE, or STRONGLY AGREE with the statement.

It is important that you answer according to your actual beliefs and not according to how you feel you should believe or how you think we want you to believe. We need the answers that best explain how you feel.

Read each statement. Circle one best option that explains what you believe.

SD = STRONGLY DISAGREE

D = DISAGREE

N = NEUTRAL

A = AGREE

SA = STRONGLY AGREE

SD D N A SA	1. Your chances of getting osteoporosis are high.
SD D N A SA	2. Because of your body build, you are more likely to develop osteoporosis.
SD D N A SA	3. It is extremely likely that you will get osteoporosis.
SD D N A SA	4. There is a good chance that you will get osteoporosis.
SD D N A SA	5. You are more likely than the average person to get osteoporosis.
SD D N A SA	6. Your family history makes it more likely that you will get osteoporosis.
SD D N A SA	7. The thought of having osteoporosis scares you.
SD D N A SA	8. If you had osteoporosis you would be crippled.

SD = STRONGLY DISAGREE

D = DISAGREE

N = NEUTRAL

A = AGREE

SA = STRONGLY AGREE

SD D N A SA	9. Your feelings about yourself would change if you got osteoporosis.
SD D N A SA	10. It would be very costly if you got osteoporosis.
SD D N A SA	11. When you think about osteoporosis you get depressed.
SD D N A SA	12. It would be very serious if you got osteoporosis.
SD D N A SA	13. Regular exercise prevents problems that would happen from osteoporosis.
SD D N A SA	14. You feel better when you exercise to prevent osteoporosis.
SD D N A SA	15. Regular exercise helps to build strong bones.
SD D N A SA	16. Exercising to prevent osteoporosis also improves the way your body looks.
SD D N A SA	17. Regular exercise cuts down the chances of broken bones.
SD D N A SA	18. You feel good about yourself when you exercise to prevent osteoporosis.

For the following 6 questions, "taking in enough calcium" means taking enough calcium by eating calcium rich foods and/or taking calcium supplements.

SD D N A SA	19. Taking in enough calcium prevents problems from osteoporosis.
SD D N A SA	20. You have lots to gain from taking in enough calcium to prevent osteoporosis.
SD D N A SA	21. Taking in enough calcium prevents painful osteoporosis.
SD D N A SA	22. You would not worry as much about osteoporosis if you took in enough calcium.
SD D N A SA	23. Taking in enough calcium cuts down on your chances of broken bones.
SD D N A SA	24. You feel good about yourself when you take in enough calcium to prevent osteoporosis.

SD = STRONGLY DISAGREE

D = DISAGREE

N = NEUTRAL

A = AGREE

SA = STRONGLY AGREE

SD D N A SA	25. You feel like you are not strong enough to exercise regularly.
SD D N A SA	26. You have no place where you can exercise
SD D N A SA	27. Your spouse or family discourages you from exercising.
SD D N A SA	28. Exercising regularly would mean starting a new habit which is hard for you to do.
SD D N A SA	29. Exercising regularly makes you uncomfortable.
SD D N A SA	30. Exercising regularly upsets your every day routine.
SD D N A SA	31. Calcium rich foods cost too much.
SD D N A SA	32. Calcium rich foods do not agree with you.
SD D N A SA	33. You do not like calcium rich foods.
SD D N A SA	34. Eating calcium rich foods means changing your diet which is hard to do.
SD D N A SA	35. In order to eat more calcium rich foods you have to give up other foods that you like.
SD D N A SA	36. Calcium rich foods have too much cholesterol
SD D N A SA	37. You eat a well-balanced diet.
SD D N A SA	38. You look for new information related to health.
SD D N A SA	39. Keeping healthy is very important for you.
SD D N A SA	40. You try to discover health problems early.
SD D N A SA	41. You have a regular health check-up even when you are not sick.
SD D N A SA	42. You follow recommendations to keep you healthy.

Please check to see that you have answered all items.

Appendix H: Osteoporosis Health Belief Scale Data

Table 1: Susceptibility subscale results

Susceptibility							
	1	**2**	**3**	**4**	**5**	**6**	**Subscale total**
1001	2	1	2	2	1	2	10
1002	3	3	2	2	2	2	14
1003	2	5	2	2	2	4	17
1004	1	1	1	1	1	3	8
1005	1	1	1	1	1	1	6
1006	2	4	2	3	2	4	17
1008	2	2	1	1	2	2	10
1010	2	2	1	2	1	3	11
1011	2	2	2	2	1	1	10
1013	3	2	2	1	2	2	12
1014	2	3	2	3	2	3	15
1015	4	3	3	3	4	4	21
1016	2	3	2	3	2	3	15
1018	4	3	2	3	3	1	16
1019	5	5	4	4	4	3	25
1020	5	4	3	4	5	5	26
1021	2	2	1	2	2	1	10
1022	5	4	5	5	4	4	27
1023	4	5	4	4	3	4	24
1028	2	3	2	2	2	2	13
1030	2	2	1	2	2	2	11
1038	1	1	1	2	1	1	7
1039	4	2	3	4	4	4	21
1040	1	1	1	1	2	1	7
1041	3	3	3	3	3	2	17
1042	1	1	1	1	1	2	7
1043	3	3	2	2	2	2	14
1044	2	2	2	2	2	1	11
1045	4	4	4	3	4	2	21
1046	4	5	3	4	3	4	23
1047	1	2	1	2	1	1	8
1048	4	2	3	3	2	3	17

1049	1	1	1	1	1	2	7
1050	2	2	1	2	1	1	9
1051	2	2	2	2	2	2	12
1054	4	4	3	4	4	4	23
1055	3	3	2	2	2	3	15
1057	2	1	1	2	2	1	9
1059	2	2	1	2	1	2	10
1060	2	2	2	2	2	2	12
1063	3	2	2	3	2	3	15
1065	3	2	2	2	2	1	12
1066	2	2	2	3	3	2	14
1069	1	2	1	2	2	2	10
1070	4	2	3	4	1	4	18
1071	3	2	2	3	4	4	18
1072	3	2	2	4	2	3	16
1073	3	2	2	2	2	2	13
1074	3	4	2	2	2	4	17
1075	1	2	2	3	2	1	11
1076	1	2	1	1	1	1	7
1077	4	3	3	4	4	4	22
1079	2	3	3	3	3	4	18
1080	3	1	3	3	2	2	14
1081	2	1	1	1	1	1	7
1082	2	2	2	2	2	4	14
1084	2	2	1	2	2	1	10
1085	2	2	2	2	2	2	12
1086	3	3	3	3	2	2	16
1087	3	2	2	2	3	3	15

Table 2: Severity subscale results

Severity							
	7	**8**	**9**	**10**	**11**	**12**	**Subscale total**
1001	3	2	2	3	4	3	17
1002	3	2	2	3	2	2	14
1003	4	4	4	4	4	4	24
1004	1	4	4	1	1	3	14
1005	5	4	4	5	3	5	26
1006	2	2	2	3	2	2	13
1008	3	2	2	3	3	3	16
1010	4	2	4	3	4	4	21
1011	3	4	4	4	1	4	20
1013	4	4	4	4	4	4	24
1014	4	2	2	3	1	4	16
1015	3	4	4	3	1	2	17
1016	3	1	1	3	1	3	12
1018	4	2	2	3	1	4	16
1019	5	4	4	4	4	4	25
1020	4	2	2	2	3	4	17
1021	4	5	4	4	3	4	24
1022	5	2	3	2	2	4	18
1023	5	5	5	5	4	5	29
1028	4	3	4	3	2	4	20
1030	4	2	3	4	2	4	19
1038	4	2	4	2	2	4	18
1039	5	4	4	4	2	4	23
1040	5	3	2	5	4	5	24
1041	4	1	1	4	1	5	16
1042	5	2	5	5	4	5	26
1043	5	2	4	3	2	3	19
1044	3	3	2	3	3	4	18
1045	5	3	3	4	4	4	23
1046	1	1	1	3	2	2	10
1047	4	2	1	2	2	2	13
1048	5	2	2	4	3	4	20
1049	1	1	1	3	1	5	12

1050	3	1	3	3	1	2	13
1051	4	3	3	4	3	3	20
1054	5	2	2	2	1	4	16
1055	4	4	4	4	4	4	24
1057	4	2	4	4	3	5	22
1059	4	3	4	3	3	4	21
1060	2	3	4	4	3	3	19
1063	2	3	4	3	1	4	17
1065	5	2	2	5	3	4	21
1066	2	2	2	3	1	2	12
1069	5	4	4	4	3	5	25
1070	2	1	2	2	1	2	10
1071	2	1	2	3	1	4	13
1072	4	4	2	4	3	4	21
1073	3	1	2	2	2	4	14
1074	4	2	4	3	3	4	20
1075	5	4	4	4	4	4	25
1076	4	3	4	3	3	4	21
1077	4	1	2	2	1	2	12
1079	4	1	1	2	2	4	14
1080	5	2	4	4	2	4	21
1081	4	3	4	4	4	4	23
1082	5	3	4	3	4	5	24
1084	3	3	4	4	3	4	21
1085	3	2	2	3	2	4	16
1086	4	2	4	3	2	4	19
1087	2	3	2	3	2	4	16

Table 3: Benefits of exercise subscale results

Benefits of Exercise							
	13	**14**	**15**	**16**	**17**	**18**	**Subscale total**
1001	4	4	3	5	2	5	23
1002	4	3	4	3	3	3	20
1003	5	4	5	4	5	4	27
1004	4	3	4	5	3	3	22
1005	4	5	5	5	3	5	27
1006	5	5	5	5	5	5	30
1008	4	4	4	4	4	4	24
1010	3	3	3	3	3	3	18
1011	3	3	3	3	3	3	18
1013	4	4	4	4	4	4	24
1014	4	3	3	4	2	3	19
1015	4	2	4	2	4	4	20
1016	3	3	3	3	2	3	17
1018	4	4	5	4	4	4	25
1019	5	4	4	3	2	4	22
1020	5	5	4	2	4	5	25
1021	4	4	4	4	4	4	24
1022	4	3	5	4	5	3	24
1023	5	5	5	5	4	5	29
1028	4	3	4	4	4	4	23
1030	4	2	2	4	2	3	17
1038	4	4	4	4	4	4	24
1039	5	3	5	5	5	3	26
1040	4	5	5	5	5	5	29
1041	4	2	4	1	2	2	15
1042	5	5	4	5	5	5	29
1043	5	5	5	5	4	5	29
1044	5	5	5	5	4	5	29
1045	5	5	5	5	2	5	27
1046	4	3	5	4	5	3	24
1047	3	2	4	4	4	3	20
1048	4	5	5	5	2	5	26
1049	5	5	3	5	2	3	23

1050	3	3	4	4	3	3	20
1051	3	4	4	4	4	4	23
1054	4	3	4	4	5	3	23
1055	5	4	5	5	5	4	28
1057	4	3	4	4	4	3	22
1059	4	4	3	3	3	3	20
1060	4	4	4	5	4	5	26
1063	4	3	5	5	4	3	24
1065	5	3	5	5	3	3	24
1066	4	3	4	4	3	3	21
1069	5	4	4	4	2	4	23
1070	3	1	3	4	4	3	18
1071	5	3	4	4	4	3	23
1072	3	4	4	3	4	4	22
1073	4	4	5	5	4	4	26
1074	4	3	4	3	2	3	19
1075	5	4	5	4	5	4	27
1076	4	3	5	3	2	3	20
1077	4	3	4	4	3	3	21
1079	4	3	4	4	4	4	23
1080	4	4	3	5	2	3	21
1081	4	4	4	5	3	4	24
1082	4	4	3	5	4	4	24
1084	5	5	5	4	4	4	27
1085	3	4	4	4	4	4	23
1086	4	5	5	5	4	4	27
1087	3	3	4	3	3	3	19

Table 4: Benefits of calcium subscale results

Benefits of Calcium							
	19	**20**	**21**	**22**	**23**	**24**	**Subscale total**
1001	4	3	3	4	4	4	22
1002	4	4	3	4	4	4	23
1003	4	4	4	4	4	4	24
1004	4	4	2	2	2	3	17
1005	5	5	5	4	4	5	28
1006	4	4	3	3	4	4	22
1008	5	4	4	4	4	4	25
1010	4	5	3	4	5	4	25
1011	5	5	5	1	5	5	26
1013	5	5	4	4	3	4	25
1014	4	4	3	3	3	4	21
1015	4	5	3	2	5	5	24
1016	3	2	3	2	4	3	17
1018	5	5	5	4	5	3	27
1019	3	4	3	4	5	4	23
1020	4	3	2	5	2	5	21
1021	4	4	4	4	4	3	23
1022	4	5	3	4	4	3	23
1023	4	4	3	5	5	4	25
1028	4	4	4	3	4	3	22
1030	4	4	4	4	4	4	24
1038	5	5	5	5	5	5	30
1039	4	5	5	5	5	3	27
1040	4	4	2	5	5	5	25
1041	5	4	4	3	3	3	22
1042	5	5	5	5	5	5	30
1043	5	5	3	4	2	5	24
1044	5	5	4	3	5	4	26
1045	5	5	4	5	5	3	27
1046	5	4	4	4	4	4	25
1047	3	4	4	4	5	3	23
1048	4	4	4	4	1	3	20
1049	4	3	3	4	4	3	21

1050	3	4	3	4	4	3	21
1051	4	4	3	4	4	4	23
1054	2	4	2	2	4	4	18
1055	4	4	4	3	3	4	22
1057	5	4	4	5	4	3	25
1059	2	4	4	3	4	3	20
1060	4	4	4	4	4	4	24
1063	3	3	4	3	4	3	20
1065	4	4	3	3	3	3	20
1066	4	4	4	4	2	3	21
1069	4	4	3	5	4	4	24
1070	5	4	4	2	4	3	22
1071	4	3	4	3	2	3	19
1072	4	5	4	2	4	4	23
1073	5	4	4	4	4	3	24
1074	3	4	4	2	1	3	17
1075	5	4	3	4	5	4	25
1076	4	4	4	5	4	4	25
1077	4	5	4	4	4	3	24
1079	4	3	2	4	4	3	20
1080	4	4	2	4	4	4	22
1081	4	4	4	4	4	4	24
1082	4	3	2	2	2	4	17
1084	2	4	3	4	3	3	19
1085	3	4	3	3	4	4	21
1086	4	4	4	4	5	4	25
1087	4	3	3	2	3	3	18

Table 5: Barriers to exercise subscale results

Barriers to Exercise							
	25	**26**	**27**	**28**	**29**	**30**	**Subscale total**
1001	3	4	5	2	4	5	23
1002	4	4	5	3	4	3	23
1003	5	5	5	5	5	5	30
1004	5	5	5	5	5	3	28
1005	1	4	4	3	4	4	20
1006	5	5	5	5	5	5	30
1008	4	4	4	3	4	4	23
1010	5	3	5	4	4	3	24
1011	5	5	5	5	5	5	30
1013	3	3	4	3	4	3	20
1014	4	4	4	4	4	4	24
1015	5	5	5	4	5	5	29
1016	5	5	1	5	5	5	26
1018	5	4	5	4	5	4	27
1019	5	3	5	2	4	3	22
1020	5	5	5	5	5	5	30
1021	5	5	5	5	5	5	30
1022	3	4	4	2	2	2	17
1023	5	5	5	5	5	5	30
1028	3	4	5	2	2	3	19
1030	5	4	5	3	4	2	23
1038	5	5	5	2	5	1	23
1039	1	4	5	1	4	3	18
1040	2	5	5	1	5	5	23
1041	4	5	5	5	5	5	29
1042	4	4	5	4	4	3	24
1043	5	5	5	4	5	5	29
1044	5	5	5	5	5	5	30
1045	4	4	4	2	4	4	22
1046	4	4	2	4	4	5	23
1047	3	4	4	2	3	3	19
1048	5	5	5	5	5	5	30
1049	5	5	5	5	5	5	30

1050	5	5	5	5	5	5	30
1051	4	4	5	4	4	4	25
1054	4	5	5	4	3	3	24
1055	5	5	4	3	4	4	25
1057	4	4	4	2	3	4	21
1059	5	5	5	5	4	2	26
1060	5	5	5	5	5	5	30
1063	4	5	5	2	4	4	24
1065	5	5	5	5	5	5	30
1066	4	4	4	2	5	5	24
1069	5	5	5	5	5	5	30
1070	4	5	5	4	4	4	26
1071	5	4	5	4	5	5	28
1072	5	5	5	5	5	5	30
1073	5	4	5	4	5	2	25
1074	5	5	5	4	5	4	28
1075	4	4	5	4	2	2	21
1076	3	5	5	1	3	3	20
1077	4	4	3	4	4	4	23
1079	4	5	5	3	4	4	25
1080	5	5	5	5	5	5	30
1081	5	5	5	5	5	5	30
1082	4	5	5	4	4	4	26
1084	3	3	5	2	2	4	19
1085	3	2	5	2	5	5	22
1086	5	5	5	5	5	5	30
1087	5	5	5	5	5	5	30

Table 6: Barriers to calcium subscale results

Barriers to Calcium							
	31	**32**	**33**	**34**	**35**	**36**	**Subscale total**
1001	4	4	4	5	5	4	26
1002	4	4	5	5	5	4	27
1003	5	5	5	5	5	5	30
1004	2	5	5	4	5	2	23
1005	3	4	5	5	5	5	27
1006	4	4	5	5	5	4	27
1008	2	4	4	4	4	4	22
1010	4	3	5	4	4	3	23
1011	5	5	5	5	5	2	27
1013	2	4	4	4	4	3	21
1014	4	4	4	4	4	4	24
1015	5	4	5	4	2	4	24
1016	4	4	4	4	4	3	23
1018	4	4	4	4	4	4	24
1019	3	2	5	5	5	4	24
1020	5	2	3	4	4	5	23
1021	4	5	5	4	4	4	26
1022	4	5	5	2	4	4	24
1023	2	5	5	3	4	5	24
1028	4	5	5	5	5	3	27
1030	3	4	4	2	4	3	20
1038	5	5	5	5	5	5	30
1039	4	1	4	1	3	5	18
1040	5	5	5	5	2	4	26
1041	5	5	5	4	5	5	29
1042	2	4	5	5	5	3	24
1043	5	4	5	5	5	5	29
1044	5	5	5	5	5	4	29
1045	4	4	4	2	2	3	19
1046	4	5	5	5	5	5	29
1047	4	4	4	5	4	4	25
1048	3	3	3	5	5	3	22
1049	2	5	5	5	2	2	21

1050	4	5	5	5	5	4	28
1051	4	4	4	4	4	4	24
1054	5	5	5	5	4	3	27
1055	5	3	5	5	5	4	27
1057	5	5	5	3	4	3	25
1059	4	5	5	5	4	3	26
1060	4	4	4	4	4	4	24
1063	3	5	5	5	5	3	26
1065	4	3	5	5	3	3	23
1066	4	2	4	4	4	4	22
1069	5	5	5	5	5	5	30
1070	4	5	5	4	5	4	27
1071	3	5	5	5	5	3	26
1072	4	5	5	5	5	5	29
1073	3	3	3	4	4	4	21
1074	4	5	5	4	4	3	25
1075	2	4	5	5	3	2	21
1076	2	4	5	3	3	3	20
1077	4	4	5	3	4	5	25
1079	4	3	3	4	4	3	21
1080	4	4	5	5	5	3	26
1081	4	4	4	4	4	4	24
1082	3	4	5	4	5	4	25
1084	3	4	3	2	2	3	17
1085	4	5	5	5	3	5	27
1086	5	3	5	5	5	4	27
1087	4	4	5	5	3	4	25

Table 7: Self-efficacy subscale results

Self-Efficacy							
	37	**38**	**39**	**40**	**41**	**42**	**Subscale total**
1001	3	4	5	5	2	4	23
1002	3	3	4	3	3	3	19
1003	4	4	5	5	2	5	25
1004	4	4	4	5	5	5	27
1005	5	5	5	5	4	5	29
1006	4	4	4	3	2	4	21
1008	3	2	3	3	3	3	17
1010	2	1	3	2	1	3	12
1011	4	3	4	5	5	5	26
1013	2	4	4	4	4	4	22
1014	4	4	5	5	5	5	28
1015	4	4	4	4	4	4	24
1016	4	4	4	3	1	4	20
1018	3	3	3	3	2	4	18
1019	3	3	4	4	3	3	20
1020	4	5	5	5	4	4	27
1021	4	4	5	3	2	4	22
1022	2	3	3	4	2	4	18
1023	3	5	5	5	2	3	23
1028	2	2	3	4	4	3	18
1030	2	2	3	2	2	3	14
1038	4	4	4	4	2	4	22
1039	2	4	5	5	5	3	24
1040	5	5	5	4	2	4	25
1041	4	5	5	5	3	5	27
1042	4	4	5	4	2	4	23
1043	4	5	5	5	1	5	25
1044	3	3	5	3	2	2	18
1045	2	4	3	3	2	4	18
1046	4	5	5	4	2	4	24
1047	5	3	3	4	2	3	20
1048	4	5	5	1	4	5	24
1049	5	5	5	3	1	3	22

1050	3	2	5	4	2	4	20
1051	3	2	4	2	2	3	16
1054	4	2	4	4	1	3	18
1055	4	4	4	4	2	4	22
1057	3	4	4	4	2	3	20
1059	4	4	4	4	2	4	22
1060	4	5	5	5	2	4	25
1063	4	3	4	4	2	5	22
1065	4	5	5	4	4	4	26
1066	2	2	3	4	4	3	18
1069	2	4	4	4	2	4	20
1070	4	4	4	2	1	4	19
1071	2	2	4	3	1	3	15
1072	3	4	4	4	2	4	21
1073	2	4	5	5	4	4	24
1074	4	3	5	5	5	4	26
1075	3	5	4	4	4	5	25
1076	2	2	3	2	1	2	12
1077	2	2	3	3	2	3	15
1079	4	3	4	4	2	4	21
1080	4	4	5	4	2	5	24
1081	3	4	4	4	2	4	21
1082	4	3	4	3	5	4	23
1084	2	2	2	2	5	3	16
1085	3	4	4	4	3	4	22
1086	4	3	4	3	3	4	21
1087	4	4	4	5	4	5	26

Table 8: Total OHBS results (out of 240 points)

Participant Number	Survey Total
1001	144
1002	140
1003	177
1004	139
1005	163
1006	160
1008	137
1010	134
1011	157
1013	148
1014	147
1015	159
1016	130
1018	153
1019	161
1020	169
1021	159
1022	151
1023	184
1028	142
1030	128
1038	154
1039	157
1040	159
1041	155
1042	163
1043	169
1044	161
1045	157
1046	158
1047	128
1048	159
1049	136
1050	141

1051	143
1054	149
1055	163
1057	144
1059	145
1060	160
1063	148
1065	156
1066	132
1069	162
1070	140
1071	142
1072	162
1073	147
1074	152
1075	155
1076	125
1077	142
1079	142
1080	158
1081	153
1082	153
1084	129
1085	143
1086	165
1087	149

Appendix I – Food Frequency Questionnaire

UNIVERSITY OF SASKATCHEWAN
COLLEGE OF PHARMACY AND NUTRITION

Subject Code | Date DDMMYY

FOOD FREQUENCY QUESTIONAIRE v2

Please Use HB Pencil making sure response bubble is filled in completely.

Please list **nutritional supplements** used in past month, using as much detail as you can remember

BRAND NAME OF SUPPLEMENT OR TYPE (e.g Exact calcium 500mg& vitamin D 400iu)	AMOUNT TAKEN (e.g. 1 tablet every other day)

1. We want to know how often you eat or drink certain foods **each <u>month.</u>**
2. Think about a **typical month** not just what you ate this week which might be different.
3. **<u>Medium</u>** portion sizes are given to help you determine the ususal size of the food or drink, and to compare to small and large.
4. If you drink or eat much less (approximately half) than the medium portion size described, then check small. If you drink a large glass of milk every day (approximately 1.5 times the size of medium), then check large.
5. Fill out the form similar to this **example**:
   - If you drink a carton of chocolate milk (50ml) Monday through Friday, then choose M (medium) and show it as 5 - 6 times per week.

TYPE of FOOD or DRINK	Never or less than 1 per month	1 per month	2-3 per month	1 per week	2 per week	3-4 per week	5-6 per week	1 per day	2+ per day	Medium serving	Serving Size S	M	L
Chocolate									X	1 cup (8 oz or 250 ml)			X

TYPE of Food or DRINK	Never or less than 1 per month	1 per month	2 -3 per month	1 per week	2 per week	3-4 per week	5-6 per week	1 per day	2+ per day	Medium Serving	Serving Size S	M	L
Macaroni with cheese										1 cup			
Canned Salmon										2 tablespoons or 1 cup of casserole			
Canned Tuna										2 tablespoons or 1 cup of casserole			
Canned Sardines										2 fish (1/2 can)			
Salmon Steak										90 g (3 oz)			
Other fish: white										90 g (3 oz)			
Other fish: oily										90 g (3 oz)			
Cream soups made with milk										1 cup (8oz or 250 ml)			
Taco or burrito made with cheese										1 regular taco: 1/2 burrito			
Pizza made with cheese										1 slice			
Lentils, beans, peas										1/2 cup cooked			
Eggs: eaten alone or in other foods										1 large egg			
Potatoes: mashed with milk & margarine										1/2 cup (1scoop)			
Orange Juice: not foritifed with calcium, vitamin D										1 cup (8 oz or 250 ml)			
Orange Juice: with calcium, vitamin D										1 cup (8 oz or 250 ml)			
Broccoli, kale, greens										1 cup raw or 1/2 cup cooked			
Seafood: e.g shrimp, crab										1 cup meat			
Beef or Pork										90 g (3 oz)			
Bacon or Sausage										2 slices 2 links			

TYPE of Food or DRINK	Never or less than 1 per month	1 per month	2 - 3 per month	1 per week	2 per week	3-4 per week	5-6 per week	1 per day	2+ per day	Medium Serving	Serving Size		
											S	M	L
Milk: whole, 2%, 1% or skim										1 cup (8 oz or 250 ml)			
Chocolate Milk										1 cup (8 oz or 250 ml)			
Soy Milk Beverage: Fortified										1 cup (8 oz or 250 ml)			
Soy Drink: Plain (not fortified)										1 cup (8 oz or 250 ml)			
Other plant milks (rice, potato, etc)										1 cup (8 oz or 250 ml)			
Milk in coffee or tea										1 tablespoon			
Milk on cereal (if not included above)										1/2 cup			
Milk shake										1 cup (8 oz or 250 ml)			
Milk dessert (ice cream, pudding)										1/2 cup (one scoop, 1 container)			
Yogurt (milk or soy										1/2 cup (125 g, 1 container			
Soft Cheese										1 tablespoon			
Hard Cheese										1 cube 2" (2 slices)			
White bread, roll, bun, biscuit bagel, nan, tortilla										1 slice, 1 small roll, 1/2 bagel			
Dark bread, roll, bagel										1 slice, 1 small roll, 1/2 bagel			
Taco chips, nacho chips										1 cup (28g)			
Waffle, pancake, French toast										1 piece (4" round)			
Butter (in any foods eaten)										1 pat 1 teaspoon			
Margarine (in any foods eaten)										1 pat 1 teaspoon			
Tofu										1 cube 2"			

Appendix J: Food Frequency Questionnaire Data

Table 1: Usual calcium and vitamin D intake results from the FFQ and assessment of calcium and vitamin D adequacy as assessed by their comparison to the EAR for each participant

	Calcium value from FFQ (mg)	Calcium intake adequate	Vitamin D value from FFQ (IU)	Vitamin D intake adequate	Intake from Supplements (included in total value)
1001	507	no	244	no	
1002	1368	yes	381	yes	
1003	305	no	131	no	
1004	1783	yes	855	yes	
1005	1975	yes	1154	yes	
1006	850	yes	335	no	
1008	459	no	103	no	
1010	180	no	65	no	
1011	718	no	226	no	
1013	366	no	140	no	
1014	2074	yes	1052	yes	Calcium – 210mg Vitamin D – 700IU
1015	878	yes	682	yes	Vitamin D – 700IU
1016	1208	yes	566	yes	
1018	187	no	54	no	
1019	425	no	170	no	
1020	486	no	242	no	
1021	2532	yes	846	yes	
1023	312	no	145	no	Calcium – 500mg Vitamin D – 100
1023	1062	yes	1156	yes	
1028	709	no	270	no	
1030	421	no	207	no	
1038	621	no	325	no	
1039	883	yes	388	yes	
1040	1186	yes	444	yes	
1041	1081	yes	395	yes	
1042	1977	yes	475	yes	
1043	1257	yes	431	yes	
1044	345	no	331	no	Vitamin D – 200IU
1045	757	no	199	no	

1046	881	yes	262	no	
1047	350	no	154	no	
1048	1225	yes	1195	yes	
1049	560	no	156	no	
1050	626	no	284	no	
1051	1022	yes	330	no	
1054	606	no	155	no	
1055	471	no	129	no	
1057	1404	yes	531	yes	
1059	2535	yes	1181	yes	
1060	556	no	219	no	
1063	1224	yes	396	yes	
1065	859	yes	1352	yes	
1066	741	no	249	no	
1069	1598	yes	630	yes	
1070	702	no	203	no	
1071	298	no	84	no	
1072	792	no	279	no	
1073	1644	yes	418	yes	
1074	931	yes	274	no	
1075	490	no	166	no	
1076	586	no	176	no	
1077	177	no	68	no	
1079	775	no	204	no	
1080	1757	yes	485	yes	
1081	606	no	144	no	
1082	1251	yes	310	no	
1084	646	no	543	yes	
1085	547	no	186	no	
1086	315	no	184	no	
1087	2310	yes	1324	yes	

Appendix G - Pile Sort Cards

Milk

Orange Juice (fortified)

Yogurt

Cheese

Tofu

Beans

Eggs

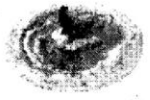
Kale

White Bread

Orange

Parsley

Hummus



Kiwi

Olive oil

Broccoli

Banana

Chicken

Almonds

Fish

Peppers

Pasta

Asparagus

Avocado

Non-Dairy Creamer

Pork

Margarine

Lucky Charms Cereal

Soy (and soy-based foods)

Spinach

Chocolate Milk

Chocolate

Appendix L – Interview Questions

INTERVIEW QUESTIONS

Young Adult Perceptions of Nutrition and Osteoporosis

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Information about these interview questions: This gives you an idea what I would like to learn about young adult beliefs and attitudes toward nutrition and osteoporosis. Interviews will be one-to-one and will be open-ended (not just "yes or no" answers). Because of this, the exact wording may change a little. Sometimes I will use other short questions to make sure I understand what you told me or if I need more information when we are talking such as: "*So, you are saying that …?*), to get more information ("*Please tell me more?"),* or to learn what you think or feel about something ("*Why do you think that is…?").*

I'm going to start by asking some questions about your views on nutrition…

1. What does nutrition mean to you?

Probe for connections between nutrition and health, weightloss, etc.

2. How important do you consider nutrition to your daily life?

Probe for how often nutrition is a factor in food choice or affects what foods are eaten

3. What other associations do you have with food besides nutrition?

4. What is ‘good’ nutrition? What is ‘bad’ nutrition?

5. How do you think your diet is connected to your identity?

Probe for vegetarianism, veganism or other ethnic and/or religious affiliations

6. What foods do you consider healthy?

Probe for how food is equated with ideas of health and the qualities of foods that lead them to be seen as healthy

7. What qualities do you look for in your food when you are deciding what to eat?

8. When you are at school or work where do you get your food?

Probe for whether they purchase food and how often. If they bring food, probe for who prepares it

9. How involved are you in your food preparation?

Probe for whether they make their own food decisions or if parents or peers often influence their food choices

Now if we can focus on bone health and osteoporosis…

10. How would you define healthy bone?

11. What can you tell me about osteoporosis?

Probe for descriptions of osteoporosis including causes, who gets it, what it looks like, and ideas about the experience of osteoporosis

If the person knows what osteoporosis is, these questions will be used:

12. What are the effects of osteoporosis on a person who has it?

13. Do you think it is important for you to know about osteoporosis? (y/n/maybe/don’t know)

Please tell me why you think this

14. Where would you get information about osteoporosis?

Probe for sources of information e.g., medical professionals, peers, internet, magazines, TV

15. Who do you think might be at risk of osteoporosis?

Probe for ideas of gender differences in risk and ideas about risk factors

16. Are there any groups of people that you think might have a higher or lower chance of getting osteoporosis?

17. How important or unimportant is the risk of osteoporosis to you personally or for family members or friends?

18. Do you feel you are at risk of osteoporosis? (yes/no/maybe/don't know)
Please explain why you think this

19. Can you suggest any factors that could increase or decrease your risk of osteoporosis at this time in your life?

20. Do you think young adults should be concerned about osteoporosis? (yes/no/maybe/don't know)
Please explain why you think this

If the person is completely unfamiliar with osteoporosis, does not know what it is or has never heard of it, these questions will be used:

21. How often do you think about your bones?
Probe for reasons why

22. What kinds of bone diseases do you know?
Probe for awareness of bone loss, weakness or fragility associated with disease

23. Is keeping your bone healthy important to you? (yes/no/maybe/don't know)
Please explain why you think this

24. What can you do to keep bone healthy?
Probe for awareness of causes of bone diseases

25. Who is at risk of bone diseases?
Probe for ideas of age or gender differences

26. Do you think you are at risk of any bone diseases? (yes/no/maybe/don't know)
Please explain why you think this, and if yes, which ones

27. Do you think you need to be concerned about your bone health? (yes/no/maybe/don't know)
Please explain why you think this

28. Where would you go to get information about your bones or bone diseases?

29. Do you think young adults should be concerned about their bone health? (yes/no/maybe/don't know)
Please explain why you think this

Now we're going to talk about osteoporosis and nutrition…

30. How important or unimportant do you consider nutrition in relation to osteoporosis/bone health?

Probe for information on how food is seen as related to osteoporosis and specific types of food that are important (such as calcium and vitamin D)

31. How often do you eat foods specifically for your bones?

Probe for ideas about how/if food choice is influenced by bone health and why

32. What can you tell me about calcium?

Probe for a description of calcium, food sources and knowledge of recommended intakes

33. What types of foods do you think contain calcium? Are these foods you regularly eat?

34. Do you feel you are eating enough calcium containing foods? (yes/no/maybe/don't know)

Please describe why you feel this way

35. How could you add more calcium into your diet?

36. How important do you consider vitamin D for osteoporosis/bone health?

Probe for knowledge on vitamin D including relationship to bone, calcium and osteoporosis

37. Describe how you get vitamin D.

Probe for knowledge on specific food/supplement sources, sun sources and recommended intake

38. What are some barriers to vitamin D uptake?

Probe for knowledge of vitamin D in foods or relationship to skin colour

39. Do you ever choose foods because they have calcium or vitamin D in them?

Please explain why

40. What other foods or nutrients might be important for osteoporosis/bone health?

Probe for knowledge on the relationship between nutrition and osteoporosis and knowledge of other micronutrients related to bone health (eg. vitamin K)

I'd like to take a moment to discuss supplements with you now…

41. Do you take any supplements? (y/n)

Please explain why

Probe for general and specific reasons (e.g., diseases/conditions)

If yes: What supplements do you take?

42. How do you choose your supplements?/ If you were to take a supplement, what factors would be important in your choice?

Probe for important factors or barriers to supplement purchase (e.g., Price, popularity, medical advice, peers)

43. Where do you get information on supplements?

Lets talk a little more about sources of information…

44. Where do you get information on nutrition?

Probe for sources (e.g., TV, peers, doctors, social media, internet) and the types of information they get from each source

45. What is the most important source of information on nutrition?

Probe for reasons why a source is important

46. Have you ever been given information on osteoporosis or bone health?(Yes/no/maybe/don't know)

Please describe the source of this information

47. Do you think young adults are given enough information on osteoporosis or bone health? (yes/no/maybe/don't know)

Please explain why you think this

48. What do you feel would be an effective way to give young adults information on the role of nutrition in osteoporosis or bone health?

49. Have you thought about any of these topics before today? (Yes/no/maybe/don't know)

50. Is there anything else you would like to discuss that we haven't covered?