Cues to Action: Do they Result in Belief and Behavioural Change in Women?

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This thesis is dedicated to Mom, Dad, Chris, Laura, and Rob for encouraging my dreams to take flight and for providing me with constant encouragement, support and love.

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Abstract

With incidence rates of osteoporosis increasing (Osteoporosis Canada, 2007), preventative efforts to minimize costs associated with condition diagnosis are a public health priority. Cues to action are specific internal (e.g., physical symptoms, family member with a condition) or external stimuli (e.g., public service announcements, health education campaigns) that are necessary to trigger appropriate health behaviours and serve to create an awareness of the health threat (Mattson, 1999). To date, limited understanding of the scope of influence cues to action have on health beliefs and behaviour associated with osteoporosis is known. The present investigation was designed to address this gap in the literature. More specifically, the influence of cues to action, a public service announcement (PSA) developed by Osteoporosis Canada and a bone screening by way of Quantitative Ultrasound, on health beliefs and health-enhancing physical activity (HEPA) across a four week period was investigated. Peri-and post-menopausal women (N = 174) were randomly assigned to one of three conditions 1) an osteoporosis public service announcement (PSA) condition; 2) a bone screening condition via quantitative ultrasound techniques, and 3) a PSA attention control condition. Health beliefs associated with osteoporosis were taken at three time points: prior to the cue to action intervention, immediately following the intervention, and four weeks post intervention. Knowledge of osteorporosis risk factors and HEPA were assessed pre and post-intervention only. Results of a regression analysis suggested that baseline health beliefs predicted baseline HEPA ($R^2_{adj} = .24$; $F(9, 161) = 6.49, p = .000$; 95% CI = .12 - .35) with exercise barriers ($\beta = -.33$) being a negative predictor and health motivation ($\beta = .21$) being a positive predictor of HEPA. Baseline health beliefs predicted

Time 2 HEPA (R^2_{adj} = .09; F (9,168) = 2.94, p = .003; 95% CI = .00 - .13) with exercise benefits (β = .18) positively predicting HEPA. Results of mixed methods ANOVAs suggested an interaction for calcium benefits (F (3, 247) = 3.33, p = .02, η^2_p = .04) and within subject changes in knowledge of osteoprotective behaviours (F (2, 321) = 3.98, p = .022) and perceived seriousness of osteoporosis (F (1, 169) = 9.93, p = .002). Estimates of effect size ranged between negligible to small. Those in the PSA condition reported more active information seeking on bone health following the intervention than those in either the bone screening or attention control conditions (28.1%, 3.3%, and 5.3% respectively). Tenants of the Health Belief Model to the prediction of HEPA were partially supported by study findings and partial support for the influence of cues to action on health beliefs in women was found. Changes in HEPA were not observed. The Nutcracker PSA was successful in prompting women to view the Osteoporosis Canada website, as it intended to do. Practical implications include, but are not limited to, insight into the role of cues to action on beliefs and behaviours relevant to bone health.

Table of Contents

CHAPTER ONE: INTRODUCTION

Osteoporosis is a skeletal disease characterized by compromised bone strength (i.e., bone density and bone quality) which results in increased fragility and fracture rate (World Health Organization, 1994). A health condition often referred to as the 'silent thief' due to the absence of concomitant symptoms, osteoporosis currently affects 1.4 million Canadians (Osteoporosis Canada, 2006). Osteoporosis has been defined as bone mineral density less than, or equal to, 2.5 standard deviations below the average maximum bone mass achieved by young healthy sex-and race-matched adults (World Health Organization, 1994). Using the above criteria it is estimated that 15% of Canadian women and 5% of Canadian men over the age of 50 have been diagnosed with the condition (Tenenhouse, Kreiger, & Hanley, 2000) with incidence rates increasing to 25% and 19% of females and males respectively over the age of 80.

Human and Financial Costs Associated with Osteoporosis

Of the approximately 25000 hip fractures that occurred in Canada in 1993, 70% were osteoporosis-related (Osteoporosis Canada, 2006). Of these, 20% resulted in death and, for those who survived, 50% resulted in disability (Osteoporosis Canada, 2006). Costs associated with bone mineral loss result in an estimated expense of $1.3 billion each year in Canada alone. Without preventative action, costs are estimated to increase to $32.5 billion by 2018 (Osteoporosis Canada, 2006). Reduced quality of life for those diagnosed has been reported as osteoporosis has been linked to disfigurement, lowered self-esteem, reduced or loss of mobility, and decreased independence (Sawka et al., 2005). Given the above, a primary concern for health promotion research is the development of interventions that can forestall disease onset and progression.

The Development of Osteoporosis

Development of osteoporosis is attributed to either inadequate accumulation of peak bone mass prior to skeletal maturity or to excessive bone loss across a lifespan. Peak bone mass refers to the maximum amount of bone an individual will attain (Lypaczewski, Lappe, & Stubby, 2002). Bone is living tissue and continually renews itself, breaking down old bone (bone resorption) and replacing it with new bone (bone formation; United States Department of Health & Human Services (USDHHS), 2005). Adolescence is a critical temporal period as the amount of bone gained during this developmental epoch typically equals that lost throughout the remainder of life (Bailey, Martin, McKay, Whiting, & Mirwald, 2000). Failure to achieve optimal bone mass during this period results in a lower reserve of bone to withstand natural bone loss later in life.

Once peak bone mass is reached, bone health is optimized through maintenance. After the age of 30, cells that build bone are not as efficient resulting in accelerated bone loss (Riggs, Khosla, & Melton, 2002). Between 40 and 50 years of age, approximately 25% of bone is lost, irrespective of gender. A period of more rapid loss occurs in women surrounding the menopausal transition. After 70 years of age, bone is continually lost for both males and females (Osteoporosis Canada, 2006).

Factors Associated with the Onset of Osteoporosis

Bone is resilient because of its intrinsic material characteristics (mass, density, mineral composition, and strength) and its dimensions (size, shape, and structure). Bone must adapt to stresses imposed on it and its ability to do so depends on genetic and lifestyle factors (USDHHS, 2005). No single cause for osteoporosis has been identified with a myriad of factors linked to its development. Genetic risk factors (e.g., race, family

history, gender, and physical stature) account for 50-90% of bone health (Recker & Deng, 2002). Consequently, 10-50% of bone health is attributable to controllable lifestyle factors (e.g., physical activity, nutrition, and smoking; Wolf, Zumuda, Stone, & Cauley, 2000) and are widely endorsed as preventative measures (USDHHS, 2005). Relatively small changes in bone mass can have a significant impact over bone health. A 10% increase in bone mass can result in as much as 50% reduced risk of fracture (Cummings & Klineberg, 1993). Further, lifestyle factors can yield bone health benefits equal to, or greater than, medication (USDHHS, 2005).

Genetic factors. Uncontrollable genetic influences such as heredity, fair complexion, small body frame, gender, and race are classified as risk factors for osteoporosis (USDHHS, 2005). Inter-generational research has demonstrated that women who have mothers who have suffered from a hip fracture are twice as likely to suffer from a hip fracture as women whose mothers have not (Curry, Hogstel, Davis, & Frable, 2002; Jackson, 1997). Reduced bone mineral density (BMD) has been found in Asian women more so than those of European and American origin (Samsioe, 1997) which has been attributed (in part) to subtle variations in body structure and weight. The above is not to suggest that women of colour and men may not develop osteoporosis.

Lifestyle factors. Controllable lifestyle factors play an important role in the prevention of osteoporosis (USDHHS, 2005). Calcium is critically important to bone health as it helps maintain bone strength and aids in the bone remodeling process. Vitamin D is an important nutritional complement to calcium as it facilitates absorption and utilization of calcium. Smoking and heavy alcohol consumption are both associated with decreased bone mass and increased fracture risk (USDHHS, 2005). These

controllable risk factors are important throughout life, however, the impact that each will have on bone will vary across the life span (e.g., calcium recommendations vary across age).

The role of physical activity. Physical activity plays an important role in bone health, as bone mass is responsive to mechanical load (Bouchard, Blair, & Haskell, 2007). Physical activity results in improved bone mass and its influence ceases when activity is stopped or reduced (Bonaiuti et al., 2002; USDHHS, 2005). The benefits of physical activity to bone health are comparable to that demonstrated with calcium supplementation (Cummings & Klineberg, 1993; Welten, Kemper, Post, & van Staveren, 1995). Further, risk factors for falls (e.g., low muscle mass and strength, poor balance, and co-ordination) can be modified by regular physical activity (Lock, Lecouturier, Mason, & Dickenson, 2006; Robertson, Campbell, Gardner, & Devlin, 2002). Various physical activities, most notably load-bearing activities, are recommended as preventative mechanisms and treatments as evidence has endorsed their role in increasing bone mineral density, improved mobility, reducing the risk of falls, and facilitating tasks of daily living (Bouchard et al., 2007; USDHHS, 2005). Knowledge of the benefits of physical activity as an osteo-protective behaviour is important when preventing the condition.

Awareness and Knowledge of Osteoporosis

Any investigation into preventative health behaviours is dependent on an individual's awareness and knowledge of the health condition. Knowledge provides professionals, patients, and the lay public with the information to make informed decisions about health practices (Cranney, O'Connor, Jacobsen, & Tugwell, 2002).

Although awareness can be assessed through a variety of means, single item instruments (i.e., have you ever heard about osteoporosis?) is the most common (Werner, 2005). Studies incorporating this single item instrument have reported levels of awareness ranging between 54% and 90% (Juby & Davis, 2001; Kutsal et al., 2005). Awareness was negatively correlated with age (r = -0.94, p = 0.00) and was positively correlated with education level (r = 0.33, p = 0.00), physical activity (r = .14, p = 0.00) and calcium intake (r = .12, p = 0.01; Kutsal et al., 2005).

For those who indicate awareness of osteoporosis as a health condition; knowledge of risk factors associated with condition diagnosis has been examined (Werner, 2005). The number of risk factors assessed varies greatly from one general question (i.e., do you know of any risk factors for osteoporosis; Matsumoto et al., 1995) to up to 24 true/false questions regarding risk factors (i.e., having a family member diagnosed with osteoporosis increases your risk of osteoporosis; Osteoporosis Knowledge Test (OKT); Kim, Horan, & Gendler, 1991). Based on a systematic review, Werner (2005) concluded that although awareness of osteoporosis as a health condition was relatively high, poor to moderate levels of knowledge are typically reported. The majority of studies included in the review were conducted on healthy peri- and post-menopausal women. Although necessary, awareness and knowledge are not sufficient on their own to facilitate or promote health behaviour change. As such, knowledge of osteoporosis is often considered in combination with other health belief and behavioural variables (Werner, 2005).

Health Belief Model

Numerous health behaviour theories have been developed to guide our understanding of why individuals engage in, or fail to engage in, health behaviours. The anticipation of negative health outcomes and the desire to reduce/avoid this outcome or impact creates motivation to engage in preventative action (Rosenstock, 1974). Further, health behaviour theories may form the basis from which interventions can be developed. Health behaviour theories have been advanced at the individual, group/community or social-ecological level. Regardless of the perspective adopted, health behaviour theories identify a) what variables are most important and b) how these variables relate or interact with one another.

The Health Belief Model (HBM; Rosenstock, 1974; Janz & Becker, 1984; see Appendix A; Glantz, Lewis, & Rimer, 1997) is a widely recognized individual-level health behaviour model and has been applied to numerous health behaviours (e.g., alcohol consumption, safe sex). Noar and Zimmerman (2005) found that 18% ($n = 509$) of theoretically-based health articles between 1974 and 2003 utilized the HBM as their driving framework. An investigation of health promotion websites targeting change in physical activity demonstrated that components of the HBM were more frequently identified (39%) than other health behaviour frameworks (e.g., Theory of Planned Behaviour; Doshi, Patrick, Sallis & Cafri, 2003).

Originally developed in the 1950's, the HBM was used to facilitate greater understanding about why some engage in preventive measures, whereas others do not (Rosenstock, 1974). HBM focuses on the health beliefs of an individual and examines the perceptions of individual risk of developing a specific health condition. Individuals'

perceptions of the perceived value of an outcome and the expectation that a given action will result in that outcome are considered to influence behaviour (Rosenstock, 1974).

Inherent to the HBM is that if an individual perceives a disease to be a threat, then that individual will be more motivated to take action to avoid that threat. Two components of threat are perceived susceptibility (i.e., the perception that one is at risk for a disease) and perceived severity (i.e., the perceived seriousness of that disease). Other important determinants of the HBM are perceived benefits (i.e., positive aspects of taking action) and perceived barriers (i.e., negative aspects of taking action). In addition to a consideration of perceived threat, the perceived benefits of taking the action need to outweigh the perceived barriers for preventative behaviours to take place. Diverse demographic, socio-psychological, and structural variables (e.g., educational attainment, age, gender, and prior knowledge) affect an individual's perceptions and thus indirectly influence health-related behaviour. Cues to action may stimulate health behaviour through their influence on perceived threat. Cues to action may be internal cues (e.g., perceived bodily functioning) or external stimuli in the environment (e.g., media information, advice, illness of a friend or family member). From its original conceptualization the HBM has been revised to include general health motivation to distinguish between illness and sick-role behaviour and health behaviours. Health motivation relates to a general tendency for an individual to engage in health behaviours. Unlike the other constructs which are related to behavioural beliefs, health motivation is concerned directly with behaviour itself (Kim, Horan, Gendler, & Patel, 1991).

Narrative reviews have generally demonstrated support (Janz & Becker, 1984; Noar, 2005; Wallston & Wallston, 1984) for the influence of HBM on health behaviours.

Strongest support for the predictive validity of the model stemmed from Janz and Becker (1984) who concluded "…given the numerous survey-research findings on the HBM now available, it is unlikely that additional work of this type will yield important information" (p. 44). The above quote is suggestive of conclusive support for the utility of the model. Fortunately, researchers have continued to examine the predictive validity of the HBM. For example, one meta-analysis suggested that weak (although statistically meaningful) effect sizes (0.01 – 0.30) between HBM constructs and behaviour existed (Harrison, Mullen, & Green, 1992) and called for further research into the utility of the model.

Health Belief Model and Physical Activity.

The HBM suggests that a person's health-related behaviour (i.e., physical activity level) depends on their perception of *susceptibility* to the disease, *severity* of the disease, *benefits* and *barriers* of the behaviour, and *health motivation*. Research on the tenets of the HBM and physical activity has received considerable investigation (Carlsson & Johnson, 2004; Hsieh, Novielli, Diamond, & Cheruva, 2001; Kim et al., 1991; Ziccardi, Sedlak, & Doheny, 2004). Most notably, the dimension of the health belief benefits/barriers to exercise has been investigated. In a sample of women ($N = 143$; $M_{age} = 70$), respondents demonstrated beliefs in the benefits of physical activity, but perceived too many barriers (O'Brien, 2000). Perceived benefits/barriers to exercise have been found to be associated with exercise adherence (Resnick & Spellbring, 2000; Seze-Eesoh, 1999). Although considerable support for the relationship between perceived barriers and exercise behaviour exist, the exercise benefits and behaviour relationship is somewhat more tenuous (Polly, 1992; Robertson & Keller, 1992; Woodridge, Wallston, Graber, Brown, & Davidson, 1992).

Other components of the HBM have also received investigation. Ali-Ali and Haddad (2004) studied a group of myocardial infarction patients (*N* = 98) and found that health motivation positively predicted exercise behaviour (ß = .28). Along with perceived severity of coronary heart disease (CHD), Mirotznik et al. (1995) found health motivation to be associated with increased exercise adherence however, perceived susceptibility to CHD and perceived barriers were associated with exercise adherence in the opposite direction than was predicted by the HBM. Cues to action in the term of social support, have been found to be positively associated with physical activity behaviour in adults (Felton & Parsons, 1994; Horne, 1994; Minor & Brown, 1993; Sallis, Hovell, & Hofstetter, 1992; Treiber et al., 1991).

Peri- and Post-Menopausal Women and Osteoporosis

Research has generated equivocal findings when considering perceived seriousness of osteoporosis with older women indicating low (Chang et al., 2003; Chen, 1992; Li, Singh, Vauski, Chi, & Huo, 2001; Lin, 1999), moderate (Carlsson & Johnson, 2004) and high levels (Hsieh et. al., 2001; Yu & Huang, 2003) of perceived seriousness. However, more consistently, older women report low to moderate levels of perceived susceptibility (Carlsson et al., 2004; Chang et al., 2003; Chang, 2006; Chen, 1992; Hsieh et al., 2001; Li et al., 2001; Lin, 1999; Yu, & Huang, 2003). A cross-sectional survey of calcium intake and its relation to knowledge and health beliefs in women between the ages of 30-45 years showed that women report more barriers to calcium (*M* = 2.90; SD = 0.70) than beliefs in the benefits of calcium (*M* = 1.90; SD= 0.40; Chang, 2006). However, Doheny, Sedlak, Estok, and Zeller (2007) investigated health beliefs in women

50 years of age and older and found that participants reported more benefits to exercise ($M = 24.41$; $SD = 3.45$) than barriers ($M = 12.43$; $SD = 4.53$).

HBM: The Missing Link?

One component of the HBM and osteoporosis related research using HBM that has gone largely ignored is cues to action. *Cues to action,* are specific stimuli, internal (i.e., physical symptoms, family member with a condition, social influence) or external (e.g., public service announcements, health education campaigns, printed posters) that are necessary to trigger appropriate health behaviours and serve to create an awareness of the health threat (Mattson, 1999). Cues to action reflect a dynamic dimension, namely the incident resulting in the initiation of behavioural change. A central focus on cues to action is important as individual beliefs and perceptions about health and illness are socially constructed and contingent upon social interaction (Aquino, Fyfe, MacDougall, & Remple, 2004). Further, cues to action may result in a "snowball effect" as individual behaviour may influence others to do the same (Aquino et al., 2004). Theoretically, cues to action are not identified as an independent variable, as such no hypotheses are advanced as to how they affect other HBM components or initiate behavioural change (Janz & Becker, 1984). Cues to action have been examined in relation to varied health behaviours with results suggestive of improved nutrition behaviours (Chew, Palmer, & Kim, 1998) and smoking reduction (Mirotznik, Feldman, & Stein, 1995) as a consequence of varied cues to action.

Assessing the Influence of Cues to Action

Non-experimental designs: Our understanding of the influence of cues to action has been relatively limited in comparison to other HBM constructs. Typically, researches

have either measured a) the influence of cues to action or b) the relationship between cues to action and other HBM constructs. Jones, Fowler, and Hubbard (2000) developed a 32-item scale with each item reflective of a cue to action. In their development of the scale, respondents were asked to reflect on one of five health behaviours (e.g., stop smoking cigarettes, reduce the fat intake) and indicate the effectiveness of each cue to prompt behavioural change. Although highly endorsed cues were generally internal sources (e.g., feeling better physically and mentally after initiating behavioural change), external cues to action (e.g. receiving advice from a health professional and family or friends) were also rated as quite effective. Cues to action from media sources generally had moderate perceived effectiveness (e.g., televised public service announcements rated $M = 1.47$; $SD = .96$ across a 4-point scale).

Non-experimental research that has examined the tenants of the HBM on health behaviour has generally ignored the influence of cues to action. For example, research examining health belief variables on breast cancer screening (Gozum & Avdin, 2004), myocardial infarction (Al-Ali & Haddad, 2004), and maternal beliefs (Bates, Fitzgerald, & Wolinsky, 1994) excluded any measure of cues to action in their investigation. Research specific to osteo-protective behaviours is no exception with cues to action frequently excluded as a variable of interest (Anderson et al., 2004; Kasper et al., 2001; Sedlak 2000; Taggart & Connor, 1995; Wallace, 2002).

Descriptive studies considering the influence of cues to action on osteo-protective behaviours have been limited to medical and family cues. The diagnosis of osteoporosis/osteopenia, screening for bone loss, and having a female family member with osteoporosis were identified as salient cues for the use of prescription medication

(Cline, Farley, Hansen, & Schommer, 2005). Similarly, an investigation of HBM variables on osteoporosis medication use among older African-American women found increased use of hormone replacement therapy as a result of cues to action such as history of hysterectomy, bone mineral density testing, and discussion with a physician about osteoporosis (Unson, Fortinsky, Prestwood, & Reisine, 2005). Chang (2006) investigated knowledge, health beliefs, and behaviours in first degree relatives of women suffering from osteoporosis. Having a mother who has been diagnosed with osteoporosis was associated with increased perceived seriousness and susceptibility ($M = 3.9$ and $M = 3.5$ respectively) versus those whose mothers had not been diagnosed ($M = 1.1$ and 1.7 respectively).

Cues to Action as an Intervention

Studies examining the design and implementation of osteoporosis prevention education as a cue to action have reported improvements in knowledge, attitudes, or behaviours (Blalock et al., 2000; Jamal et al., 1999; Sedlak, Doheny, & Jones, 2000). Ribeiro and Blakeley (2001) also found that a workshop developed to educate women about the disease and to encourage women to take appropriate preventative measures was effective in increasing participants' ($N = 138$) level of knowledge on osteoporosis. This increase was still evident 6 months post-intervention. Slight increases in behavioural change indices in the form of calcium intake and hormone replacement therapy (HRT) were also present.

A descriptive study that used a sample of 211 primarily Caucasian women ages 60-96 years ($M_{age} = 76.41$) used a planned 30 minute osteoporosis educational program to increase osteoporosis knowledge (Curry & Hogstel, 2002). The program included basic

facts about osteoporosis including definitions, causes, risk factors, prevention, diagnosis, and treatment. Significant increases in knowledge were found pre- (*M* = 6.89) post-test (*M* = 9.96; the highest score possible was 12). Although behavioural change was not considered, the authors suggest that educational interventions can provide the guidance needed by older women to fulfill their need to be informed and to take all measures possible to enhance bone health and quality of life.

Sedlak et al. (2000) evaluated the influence of three osteoporosis prevention programs. The three programs were virtually identical in content; however they differed in length and method from which the content was presented. In the "intense" program, participants met with program developers for three sessions over a 3-week period, were given assignments to complete, and recorded the frequency and amount of weight bearing activity per week. Those in the "intermediate" group met for one 3-hour session per week and those in the "brief" group met for one 45-minute session per week. Regardless of intervention, differences in perceived benefits of calcium were noted. Tussing and Chapman-Novakofski (2005) engaged a sample of 42 women ($M_{age} = 48$) in an 8-week educational intervention that included eight hands-on lessons that were based on the HBM and Theory of Reasoned Action (Fishbein & Ajzen, 1975). Each lesson included a short lecture, hands-on activities to increase self-efficacy, and pertinent handouts to reinforce behaviours learned. Post intervention, an increase in perceived susceptibility, perceived benefits of calcium intake was reported. Behavioural change was noted as calcium intake had increased from 644mg/day to 821mg/day on average.

Brecher et al. (2002) evaluated the effectiveness of a primary osteoporosis prevention program on women aged 25-75 years who were assigned to either a treatment

or a control group. Those in the treatment group reported greater behavioural intention to change calcium intake post-intervention and at the 3 month follow up. Women aged 18 or above were the population of interest in a study by Chan, Ko, and Day (2005). Participants received a 45 minute educational intervention which covered four osteoprotective behaviours (i.e., consumption of soya foods, milk, exercise, and vitamin D/exposure to sunlight). Results revealed increases in each osteo-protective behaviour: consumption of soya foods ($M = 4.30$; $SD = 0.50$), milk ($M = 4.20$; $SD = 0.80$), more exercise ($M = 4.30$; $SD = 0.50$), and vitamin D/exposure to sunlight ($M = 4.20$; $SD = 0.90$) for those in the treatment group compared with those in the control group ($M = 3.30$; $SD = 0.90$; $M = 3.00$; $SD = 0.90$; $M = 3.40$; $SD = 1.00$; $M = 2.70$; $SD = 0.90$ respectively) . In comparison, Blalock et al. (2002) recruited 547 women to evaluate the effects of two interventions; a tailored educational intervention and a community-based intervention simultaneously on calcium intake and exercise. No consistent effects of cues to action were noted based on the interventions.

Media Campaigns as a Cue to action

Attempting to influence health beliefs and behaviour at a population-level requires interventions that can reach large numbers of people and minimize costs (Cavill & Bauman, 2004). This has lead public health personnel to consider social marketing techniques and mass media campaigns to educate and influence community understanding and beliefs. These sources are considered to be external cues to action and are defined as "purposive attempts to inform, persuade, and motivate a population using organized communication activities through specific channels, with or without other supportive community activities" (Rice & Atkin, 2001 p.7). Media campaigns can reach

large populations at relatively low costs to attempt to influence attitudes, cognitions, knowledge, and potentially behaviour (Cavill & Bauman, 2004). Specific channels include: television and radio broadcasting, print media, comic strips or posters. Used individually or in combination, these channels can be chosen to expose the target population to the message of the campaign. Mass media campaigns to promote health behaviour (e.g., healthy eating, physical activity) and discourage unhealthy behaviour (e.g., drinking and driving, safe sex practices) have become an important tool of public health practitioners (Hornik, 2002; Institute of Medicine, 2002). As a testament to their effectiveness, a meta-analysis of 48 health communication campaigns reported that media exposure accounted for 7%-10% of behavioural change (Snyder, 2001), thereby providing support that along with increased awareness, attitudes, and knowledge, mass media campaigns are effective in increasing or changing behaviour

Media campaigns and physical activity: Research assessing the impact of a national mass media campaign on campaign awareness, change in knowledge of physical activity recommendations, and self-reported physical activity (Hillsdon, Cavill, Nanchahaln, Diamond, & White, 2001) revealed that 38% reported being aware of the message, knowledge of physical activity recommendations increased by 37%, but no evidence of behavioural change resulted. Bauman, Bellew, Owen, and Vita (2001) found that a statewide campaign which used a combination of paid and unpaid television and print to promote regular physical activity translated into increased message awareness (from 12.9% to 50.7%) and increased physical activity by at least an hour per week. Following a narrative review of 15 mass media campaigns focused on physical activity, Cavill and Bauman (2004) reported that 70% of the target group was aware of the

campaign and there was an increase in attitude and knowledge among half of the campaigns reviewed. However, this increase was found for physical activity behaviour in motivated sub-groups only.

Television as the Cue to Action

Television has been a very popular and effective choice for health promotion campaign designers (Noar, 2006). Previous research conducted to determine the effectiveness of television as a source of osteoporosis information has varied. Juby and Davis (2001) found that seniors ($M_{age} = 76$) reported television as the greatest source of osteoporosis information (31.0%) in comparison to friends (28.3%), and physician (26.2%). Consistent with these findings, women ($M_{age} = 63$) reported learning about osteoporosis via television (53%; Matthews et al., 2006). However, Kutsal et al. (2005) reported that television was less frequently identified as a source of information (5.1%) compared with physicians (56.8%) or family and friends (14.1%) in a population of seniors ($M_{age} = 60.4$).

Public service announcements (PSAs) are presented by nonprofit organizations which attempt to persuade a target audience to take some specific action or adopt a favourable view towards a particular service, issue, or cause. They can be presented on their own or can be included as part of a mass media campaign to communicate a specific message. PSAs may use a combination of paid and donated channels to enhance message exposure to the target population.

Systematic attempts to evaluate the effectiveness of donated televised PSAs targeted at health related behaviours have been conducted. Fishbein et al. (2002) evaluated the effectiveness of 30 televised anti-drug PSAs and reported considerable

variation in their relative effectiveness. Differential effects were attributed to the message framed within the announcement. Effective PSAs provided information about negative consequences of drug use, whereas the least effective PSAs focused on avoidance behaviour. Three 30-second television PSAs addressing the problem of physical inactivity and promoting increased physical activity among adults (30-64 years) were evaluated (Renger, Steinfelt, & Lazarus, 2002). Results provided support for the effectiveness of television in delivering the message to the target audience and that the campaign was effective in changing perceived barriers and benefits of physical activity as well as the behaviour itself.

Evidence that PSAs are effective in creating awareness of a topic, increasing knowledge around a topic, and changing beliefs and/or behaviours has been established (Bauman et al., 2001; Fishbein et al., 2002; Renger et al., 2002). However, it is important to note that donated television PSAs alone are not appropriate to reach narrow (i.e., very specific) audiences for two reasons; 1) television is a mass communication medium and, 2) they rely on donated airtime. Messages must be simple and straightforward so that television PSAs do not compromise important health messages (Cooper et al., 2005).

Medical Screening as a Cue to Action

Bone screening is an effective tool in identifying low bone mineral density (BMD) in women at high risk for osteoporosis. Osteoporosis Canada (2007) is an advocate of bone screening as it plays a critical role in preventing osteoporotic-related fractures. Osteoporosis Canada recommends that individuals at risk (e.g., in the period surrounding the menopausal transition) undergo bone screening to allow for early detection of bone loss to assist in planning proper healthcare strategies. Descriptive

studies have provided some support that BMD testing and the consequent diagnosis of osteoporosis have been identified as salient cues for the use of prescription medication, hormone replacement therapy, and increased perceived seriousness and susceptibility (Chang, 2006; Cline et al., 2005; Unson et al., 2005).

After a comprehensive search it became apparent that there is only one study that has investigated the effectiveness of BMD screening alone on changing knowledge, beliefs and protective behaviours associated with osteoprosis. McLeod, McCann, Horvath, and Wactawski-Wende (2007) demonstrated that the results of osteoporosis dual energy x-ray absorptiometry (DXA) screening influenced post-menopausal women's decisions to increase calcium intake. Most research has documented increased knowledge, beliefs and behaviours (e.g., exercise, calcium intake, hormone replacement therapy, initiating medical consultation/treatment etc.) when supplementing BMD screening with feedback and an educational component (Anastasopoulou & Rude, 2002; Law & Shapiro Pharm, 2005; Naunton, Peterson, & Jones, 2006; Rohr, Clements, & Sarkar, 2006).

Results of these multi-component cues to action interventions including BMD assessment have generally been supportive of increases in health beliefs associated with osteoporosis (Law & Shapiro Pharm, 2005; Naunton et al., 2006; Sedlak, Doheny, Estok, & Zeller, 2005). Behavioural change specific to increased calcium consumption (Anastasopoulou & Rude, 2002; Jamal et al., 1999; Sedlak et al., 2005; Rohr et al., 2006) hormone replacement therapy (HRT; Torgerson et al., 1997) and physical activity (Cerulli & Zeolla, 2004; Naunton et al., 2006; Rohr et al., 2006). Finally, Anastasopoulou and Rude (2002) reported increased medical consultation following BMD screening.

Inconsistent with the above findings, some researchers have found no effect of BMD screening/educational cues to action on knowledge and physical activity behaviour (Blalock et al., 2002; Cram, Schlechte, & Christensen, 2006).

Statement of the Purpose

The purpose of the investigation was to examine the influence of cues to action on health beliefs and physical activity behaviour. More specifically, the influence of a PSA developed by Osteoporosis Canada and bone screening by way of Quantitative Ultrasound on health beliefs related to osteoporosis and health-enhancing physical activity (HEPA) behaviour across a four week period in peri- and post-menopausal women was investigated. Employing a randomized experimental design (see Appendix B for study design; Pedhauzer & Schmelkin, 1991), participants in the intervention conditions (PSA and BS) were compared to those in an attention control (AC) condition. The following hypotheses were advanced.

H_0: Health beliefs of osteoporosis would not predict health enhancing physical activity (HEPA).

H_1: Based on previous research (e.g., Polly, 1992; Robertson & Keller, 1992; Woodridge, Wallston, Graber, Brown, & Davidson, 1992) it was hypothesized that health beliefs of osteoporosis would predict HEPA.

H_0: There would be no difference in health beliefs of osteoporosis between the intervention conditions and the AC condition at baseline, Time 1 (immediately after the manipulation), and Time 2 (four weeks after the manipulation).

H_2: Based on previous research (e.g., Curry et al., 2001; Ribeiro et al., 2001; Sedlak et al., 2000; 2005; Tussing et al., 2005), it was hypothesized that the intervention

conditions would report greater health beliefs of osteoporosis at Time 1 and Time 2 than those in the AC condition.

H_0: There would be no difference in health-enhancing physical activity behaviour between the intervention conditions and the AC condition.

H_3: Based on previous research (Bauman et al., 2001; Cavill et al., 2004; Cerulli et al., 2004; Renger, Steinfelt & Lazarus, 2002) it was hypothesized that the intervention conditions would report higher health-enhancing physical activity behaviour than the AC condition at Time 2.

Significance of the Study

The present investigation extends the literature on HBM and osteo-protective behaviours and can be linked to theoretical, design, sampling, and measurement considerations stemming from previous research. The HBM posits eight constructs that may assist health professionals in understanding why some people engage in preventative action, whereas others do not. Through an enhanced understanding of individual perceptions of perceived threat, benefits and barriers, health motivation, and demographic variables, our understanding of those more likely to engage in osteo-protective behaviours has been advanced. Unlike the majority of HBM and osteoporosis research (e.g., Kasper, Peterson, & Allegarante, 2001; Hsieh et al., 200), this investigation incorporates knowledge as a socio-psychological variable in the HBM as opposed to a separate variable of interest. Cues to action have received relatively scant research attention in comparison to other HBM constructs. As such, our understanding of their relative influence is only minimally understood.

When considering study design, the bulk of the research on HBM and osteo-protective behaviours has been non-experimental (e.g., Anderson et al., 2004; Kasper et al., 2001; Sedlak 2000; Taggart & Connor, 1995; Wallace, 2002). While valuable information can be derived from using such designs, statements specific to cause-and-effect cannot meaningfully be advanced (Cook & Campbell, 1979). Research has also examined changes in osteo-protective behaviours over time (Ali & Twibell, 1995; Curry & Hogstel, 2001; O'Brien, 2000; Resnick & Spellbring, 2000). However, change is typically measured across short durations (i.e., immediately following an educational session) or behavioural change is inferred from measures of intention. Through adopting a randomized experimental design, the present investigation extends existing research and the quality of the conclusions between HBM variables and physical activity behaviour.

Research examining HBM variables on bone health has generally been conducted on university-aged samples (Gasparotto et al., 2006; Kasper et al., 2001; Piaseu et al., 2002; Taggart & Connor, 1995; Ziccardi et al., 2004), adult populations demonstrating wide dispersion in age ranges (Brecher et al., 2002; Carlsson & Johnson, 2004; Williams et al., 2002), or adults over the age of 60 years (Curry & Hogstel, 2001; Juby & Davis, 2001). Given the natural reduction in bone mineral density as a result of age, understanding bone health across the lifespan is of value. However, little research has examined osteo-protective behaviours across the peri- and post-menopausal transition (Di Daniele et al., 2004; Somboon, Davis, Seif, & Bell, 2005) with none extending their investigation to include physical activity behaviours. Menopause is the permanent end of menstruation and fertility and is confirmed when a woman has not had a menstrual period

for 12 consecutive months (North American Menopause Society, 2003). Natural menopause occurs between the ages of 40 and 58 with the average age of menopause being 51 years. Peri-menopause overlaps the menopausal transition as it encompasses the time of up to 6 years or more immediately prior to natural menopause plus one year after menopause (North American Menopause Society, 2003). Consequently, limiting the sampling frame to the peri- or post-menopausal period may reflect an important transitional period for women as it is during this time when a rapid decrease in estrogen is seen resulting in decreased BMD and an increased susceptibility to osteoporosis (United States Department of Health & Human Services, 2005).

Much of the research that has examined physical activity behaviour has used either one-item instruments or assessment tools designed only for the purposes of the study (e.g., Blalock et al., 2002; Kypri & McAnally, 2005). Further, physical activity has often been conceptualized as structured exercise (e.g., Brecher et al., 2002; Sedlak et al., 2000) as opposed to lifestyle physical activity which has been linked to positive biological health (Bouchard, Blair, & Haskell, 2007). Lifestyle physical activity encompasses any movement that benefits health and functional capacity of the organism without undue harm or risk. Consequently, previous research may not have adequately captured physical activity in all its forms to fully understanding this important variable to bone health (CDC, 2007).

Finally, the bulk of the existing literature has considered the combined influences of multiple cues to action on health beliefs and behaviour (Anastasopoulou & Rude, 2002; Law & Shapiro Pharm, 2005; Naunton et al., 2006; Rohr et al., 2006). The present investigation explored PSAs and screening as separate cues to action. PSAs have become

a popular public health promotion tool. However the extent to which PSAs are effective in promoting health beliefs and behaviour change of osteoporosis is unknown. While bone screening has become a popular cue to action in the health promotion literature, feedback has always been given prior to assessing its influence on health beliefs and behaviour. The present investigation offered participants their bone screening results upon study completion. The purpose of doing so was; 1) to allow for similarity between the three conditions and 2) awareness of bone screening results would have differentiated the target sample into those at risk and those not at risk of osteoporosis which may contaminate the outcome variables of interest.

CHAPTER TWO: METHODS

Participants

Participants consisted of peri- and post-menopausal women ($N = 174$) between the ages of 45-60 years ($M = 50.75$; $SD = 4.10$) who had access to a computer as they were recruited by way of email. Primarily Caucasian (99.40%, $n = 173$), participants were on average 164 centimeters ($SD = 3.24$) in height and weighed 70.5 kilograms ($SD = 31.76$). Participants reported a mean BMI of 26.2 and according to anthropometric guidelines (Health Canada, 2006), 45% were in the normal range (BMI = 18.5-24.9). Participants generally reported never having experienced a fracture (67.80%. $n = 188$), having no family history of osteoporosis (65.50%, $n = 114$), having had at least one medical check up in the last year (69.50%, $n = 121$), not currently using HRT (90.80%, $n = 158$), or calcium supplements (62.10%, $n = 108$).

Measures

Demographic and lifestyle information. Relevant demographic, medical history and lifestyle variables were queried. Self-reported height, weight, race, incidence of fracture, family history of osteoporosis, medication use and supplements in the form of hormone replacement therapy or calcium supplements were considered. Lifestyle questions were asked to all participants at Time 2 to assess changes over the previous month in HRT and calcium intake. Two additional questions were asked; first participants were asked "If over the course of past 4-weeks they had gone to the Osteoporosis Canada website or actively sought more information on osteoporosis". Second, participants were asked "If their physicians had ever spoken to them about osteoporosis". The purpose of this question was to control for the effect of additional

cues to action, specifically those from a physician. Participants responded to both items using a dichotomous format (Yes or No). Upon completion of the Time 2 questionnaire, participants were asked if they had viewed either public service announcement prior to the study as a manipulation check.

Osteoporosis knowledge test. The Osteoporosis Knowledge Test (OKT; Kim et al., 1991) was completed as an assessment of general knowledge of osteoporosis. The OKT is a 24 item measure of controllable and uncontrollable risk factors linked with this health ailment. The test addresses a variety of topics, including the relationship of exercise and dietary intake of calcium to osteoporosis prevention. Items are measured using a multiple-choice format. Scores range from 0 to 24, with higher scores indicative of greater overall knowledge. Scores can also be reported as percent correct. Preliminary evidence for the content validity of the scale has been established through judge ratings and item analysis (Kim et al., 1991). Reliability coefficients for internal consistency for OKT calcium and OKT exercise were .72 and .69 respectively (Kim et al., 1991). A systematic evaluation of the OKT by Werner (2005) showed that when used by various populations such as healthy men and healthy women, internal consistency reliability scores ranged from 0.40 to 0.86.

Osteoporosis health belief scale. The Osteoporosis Health Belief Scale (OHBS; Kim, Horan, Gendler, & Patel, 1991) is a 35 item tool consisting of seven subscales reflecting constructs identified in the Health Belief Model. Subscales include susceptibility (e.g., you feel your chance of getting osteoporosis in the future is good), seriousness (e.g., if you had osteoporosis, your whole life would change), benefits to exercise/calcium intake (e.g., eating calcium rich foods reduces risks of broken bones;

exercising regularly prevents future pain), barriers to exercise/calcium intake (e.g., calcium rich foods do not agree with you; exercising regularly can be time consuming), and health motivation (e.g., you frequently do things to improve your health). Each item was across a 5-point Likert scale anchored at the extremes by 1 (strongly disagree) and 5 (strongly agree).

Initially generated from the Self Breast Examination instrument (Champion, 1984) the OHBS was originally comprised of 50 items. To evaluate ease of administration, understandability, and content validity the instrument was pilot tested with 16 elderly participants (Kim et al., 1991). Based on the pilot study, 15 items were deleted from the original instrument resulting in a 35 item OHBS. Decisions to delete items were based on the 1) low item correlations or total subscale scores and 2) multicollinearity. Based on the above, the OHBS is comprised of 7 subscales, each represented by 5-items.

To evaluate predictive validity, calcium and exercise behaviours in a sample of 150 adults 60 years or older, were assessed (Kim et al., 1991). OHBS items were submitted to factor analytic procedures to evaluate the structural validity of the scale using principal component factor analysis with Varimax rotation. Kaiser's criterion of eigenvalues greater than or equal to 1.0 was used in determining the number of factors retained . A six-factor solution resulted and was labeled accordingly: Susceptibility, Seriousness, Health Motivation, Barriers, Benefits related to calcium, and Benefits related to exercise. Barriers for calcium and exercise did not reflect distinct constructs and loaded on the same factor.

To complement results from factor analytic procedures estimates of internal consistency reliability were considered (Kim et al., 1991). Cronbach's alpha reliability coefficients ranged from .61 (Health Motivation) to .80 (Susceptibility). Researchers have documented support for test-retest reliability (r_{12} = .72-.90; Chang et al., 2003) and discriminant validity as females scored higher on measures of susceptibility compared to males in a sample of adults (Carlsson & Johnson, 2004).

Physical activity behaviour. The Short Questionnaire to Assess Health-Enhancing Physical Activity (SQUASH; Wendel-Vos & Schuit, 2002) was developed to assess habitual activities with respect to occupation, leisure time, household, transportation means, and other daily activities in an average week. The SQUASH contains 14 questions that are pre-constructed to assess (A) commuting activities, (B) leisure time activities, (C) household activities, and (D) activities at work and school. This instrument consists of three main queries: days per week, average time per day, and intensity. Sample questions include, 'how many days per week do you go to work or school on foot or by bicycle? How many minutes does this activity take per day? How intensive is this activity? (low, moderate, and high)'.

Based on participant responses, metabolic equivalent units (METs) were calculated to allow for intra- and inter-individual comparison. Consistent with Canadian physical activity guidelines and the Ainsworth et al. (2000) compendium of physical activities, the data were subdivided into three categories reflecting perceived relative intensity. Light activities are classified as <3.00 METs, moderate activities reflect MET units ranging between 3.00 to 6.00, and vigorous activities are those whereby the MET units are $\geq$ 6.00. MET values <3.00 were not used as they are considered to contribute

negligibly to habitual activity levels (Wendel-Vos & Schuit, 2002). Total minutes of activity were calculated for each question by multiplying frequency (days/week) by duration (min/day). Activity scores for separate questions were calculated by multiplying total minutes of activity by the intensity score. The total activity score was calculated by taking the sum of the activity scores for separate questions.

Reliability and validity of the SQUASH was evaluated in a sample of 50 males and females (*n* = 36 males and *n* = 14 females) between the ages of 18-65 years (Wendel-Vos, Schuit, Saris, & Kromhout, 2003). At baseline, participants completed a physical examination which included anthropometric measures, blood pressure, and submaximal aerobic fitness test. The SQUASH was completed at baseline and 5 weeks later. Following completion of baseline measures, participants were asked to wear an accelerometer during waking hours. Test-retest reliability for total activity was (r_{12} = .58). Separate intensity items had a mean test-retest score of (r_{12} = .75) with intense housework being the least reliable (r_{12} = .44) and commuting by bike being the most reliable (r_{12} = .96). Reliability of intensity categories (light, moderate, vigorous) was (r_{12} =.58, .54, and .92) respectively. Convergent validity of the SQUASH was examined in comparison to values derived from accelerometer data (r_{12} = .45). This value was deemed comparable to other self-report questionnaires with accelerometer values (Miller, Freedson, & Kline, 1994; Philippaerts, Westerterp, & Lefevre, 1999). Consequently, reasonable initial support for the validity of physical activity scores derived from using the SQUASH has been documented.

Cues to Action: The PSA Condition

Osteoporosis Canada produced its first national television advertisement campaign in the fall of 2005. The '*Nutcracker*', was released as a (PSA). Produced in both official languages of Canada, only the English version was used. The advertisements were designed to increase public awareness of osteoporosis and further encourage people to visit the Osteoporosis Canada website to learn more information about the condition (Osteoporosis Canada, 2006). The '*Nutcracker*' was created and produced for Osteoporosis Canada by the Toronto office of Anderson DDB.

The Nutcracker PSA contains the image of a woman's hand holding a nutcracker and walnut. It symbolizes the fracturing of bone through the cracking of a walnut. A female voice says "It takes years to develop osteoporosis … and just one simple movement to discover you've got it. You could be at risk. Find out more, visit osteoporosis.ca." The PSA targets women 50 years and older as this age cohort is typical of the menopausal transition period when bone mineral loss is heightened with the consequent hormonal changes (USDHHS, 2005).

Cues to Action: The Bone Screening (BS) Condition – Quantitative Ultrasound (QUS)

Bone properties of the peripheral skeleton were determined from the speed of sound (SOS) measured by Quantitative Ultrasound (QUS, Sunlight Omnisense™ 7000S, Sunlight Medical, Ltd., Israel) at the mid-shaft of the dominant and non-dominant tibia in metres per second (m/s).

Procedures for SOS measurement were conducted as described by Njeh, Boivin, and Langton (1997). Briefly, the probe contains a set of two transmitters and two receivers, housed in a compact holder. The SOS measurement reflects the shortest time

that elapses between pulse transmission and the first reception of a signal. The exact path of the signal is determined by Snell's law: as the signal enters the bone from the soft tissue, it is refracted through a critical angle, which is a function of the ratio of the SOS in soft tissue and bone. After it propagates along the bone, the sound wave emerges at the same critical angle. The time taken for the signal to travel between the transmitting and receiving transducers is used to determine the SOS in bone that it is influenced by the density, elasticity and cohesiveness of the bone; the faster the speed of propagation, the stronger the bone. Cross-sectional and prospective studies have shown QUS to be highly correlated ($r = .93$) with bone mineral density estimates and predictive of osteoporotic fractures in levels comparable to the gold standard (Chen, Chen, Fund, Lin, & Yao, 2004; Marín, González-Macías, Díez-Pérez, Palma, & Delgado-Rodríguez, 2006). Research has demonstrated support for a positive relationship between QUS measurements and physical activity behaviour in post-menopausal women (Blanchet et al., 2003).

Cues to Action: Attention Control (AC) Condition

The Advertising Council, in partnership with Autism Speaks, launched in April 2006 a new PSA campaign designed to raise awareness about autism and to urge parents to learn the signs of autism. It seeks to educate parents about the growing rate of autism in this country and to ultimately increase the level of early detection. The PSA communicates the statistic that 1 in 166 children are diagnosed with some form of autism. The PSA also encourages parents to visit AutismSpeaks.org to learn the signs of the disorder.

The Car Seat PSA portrays a woman's hands buckling her child in a car seat. A female voice in the spot says: "The odds of a child being in a fatal automobile accident

are 1 in 23000. The odds of a child being diagnosed with autism … 1 in 166. The odds say its time to listen. To learn the signs of autism visit AutsimSpeaks.org." The PSA is aimed at parents of young children. The Nutcracker and Car Seat PSAs differ in content as the Nutcracker PSA conveys information specific to osteoporosis and the Osteoporosis Canada website where as the Car Seat PSA conveys information specific to autism and the Autism Speaks website. However, similarities include a short duration (i.e., 15-25 seconds in length), a female voice, similar target audience (i.e., adult women), reported statistics and a website for more information.

Procedure

For visual representation of the study design see Appendix B. Following clearance by the Brock University Research Ethics Board (File: 06-178; see Appendix C), female participants (N = 174) between the ages of 45-60 years who spoke English were recruited. Peri- and post-menopausal women at Brock University and in the Niagara community served as the sampling frame. Consistent with Dillman's tailored design (2007) for recruitment and participant retention, participants were recruited by way of e-mail (see Appendix D) and poster advertisements (see Appendix E) throughout the Brock University and Niagara community. Snowball sampling recruitment procedures were also employed. Exclusion criteria were those who 1) fell outside the target age (45-60, peri- or post-menopausal) and/or 2) indicate that they had been diagnosed with osteoporosis and/or 3) were physically unable to partake in physical activity and/or 4) had undergone a bone scan in the past 2 years. Once the participant made initial contact, a letter of information was presented (see Appendix F) and an opportunity to ask questions pertaining to the nature of the study or their involvement was provided. Those meeting

the inclusion criteria were re-contacted and once consent was gained (see Appendix G), participants were entered into a database and were randomly assigned using simple allocation to one of three conditions (PSA, BS, AC). All participants in the study were volunteers who had the opportunity to discontinue participation in the study at any time. Two participants discontinued the study and a resource sheet was prepared for any participant that decided to discontinue participation (see Appendix H). Participants, regardless of condition assignment were given the opportunity to receive all cues to action and feedback upon completion of the study (see Appendix I).

Individual meetings were scheduled with each participant and were held in a pre-determined common location. During this meeting (Baseline), a survey package (see Appendix J) containing demographic, lifestyle and medical history information, OKT, OHBS, and the SQUASH as well as screening questions (see Appendix K) was administered. Each questionnaire package was assigned a numeric code to preserve confidentiality. Completion of the questionnaire package took between 20 -30 minutes. Participants were then shown the cue to action manipulation (i.e., either the Nutcracker PSA or the Car Seat PSA which was shown on a laptop, or given the bone scan). Immediately after the manipulation (Time 1), participants completed a second survey package containing the OHBS. At this time, participants scheduled their Time 2 appointment which commenced four weeks later and were told they would receive a reminder one week prior to their meeting via e-mail (see Appendix L).

A third questionnaire package containing the OKT, OHBS, SQUASH, and final lifestyle questions and the manipulation check (see Appendix M) was completed four weeks following the manipulation (Time 2), consistent with other behavioural change

research in health education (Chan et al., 2005; Ehrhardt et al., 2002; LaBrie, Pedersen, Earleywine, & Olsen, 2006; Orbell, Hodgkins, & Sheeran, 1997). To maintain confidentiality of participation, all research assistants completed a statement of confidentiality form (see Appendix N).

Study Design and Data Analysis

The present study employed a randomized experimental design. Health beliefs (other than knowledge) were measured through surveys across three time periods (Baseline, Time 1, and Time 2). Knowledge and HEPA were measured across two time periods (Baseline and Time 2). Demographic and lifestyle variables were measured at Baseline, with select lifestyle and medical questions assessed again at Time 2.

Data analysis progressed in sequential stages. First, data was screened for out of range responses, non-response errors, and examined for compliance with statistical assumptions. Second, differences between demographic and lifestyle variables between conditions were determined through the appropriate non-parametric (e.g., χ^2) or parametric statistics (e.g., ANOVA) depending on level of measurement. Third, estimates of internal consistency (Cronbach's Coefficient α; Cronbach, 1951) were calculated for each subscale of the OHBS at each time point. Test-retest reliability estimates of the OKT, OHBS, and SQUASH were determined through Pearson Product Moment Correlation Coefficients. Fourth, bivariate correlations were computed between relevant study variables to determine patterns of inter-relationships. Multiple regression analyses were conducted to examine whether condition or health beliefs (Baseline) predicted HEPA at Baseline and Time 2. Finally, a series of mixed model ANOVAs were conducted with one between groups variable (PSA vs. BS vs. AC) and one within groups

variable (Time) to examine differences between conditions and changes over time. Where significant differences over time were found, Ryan test (REGWQ) post hoc analyses were calculated to determine specifically where significant differences lay. Confidence intervals were computed as a complimentary source of information to null hypothesis significant testing (Thompson, 2001). Estimates of effect size (i.e., ω^2 and *phi* – coefficients) were computed and interpreted to consider not only statistical, but practical significance consistent with guidelines advocated by Grissom and Kim (2005).

CHAPTER THREE: RESULTS

Preliminary Findings

After screening for data entry error, patterns of missing data were examined. All missing data were deemed to be random through the Missing Values Analysis in SPSS. As no more than 5% of the data were missing for any study variable, missing data were replaced through mean estimation procedures (Tabachnick & Fidell, 2001). Data were examined to test the assumption of normality by examining skewness and kurtosis values for each study variable (see Tables 2-5; Glass & Hopkins, 1996) across all test administrations. Data were screened for univariate outliers using Z-scores. Cases with standardized scores in excess of 3.29, $p = .00$ were deleted. Malhalanobis distance values were calculated to test for multivariate outliers, with no number exceeding the criterion value of $\chi^2 = 27.88$, $p = .00$. Scatter plots were used to test the assumption of multivariate normality and homoscedasticity of residuals, scores exceeding 3 standard deviations were considered outliers and were deleted for each regression analysis. Based on the above, 11 participants were removed from baseline health beliefs predicting HEPA and four from the prediction of time 2 HEPA, therefore acceptable participant-to-variable ratio (163:9 and 170:9) was met (Stevens, 1996). Assumptions of a mixed-model ANOVA were met as participants were randomly assigned to conditions; the data were measured at the interval and ratio level; and conditions were similar in sample size. To test the assumption of homogeneity of variance, the Levene's test was interpreted to determine that there were no violations. To test the assumption of sphericity, the Mauchly Sphericity test was examined. This assumption was violated for the HBM variable seriousness in which case the Huyn-Feldt correction was used (Field, 2003). All study

variables demonstrated acceptable homogeneity ($p > .05$). *Z*-scores were calculated to test for univariate outliers.

Internal consistency reliability (Cronbach's α; Cronbach, 1951) estimates ranged from 0.53 to 0.90. Test-retest reliability for the OKT was $r = .67$ and for the SQUASH was $r = .49$. Test-retest reliability for different types of activity ranged from $r_{12} = -.02$ (light household) to .64 (leisure sports). Test-retest reliability for different OHBS variables ranged from $r_{12} = .19$ (calcium benefits) to .79 (susceptibility). Descriptive statistics, estimates of normality and Cronbach's alpha coefficients can be found in Tables 2-5. The results of the confirmatory factor analysis (CFA) provided partial support for the structural validity of OHBS scores across an a priori four-factor first order measurement model ($\chi^2 = 360.76$; df = 168; *Comparative Fit Index* = 0.87; *Incremental Fit Index* = 0.88; *Root Mean Square Error of Approximation* = 0.08 (90% *confidence interval* = [0.07-0.09]). The pattern of standardized factor loadings ranged from 0.30 to 0.93 (Mean = 0.70; *SD* = 0.19) across the target latent OHBS factors. These indices are recommended for use when the sample size is small and the data likely deviate from normality (Hu & Bentler, 1999; West et al., 1995).

Baseline descriptive statistics. No differences in baseline demographic, lifestyle and medical history were found across conditions ($p > .05$; see Table 1). Descriptive statistics on the total sample suggest that at baseline participants in general reported moderate levels of knowledge ($M = 16.39$; $SD = 2.93$) and perceived susceptibility and seriousness ($M = 2.63$; $SD = 0.98$; $M = 3.10$; $SD = 0.99$ respectively). The benefits of exercise and calcium intake were more strongly endorsed ($M = 3.82$; $SD = 0.64$; $M = 4.03$; $SD = 0.54$ respectively). Participants perceived low to moderate barriers to calcium intake ($M = 2.00$; $SD = 0.78$) and exercise ($M = 2.76$; $SD = 1.02$), with levels of health

motivation more highly endorsed ($M = 3.78$; $SD = 0.95$). Finally, estimated weekly energy expenditure averaged 3630.09 METs ($SD = 3514.95$). A series of one-way ANOVAs were conducted to determine whether differences existed in health beliefs and HEPA across the three conditions at Baseline. No differences were found ($p > .05$) and effect size estimates were negligible (see Tables 2 and 5).

Main Findings

Do health beliefs predict physical activity? Weak to moderate bivariate correlations were found between measures of the HBM for Baseline, Time 1 and Time 2 with patterns of relationships ranging from ($r_{exercisebenefits.susceptibility}$ and $r_{physicalactivity.calciumbenefits} = .01$ to $r_{exercisebenefits.healthmotivation} = .50$; $r_{exercisebenefits.seriousness}$ and $r_{calciumbenefits.seriousness} = .01$ to $r_{exercisebenefits.calciumbenefits} = .58$; $r_{exercisebenefits.seriousness}$ and $r_{physicalactivity.calciumbenefits} = .00$ to $r_{calciumbeneifts.exercisebenefits} = .60$ respectively across each of the three time points). No changes in the classification of the magnitude of bivariate relationships as advocated by Cohen (1992) were noted over time. Generally consistent patterns of association over time were observed with a positive relationship between perceived susceptibility and perceived seriousness; and a negative relationship between exercise benefits and exercise barriers, calcium benefits and calcium barriers, and knowledge and susceptibility. Relationships between knowledge and seriousness, physical activity and seriousness, and physical activity and susceptibility differed in direction across time (see Tables 6, 7, and 8). Despite differences in direction, the magnitude of the correlation was negligible (Cohen, 1992).

Condition and baseline health beliefs predicting baseline physical activity. A simultaneous multiple regression analysis was conducted to determine the predictive

relationship between condition and baseline health beliefs on baseline HEPA across the entire sample. Twenty-four percent of the variance in HEPA was accounted for by health belief scores and condition (R^2_{adj} = .24; F (9, 161) = 6.49, p = .000; 95% CI = .12 - .35). Two health beliefs accounted for the variance in HEPA, with health motivation serving as a positive predictor (β = .21) and exercise barriers a negative predictor (β = -.33; see Table 9).

Condition and baseline health beliefs predicting time 2 physical activity. The predictive relationship between condition and baseline health beliefs on Time 2 HEPA across the entire sample was examined through simultaneous multiple regression analyses. Nine-percent of the variance in HEPA was accounted for by health belief scores and condition (R^2_{adj} = .09; F (9,168) = 2.94, p = .003; 95% CI = .00 - .13). Exercise benefits was found to be a positive predictor of HEPA (β = .18; see Table 10).

Differences between the cues to action conditions and attention control conditions. A mixed-model ANOVA was conducted to determine whether there were differences in HEPA and health beliefs between conditions over time, as well as to determine the interaction between condition and time. No significant differences were found for HEPA (see Figure 1). One interaction term was statistically meaningful, that for calcium benefits (F (3, 247) = 3.33, p = .02; see Figure 2). Examination of the cell means indicated a decrease in perceived calcium benefits from Baseline (M = 3.98) to Time 1 (M = 3.90) followed by an increase at Time 2 (M = 4.15) for those in the PSA condition. For those in the BS and AC conditions, decreases in perceived calcium benefits were noted following the manipulation (see Tables 2,3,4). As such, beliefs in the benefits of calcium increased over the 4 weeks for those who viewed the "Nutcracker"

PSA while beliefs in the benefits of calcium continue a subtle downward trend for those in the other two conditions.

A within-subjects main effect for seriousness (F (2, 321) = 3.98, p = .02) and knowledge of osteoprotective behaviours (F (1, 169) = 9.93, p = .00) was found. Pairwise comparisons showed that Baseline seriousness was significantly higher (M = 3.10, SD = .99) than Time 1 seriousness (M = 2.95, SD = .99; p = .04). No significant differences were found with Time 2 seriousness. In addition, pairwise comparisons showed that Baseline knowledge was lower (M = 16.39, SD = 2.93) than Time 2 knowledge (M = 16.94, SD = 3.08; p = .002). No other statistical differences emerged (see Table 11).

Post Hoc Analyses

Time 2 demographic, lifestyle and medical history. Following the manipulation, a series of Chi Square analyses were run to determine differences between conditions on osteoporosis specific information seeking behaviours (see Table 12). Those in the PSA condition reported visiting the osteoporosis website more frequently (n_{yes} = 14) than those in the AC (n_{yes} = 3; χ^2 (1) = 8.37, p = .004; phi = .22) and BS conditions (n_{yes} = 2; χ^2 (1) = 11.16, p = .001; phi = .25) over the previous four weeks. Frequency of website visitation was also assessed with differences noted between the PSA condition (n_{once} = 12) and the BS condition (n_{once} = 2; χ^2 (3) = 9.54, p = .02; phi = .23) and the AC condition (n_{once} = 2; χ^2 (2) = 8.72, p = .01; phi = .22). Those in the PSA condition reported more actively seeking information on osteoporosis (n_{yes} = 16) compared to the BS condition (n_{yes} = 6; χ^2 (2) = 7.56, p = .02; phi = .21).

CHAPTER FOUR: DISCUSSION

The present investigation examined the influence of cues to action on health beliefs associated with osteoporosis and HEPA. More specifically, the purpose of the study was to broaden our understanding of the role of an osteoporosis-specific PSA and bone screening on peri- and post-menopausal women who did not self-report a diagnosis of osteoporosis. The PSA was created by Osteoporosis Canada to increase condition awareness, as well as to prompt women to view the Osteoporosis Canada website for more information (Osteoporosis Canada, 2006). Bone screening was conducted at the mid-shaft of the dominant tibia by way of Quantitative Ultrasound. Bone screening is an effective tool for early detection of bone loss and may play an important role in health management (Osteoporosis Canada, 2006). Participants in the above conditions were compared to those in an AC condition on health beliefs and HEPA across a one month period.

Result of regression analyses supported the role of baseline health beliefs at proximal and distal estimates of HEPA. Partial support for the influence of cues to action on health beliefs was found through interpretation of the interaction term for calcium benefits and a within subjects effect for seriousness and knowledge. Changes in HEPA were not observed. Information seeking behaviours increased as a result of the Nutcracker PSA.

Comparison of Study Participants to those of Previous Research

Descriptive statistics on relevant study variables offer valuable information that can be used to 1) position results with reference to empirical literature and 2) frame results of inferential statistics. The present study measured awareness through knowledge

of risk factors with moderate levels reported at baseline and Time 2. Consistent with previous research (Carlsson & Johnson, 2004; Chang et al., 2003; Chang, 2006; Chen, 1992; Doheny et al., 2007; Hsieh et al., 2001), participants in the present study reported moderate levels of perceived seriousness, low-to-moderate levels of perceived susceptibility and more beliefs in the benefits (than barriers) of exercise. Contradictory to previous research (e.g., Change, 2006), participants in the present investigation reported more beliefs in the benefits of calcium than calcium barriers.

The SQUASH is a newly developed instrument to assess HEPA, therefore little is known regarding peri- and post-menopausal women and their HEPA, based on scores derived from this instrument. HEPA can be conceptualized as High (3000 MET minutes of activity per week); Moderate (between 1500 and 2999 MET minutes of activity per week); and Low (less than 1500 MET minutes of activity per week; CFLRI, 2007). According to the above guidelines, 31% of women in the present study reported low activity levels; 21% reported moderate activity levels and; 47% reported high activity levels. This is in direct contrast to population health data which suggests that 20% of Canadian women between the ages of 45 – 64 are highly active (CFLRI, 2007). However, such data have not been collected using the SQUASH and estimates of habitual physical activity data are challenging to assess accurately (Welk, 2002) and can vary according to instrumentation (Mahar & Rowe, 2002).

Health Beliefs and the Prediction of HEPA

Constructs embedded within the HBM are posited to demonstrate a pattern of relationships identified in Appendix A. Consideration of the pattern of relationships in the present investigation generally support those advocated by Rosenstock (1974).

Positive correlations between perceived susceptibility and perceived seriousness; knowledge and benefits of both exercise and calcium and health motivation was found. Negative relationships between exercise benefits and exercise barriers and calcium benefits and calcium barriers was reported. Knowledge demonstrated no relationship with perceptions of seriousness and susceptibility which is inconsistent with tenants of the HBM.

The HBM further posits a number of variables associated with the likelihood of taking preventative action (Becker, 1985; Rosenstock, 1974). Consistent with theoretical predictions, health beliefs associated with osteoporosis predicted greater HEPA with the percent variance accounted for greater with proximal, as opposed to distal measure of HEPA (24% vs. 9% respectively). This finding is not surprising as previous research has noted a stronger association between psychological variables and health behaviour across more proximal than distal temporal periods (Al-Ali & Haddad, 2004; Godin, Gagnon, Lambert, & Conner, 2005). Consideration of the meaningfulness of the individual predictors on HEPA were supported by existing research as health motivation (Ali-Ali & Haddad, 2004; Mirotznik et al., 2005) and exercise benefits and barriers (Ali-Ali & Haddad, 2004; Ali & Twibell, 1995; Dishman & Steinhardt, 1990; Godin et al., 1991; Hofstetter et al., 1991; Horne, 1995; Polly, 1992; Robertson & Keller 1992; Woodridge et al., 1992) have been reported. Further, the direction of predictor variables on HEPA was generally consistent with patterns of influence supported by the HBM (Rosenstock, 1974).

The Influence of Cues to Action on Health Beliefs and HEPA

Health beliefs are of particular importance for individuals in relation to osteoporosis (Doheny et al., 2007) and are advocated as being integral aspects of health promotion (Rosenstock, 1974). Consideration of baseline data on HBM variables demonstrated no differences between conditions prior to the cues to action manipulation. Hypothesized differences between the cues to action conditions (PSA and BS) received only limited support. Results supported a condition x time interaction for calcium benefits. On average, participants regardless of condition reported decreased perceived calcium benefits immediately following the manipulation (Time 1); however, those in the PSA condition reported an increase in calcium benefits at Time 2 while the BS and AC conditions continued a decrease at Time 2. To place this finding in light of existing literature, Tussing and Chapman-Novakofski (2005) reported increased perceptions of the benefits of calcium immediately after the introduction of a cue to action (i.e., educational osteoporosis prevention program).

Across test administrations, knowledge of osteo-protective behaviours increased for those assigned to the PSA or BS conditions. Previous literature (e.g., Anastasopoulou et al., 2002; Curry & Hogstel, 2001; Law & Shapiro Pharm 2005; Ribeiro & Blakeley, 2001) has demonstrated increased knowledge following cues to action. Specific cues to action including televised communications (Juby & Davis, 2001; Matthews et al., 2006) and medical screening (Anastasopoulou & Rude, 2002; Law & Shapiro Pharm, 2005; Naunton et al., 2006), reported increased knowledge. Increased knowledge, however, was not limited to those in the osteoporosis specific cues to action conditions as those in the attention control condition also reported an increase. Although speculative, it may be that

volunteering to participate in this study and completing questionnaires on health beliefs associated with the condition may have served as a cue itself. Further support for the above may be documented as 21% of women in the PSA condition reported actively seeking more osteoporosis information after the manipulation.

Across all conditions, perceived seriousness was higher at Baseline than at Time 1, with this trend reversing at Time 2, to values more consistent (albeit lower) with the Baseline test administration. Regression-to-the-mean (a statistical phenomenon where the measures on the average regress toward the population mean on average; Cook & Campbell, 1979) may explain this finding. The net effect of regression toward the mean is that the higher scores on the pre-test tend to be lower on the post-test and the lower scores on the pre-test tend to be higher on the post-test (Cook & Campbell, 1979) but essentially there is no change that takes place due to the treatment with the dependent variable of interest. This finding is divergent from that reported in other literature as increased perceptions of seriousness following multi-component cues to action interventions (i.e., medical screening and education) have been found (Chang, 2006; Cline, 2005; Unson et al., 2005). Differences in the cues to action intervention are noted between these citations and the present investigation and include: individual feedback; the individualized tailoring of the educational component; the duration of the cues to action intervention and; the absence of research considering PSAs on health beliefs associated with osteoporosis.

The OHBS assesses perceptions of perceived seriousness of condition diagnosis. Regardless of condition assignment, moderate levels of perceived seriousness were reported. However, consideration of participants' demographic, medical, and lifestyle

history is suggestive that they were generally healthy. The sample represented a highly active, lower risk group of peri- and post-menopausal women. Consequently, participants may have perceived themselves to be less at risk, and consequently, the condition less serious. The above explanation may further be applied to other outcome variables (i.e., health beliefs) of interest. For example, participants reported low barriers to exercise and calcium intake and already quite highly endorsed the benefits of exercise and calcium intake which may result in a ceiling effect.

Cues to action and HEPA

The influence of cues to action on HEPA as a health behaviour to prevent, or delay, the onset of osteoporosis (USDHHS, 2005) was investigated. Contrary to that hypothesized, differences were not found for HEPA across the one month period between conditions. Previous research has been inconsistent in its findings specific to the role of osteoporosis specific cues to action on physical activity with some demonstrating increases (Cerulli & Zeolla, 2004; Naunton et al., 2006; Renger, Steinfelt, & Lasarus, 2002; Rohr et al., 2005) and others not (Blalock et al., 2002; Cram et al., 2006).

In an effort to interpret the lack of behavioural change, consideration of the level of self-reported HEPA is warranted. Participants in the present study, regardless of condition, reported high levels of HEPA (47% classified as highly active) in comparison to age and gender matched controls (CFLRI, 2007). Consequently, many participants were already actively engaged in physical activity at a level consistent with promoting bone health. A decrease in mean physical activity was seen in the PSA ($M_{Baseline}$ = 4239.15; M_{Time2} = 3995.76) condition post-intervention; however, extreme HEPA levels that were present at baseline (i.e., 5.3 % fell between 11090 and 23808 METs) in the PSA

condition disappeared at Time 2 (i.e., highest MET score was 10833) and could be a result of regression-to-the-mean (Cook & Campbell, 1979). A small increase in HEPA at Time 2 was found for the BS and AC conditions. Consideration of descriptive statistics for the three conditions are indicative of not only high levels of HEPA (as indicated by mean scores) but considerable dispersion around cell means. As such, between group differences (or differences in change scores) may be obfuscated by high levels of dispersion in the distribution of scores (Pedhazer, 1982). Previous research by Cerulli and Zeolla (2004) and Naunton et al. (2006) supported an increase in physical activity as a result of bone screening. Finally it is important to note that no cue to action condition (e.g., PSA or BS) was specifically intended to increase HEPA.

Cues to action and Information Seeking Behaviour

In addition to increasing condition awareness, Osteoporosis Canada created the 'Nutcracker' PSA to prompt women to view the website for more information (Osteoporosis Canada, 2007). Based on the present investigation, this objective was achieved as participants in the PSA condition reported actively seeking more osteoporosis related information than those in the BS and AC conditions. This is consistent with research by Anastasopoulou and Rude (2002) who reported that 63% of the participants in their study indicated that they had sought additional information in the form of medical consultation following a cue to action intervention.

Practical Implications

The importance of this study stemmed from theoretical, design, sampling, and measurement considerations which extended the existing empirical knowledge base. First, this study focused on better understanding cues to action as a HBM construct which

previous research on health beliefs associated with osteoporosis has generally ignored (Carlsson et al., 2004; Chang et al., 2003; Chang, 2006; Chen, 1992; Hsieh et al., 2002; Li et al., 2001; Lin et al., 2003). The present investigation employed a randomized experimental design that measured changes in health beliefs and behaviour across a relatively short duration (i.e., one month). The use of this design extends existing research, the bulk of which is cross-sectional or assesses change immediately following an intervention only (Anderson et al., 2004; Kasper et al., 2001; Sedlak, 2000; Taggart & Connor, 1995; Wallace, 2002). Further, random assignment to conditions affords greater control over threats to internal validity than cross-sectional or quasi-experimental designs (Cook & Campbell, 1979).

The present investigation targeted peri- and post menopausal women between the ages of 45 – 60 years who did not self-report having osteoporosis. This sample is under-represented in existing research, yet is an important epoch for the development of osteoporosis (USDHHS, 2005). Understanding bone health is important across the peri and post-menopausal transition as it is during this time when a rapid decrease in estrogen is noted which results in an increased susceptibility to osteoporosis (USDHHS, 2005). Research examining health beliefs associated with osteoporosis has typically targeted the younger adult population (Gasparotto et al., 2006; Kasper et al., 2001; Piaseu et al., 2002; Taggart & Connor, 1995; Ziccardi et al., 2004) or those over sixty years (Curry & Hogstel, 2001; Juby & Davis, 2001).

The measurement of physical activity following an osteoporosis health belief intervention is not novel (e.g., Cerulli & Zeolla, 2004; Naunton et al., 2006) however physical activity has typically been defined as structured exercise (e.g., Brecher et al.,

2002; Sedlak et al., 2000) which differs from HEPA (CDC, 2007). The present study adds to existing literature as its focus was on HEPA which has been advocated to confer positive health changes (Bouchard et al., 2007) and may better reflect physical activity in all its forms than to structured exercise. Finally, this study aimed to investigate the influence of two cues to action on health beliefs and HEPA to determine their relative influence as opposed to the combined influence of a multi-component intervention (Anastasopoulou & Rude, 2002; Law & Shapiro Pharm, 2005; Naunton et al., 2006).

The results of this study have demonstrated that, for the population sampled, cues to action warrant consideration as a mechanism through which health beliefs may be altered. Viewing the PSA was linked with increased beliefs in the benefits of calcium in an active sample of peri- and post-menopausal women. Additionally, PSAs and bone screenings as cues to action resulted in an increased knowledge of osteoporosis risk factors and a decrease in seriousness, however, this was also the case for the AC condition. Finally, the Osteoporosis Nutcracker PSA was successful in prompting women to actively seek more information (i.e., visiting the Osteoporosis Canada website). The importance of cues to action in the present study provides insight into an understudied component of the HBM.

The influence of health beliefs on HEPA offers insight into potential interventions targeting HEPA as a preventative health behaviour for osteoporosis. Health professionals may want to consider developing preventative education interventions that focus on 1) identifying barriers to exercise and then determining how to decrease those barriers and 2) on the importance of being motivated toward the prevention of health related concerns.

Finally, the lack of significant differences in HEPA as a result of the cues to action suggest that, for an already active non-osteoporotic group of peri- and post-menopausal women, cues to action were not successful in changing HEPA. More specifically, a 15 second PSA that did not target physical activity as an outcome and a bone screening that did not provide individual feedback were not successful in changing HEPA. As a result, health professionals may want to consider the importance of developing preventative cues to action that target an outcome (i.e., physical activity as a preventative measure) directed toward a specific audience (i.e., inactive at risk population). In addition, individual feedback following a bone screening may have an influence on HEPA as this has been seen in previous literature (Cerulli & Zeolla, 2004; Naunton et al., 2006; Rohr et al., 2005).

Consideration of effect sizes as a compliment to null hypothesis significance testing further permits comparison of findings not subject to variation from the influence of sample size (Kline, 2005). The effects of cues to action on health beliefs and health behaviours noted were somewhat lower than those reported in other health communication campaigns (Synder & Hamilton, 2002). Although the reported effects in the present investigation are negligible to weak (Cohen, 1992), further investigation into their relative meaningfulness is relevant when considering the challenge of changing physical activity behaviour at the population level. One strategy for demonstrating important effects involve showing that even a minimal manipulation influences the dependent variable (Prentice & Miller, 1992). As such, effects (albeit weak) were noted following a brief cue to action intervention with no follow-up or individualized feedback.

Study Limitations

Several limitations that may have influenced study findings should be recognized and noted. One limitation may be diffusion of treatment (Trochim, 2001) and occurs when a comparison group learns about the manipulation from a participant in another group (Cook & Campbell, 1979). This threat to internal validity could equalize the outcome between the groups, consequently causing it to be harder to determine if the manipulation is effective (Cook & Campbell, 1979). Although participants were asked to refrain from discussing the study with other participants, information regarding the PSAs and the bone screening could have been discussed which may have influenced study findings.

Consideration of measurement properties may be interpreted as another limitation. First, the SQUASH was a relatively new instrument assessing HEPA and although the reproducibility and relative validity of SQUASH scores on a sample of males and females (M_{age} = 44) has been documented (Wendel-Vos et al., 2003); only 30% were female. Furthermore test scores derived from the SQUASH have been marked as reasonable and acceptable in a sedentary population (Wendel-Vos et al., 2003), however test score interpretation for an active sample (as is the case in the present study) is unknown.

Self-report instruments to assess physical activity behaviour are a common assessment tool. However certain limitations have been noted including: item misinterpretation; recall bias; or deliberate misrepresentation of information (Welk, 2002). Despite limitations, self-report techniques are endorsed as acceptable methods of assessing physical activity behaviour (Welk, 2002).

A primary concern for researchers employing survey methods is the extent to which the content of each item of the scale matches the content domain intended to be measured by the item (Dunn, Bouffard, & Rogers, 1999; Penfield & Giacobbi, 2004). Typically identified as item-content relevance, this step is essential to ensure the meaningfulness of inferences derived from test scores. Horan et al. (1991) documented preliminary support for the content validity of the OHBS in a sample of women over the age of 60. However, use of the advocated test statistics (Aiken, 1980) or the test score confidence interval was not documented (Kim et al. 1991). Further, the content relevance of items on each subscale of the OHBS has not been examined to document the extent to which these items fully encapsulate the intended construct of interest.

Messick (1995) suggests that construct validation is an ongoing process requiring evidence from multiple sources. Consequently, consideration of the structural validity of scores derived from the OHBS in the present sample was examined through confirmatory factor analytic procedures. The a priori specified measurement model was found to be untenable. The removal of the two most troubling items for each subscale (as defined by factor loadings and modification indices) resulted in an adequate fit. Future research may want to further investigate the structural validity of the OHBS scores.

Internal consistency reliability coefficients were consistently lower for calcium and exercise benefits across the three time periods and were low for calcium and exercise barriers at Time 2. Although there is no sacred level of determining acceptable vs. unacceptable reliability (Schmitt, 1996), caution is warranted in interpreting test scores based on low reliability coefficients given their insidious effects on validity of score

interpretations (Messick, 1995) and notoriety for confounding the results of subsequent null-hypothesis testing approaches to inquiry.

The power of the selected cues to action may have been a limitation. The success of media campaigns has varied and the effectiveness is difficult to measure (Hornik, 2002). The Nutcracker PSA selected for use was 15 seconds in duration. Cues to action research resulting in behaviour change have included manipulations that are longer in duration (Bauman et al., 2001; Fishbein et al., 2002; Renger et al., 2002). However, given that the PSA was designed to increase awareness (in this study measured as knowledge) and encourage people to visit Osteoporosis Canada's website, it can be argued that this PSA was effective in altering knowledge as a belief and information seeking as a behaviour. Other health beliefs and behavioural outcomes (e.g., HEPA) were not the message that was framed in the selected PSA. Messages targeting outcome expectancies (i.e., beliefs about consequences of performing the behaviour), normative beliefs and self-efficacy beliefs have produced behavioural change (Fishbein, Guenther-Grey, & Johnson, 1997; Kamb, Fishbein, & Douglas, 1998; Jemmot, Jemmot, & Fong, 1998; 1999). No feedback was offered after the bone screening which could have potentially reduced its influence as a cue to action. Previous research that has documented increases in knowledge, beliefs and behaviours (e.g., exercise, calcium intake, HRT, initiating medical consultation/treatment, etc.) as a result of a bone screening have provided participants with their individual results (Anastasopoulou & Rude, 2002; Law & Shapiro Pharm, 2005; Naunton et al., 2006; Rohr, Clements & Sarkar, 2006).

Finally, a limitation of the study was that the participants were not representative of the majority of the population for whom the PSA intended given that they were highly

motivated, highly active, responded to a study ad that included the words "bone health", "osteoporosis", and "bone scan" which suggests that they were interested in this topic.

Future Directions

Health educators may want to further consider the use of various PSAs when designing preventative interventions and an understanding of peri- and post-menopausal health beliefs and HEPA may be useful when designing appropriate public health education programs that target this meaningful transition period for bone health. Further attention to duration of the PSA, intensity of the message, specifically targeting behavioural outcomes (i.e., increase in physical activity) or preventative measures may be of benefit to health educators in assessing the impact of health promotion cues to action. The PSAs may be one mechanism to encourage information seeking behaviour that targets a population as opposed to a more individualistic approach (e.g., bone scans). However, health educators may want to investigate bone scans as an intervention that may allow for more tailored and individualized information regarding osteoporosis and its preventive behaviours.

The present investigation examined only one important osteo-protective behaviour, (i.e., HEPA) and the program of prediction is only as useful as the assessment of the dependent variable of interest (Pedhazur & Pedhazur Schmelkin, 1991). Future studies may consider examining the role of calcium and vitamin D intake, smoking, alcohol use, and caffeine intake as they are controllable risk factors that play an important role in the prevention of osteoporosis (USDHHS, 2005). Insight as to whether the PSA would influence other behaviours linked with promoting bone health would be beneficial for health educators.

The women in the present study were Caucasian, generally healthy (as suggested by estimates of body mass index and the absence of condition diagnosis) and physically active. The Osteoporosis Canada Nutcracker PSA is a nation wide campaign and targets all of Canada's multi-cultural female population as it is bilingual. Future research may want to consider messages that target specific cultural groups as messages which target specific ethnic populations have been shown to be more effective in promoting health behaviour (Andersen, Franchowiak, Zuzak, Cummings, Bartlett, & Crespo, 2006). Additionally, future researchers may want to consider education level and social economic status of participants. Insight into the influence of the Nutcracker PSA on knowledge and health beliefs of osteoporotics may be of use when determining if this national wide PSA is suited to the general Canadian female population. Osteoporosis results in physical and psychological costs for males as one in eight men over the age of 50 years will suffer from osteoporosis and the effects of osteoporosis are not confined to those with the condition (Osteoporosis Canada, 2006). Future research is warranted to investigate the influence of PSAs on health beliefs and behaviours of males.

Finally, the psychometric properties of the OHBS (Kim et al., 1991) should be re-visited prior to future investigation with peri- and post-menopausal women as concerns over the factor structure were raised. Additionally, concerns were also raised around the psychometric properties of the OHBS with female young adults (Mack, Gasparotto, DiGiovanni, Klentrou, & Gammage, 2006); therefore, this should be a consideration in future research with other populations. Careful attention to issues of content validity (Dunn et al., 1999) and structural validity (Messick, 1995) seem to be the primary areas warranting increased focus.

Conclusion

In conclusion, this was the first study to examine the influence of cues to action (i.e., an osteoporosis PSA and bone screening) on health beliefs related to osteoporosis and osteoprotective behaviours (i.e., HEPA) in a sample of peri- and post-menopausal women. Results of the present investigation suggest that health beliefs associated with osteoporosis predict HEPA, but that the influence of condition specific cues to action are minimal across the test administration periods. The Nutcracker PSA was successful in prompting women to visit the Osteoporosis Canada Website for more information which is what it intended to do. Additionally, women actively sought out more osteoporosis information following viewing the Nutcracker PSA. Financial, personal and social costs associated with condition diagnosis are high and are expected to increase. Consequently the need for population health prevention measures is warranted. Further consideration into the role of cues to action on associated health beliefs and a variety of osteo-protective behaviours can provide insight for developing strategies to reduce the onset of osteoporosis.

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Tables

Table 1

Baseline Demographic, Medical, and Lifestyle Descriptive Statistics

	Condition											
	PSA (n = 57)				BS (n = 60)				AC (n = 57)			
Variable	*M*	*SD*	Skew.	Kurt.	*M*	*SD*	Skew.	Kurt.	*M*	*SD*	Skew.	Kurt.
Age	50.68	3.62	.23	-.55	51.50	4.64	.45	-.72	50.02	3.86	.83	.27
Height (inches)	64.14	3.10	-.89	3.07	65.03	3.07	-.53	1.82	64.47	3.54	-.84	2.12
Weight (lbs)	156.77	37.38	1.10	1.35	152.63	28.78	.70	.29	156.05	28.90	.75	1.06
	%				%				%			
Fracture	29.80 (n = 17)				40.00 (n = 24)				26.30 (n = 15)			
Family History of Osteoporosis	42.10 (n = 24)				31.70 (n = 19)				29.80 (n = 17)			
Medical Check up in the past year	68.40 (n = 39)				71.70 (n = 43)				68.40 (n = 39)			
Hormone Replacement Therapy	8.80 (n = 5)				10.00 (n = 6)				8.80 (n = 5)			
Calcium Supplementation	29.80 (n = 17)				43.30 (n = 26)				40.40 (n = 23)			

Note. Skew = Skewness; Kurt = Kurtosis; % = Percent reporting yes.

Table 2

Baseline Study Variable Descriptive Statistics

		Condition														
		PSA ($n = 57$)					BS ($n = 60$)					AC ($n = 57$)				
Variable	ω^2	*M*	*SD*	Skew.	Kurt.	α	*M*	*SD*	Skew.	Kurt.	α	*M*	*SD*	Skew.	Kurt.	α
Knowledge	.01	16.58	3.29	-.35	-.42	.73	16.31	2.94	-.40	.71	.67	16.28	2.55	-.47	-.35	.65
Susceptibility	.00	2.78	1.03	.32	-.53	.90	2.49	.97	.61	.08	.90	2.61	.95	.82	.15	.90
Seriousness	.00	3.05	1.07	-.28	-.95	.80	3.01	.98	.01	-.69	.80	3.25	.01	-.58	-.49	.80
Calcium Benefits	.01	3.98	.56	-.14	.49	.53	4.09	.55	.17	-.02	.53	4.01	.51	.31	-.15	.53
Calcium Barriers	.00	1.89	.75	.60	-.49	.75	1.98	.75	.60	-.23	.75	2.14	.82	.73	-.04	.75
Exercise Benefits	.01	3.95	.64	.37	-.68	.56	3.82	.61	-.06	-.21	.56	3.70	.64	-.31	.39	.56
Exercise Barriers	.01	2.68	1.04	.26	-.63	.77	2.72	.94	.36	-.33	.77	2.90	1.10	-.26	-.87	.77
Health Motivation	.01	3.77	.94	-.93	.48	.82	3.83	1.07	-.72	-.53	.82	3.74	.84	-.31	-.53	.82

Note. Skew. = Skewness; Kurt. = Kurtosis; α = Cronbach's Coefficient α; ω^2 = Omega squared.

Table 3

Time 1 Study Variable Descriptive Statistics

	Condition															
		PSA (n = 57)					BS (n = 60)					AC (n = 57)				
Variable	ω^2	*M*	*SD*	Skew.	Kurt.	α	*M*	*SD*	Skew	Kurt	α	*M*	*SD*	Skew	Kurt.	α
Susceptibility	.03	2.82	1.04	.35	-.30	.93	2.32	.90	.93	1.02	.93	2.58	.95	.73	.14	.93
Seriousness	.00	3.06	1.03	-.39	-.76	.82	2.84	1.05	.27	-.82	.82	2.94	.90	-.36	-.87	.82
Calcium Benefits	.01	3.89	.62	.09	.10	.68	4.08	.46	.55	.41	.68	3.98	.52	.24	.24	.68
Calcium Barriers	.00	1.84	.68	.97	.86	.77	1.96	.74	.70	.25	.77	2.05	.79	.68	.02	.77
Exercise Benefits	.00	3.87	.60	.39	.03	.52	4.00	.52	.24	.05	.52	3.84	.59	-.48	.31	.52
Exercise Barriers	.00	2.56	1.06	.43	-.65	.79	2.73	.90	.30	-.39	.79	2.87	1.02	-.22	-.95	.79
Health Motivation	.01	3.87	.92	-.87	.64	.81	3.86	1.01	-.80	-.26	.81	3.73	.73	-.28	-.38	.81

Note. Skew. = Skewness; Kurt. = Kurtosis; α = Cronbach's Coefficient α; ω^2 = Omega squared.

Table 4

Time 2 Study Variable Descriptive Statistics

		Condition														
		PSA ($n = 57$)					BS ($n = 60$)					AC ($n = 57$)				
Variable	Ω^2	*M*	*SD*	Skew.	Kurt.	α	*M*	*SD*	Skew.	Kurt.	α	*M*	*SD*	Skew.	Kurt.	α
Knowledge	.01	17.11	3.17	-.10	-.49	.72	16.68	3.27	-.66	.25	.67	17.05	2.82	-.32	-.21	.65
Susceptibility	.00	2.62	1.01	.21	-.59	.92	2.40	.94	.75	.31	.92	2.54	.92	.62	.18	.92
Seriousness	.00	3.08	1.03	-.51	-.68	.83	2.85	1.12	.16	-.79	.83	3.00	.93	.08	-.31	.83
Calcium Benefits	.01	4.15	.55	.21	-.95	.76	3.90	.89	-1.59	3.67	.76	3.94	.66	-1.42	.39	.76
Calcium Barriers	.00	1.90	.69	.45	-.25	.70	1.98	.77	.87	1.25	.70	2.07	.71	.83	-.01	.70
Exercise Benefits	.01	3.96	.66	-.21	.39	.68	3.83	.83	-1.23	3.22	.68	3.69	.65	-.99	1.23	.68
Exercise Barriers	.01	2.80	2.04	5.67	38.63	.38	2.67	.94	.17	-.38	.38	2.88	.83	.17	-.33	.38
Health Motivation	.00	3.84	.96	-.62	-.32	.85	3.86	.91	-1.04	1.05	.85	3.70	.90	-1.07	1.05	.85

Note. Skew = Skewness; Kurt = Kurtosis; α = Cronbach's Coefficient α; ω^2 = Omega squared.

Table 5

Baseline and Time 2 Physical Activity Descriptive Statistics

		Condition											
		PSA (n = 57)				BS (n = 60)				AC (n.= 57)			
Variable	Ω^2	*M*	*SD*	Skew.	Kurt.	*M*	*SD*	Skew.	Kurt.	*M*	*SD*	Skew.	Kurt.
Physical Activity Baseline	.00	4239.15	4259.41	2.54	8.49	3509.41	2614.10	1.22	1.41	3148.07	3492.25	3.32	15.24
Physical Activity Time 2	.01	3995.76	2967.74	.98	.22	3843.55	3286.49	1.55	3.18	4056.08	3322.55	1.53	2.75

Note. Skew = Skewness; Kurt = Kurtosis; ω^2 = Omega squared.
M Physical Activity Scores reflect estimates of energy expenditure expressed in MET minutes/week

Table 6

Pearson Bivariate Correlations between Study Variables at Baseline

Construct	1	2	3	4	5	6	7	8	9
1. Seriousness	--								
2. Susceptibility	.11 (.00 - .24)	--							
3. Exercise Benefits	-.07 (-.22 - .00)	.01 (.00 - .14)	--						
4. Exercise Barriers	.37 (.22 - .49)	.21 (.00 - .35)	-.08 (-.28 - .00)	--					
5. Calcium Benefits	.09 (.00 - .24)	-.04 (-.17 - .00)	.53 (.41 - .62)	.02 (.00 - .14)	--				
6. Calcium Barriers	.31 (.17 - .44)	.25 (.10 - .39)	-.14 (-.28 - .00)	.36 (.22 - .48)	-.14 (-.28 - .00)	--			
7. Health Motivation	-.30 (-.42 - .14)	-.25 (-.39 - .10)	.13 (.00 - .26)	-.55 (-.65 - -.44)	.14 (.00 - .28)	-.39 (-.51 - -.26)	--		
8. Knowledge	-.02 (-.14 - .00)	-.05 (-.20 - .00)	.27 (.14 - .40)	-.07 (-.22 - .00)	.32 (.17 - .45)	-.14 (-.28 - .00)	.30 (.14 - .42)	--	
9. Physical Activity	-.18 (-.32 - .00)	.14 (.00 - .28)	.17 (.00 - .32)	-.35 (-.47 - -.20)	.01 (.00 - .14)	-.10 (-.24 - .00)	.26 (.10 - .39)	.15 (.00 - .28)	--

Note. All *r*'s greater than |.13| significant at $p < .05$ (one-tailed); ( ) = 95% Confidence Intervals.

Table 7

Pearson Bivariate Correlations between Study Variables at Time 1

Construct	1	2	3	4	5	6	7
1. Seriousness	--						
2. Susceptibility	.12 (.00 - .26)	--					
3. Exercise Benefits	.01 (.00 - .14)	-.11 (-.24 - .00)	--				
4. Exercise Barriers	.28 (.14 - .41)	.19 (.00 - .33)	-.05 (-.20 - .00)	--			
5. Calcium Benefits	-.01 (-.14 - .00)	-.24 (-.37 - -.10)	.58 (.47 - .67)	-.09 (-.24 - .00)	--		
6. Calcium Barriers	.18 (.00 - .32)	.19 (.00 - .33)	-.15 (-.28 - .00)	-.48 (-.58 - -.36)	-.19 (-.33 - .00)	--	
7. Health Motivation	-.27 (-.40 - -.14)	-.24 (-.37 - -.10)	.16 (.00 - .30)	-.55 (-.65 - -.44)	.25 (.10 - .39)	-.48 (-.58 - -.36)	--

Note. All r's greater than $|.13|$ significant at $p < .05$ (one-tailed); ( ) = 95% Confidence Intervals.

Table 8

Pearson Bivariate Correlations between Study Variables at Time 2

Construct	1	2	3	4	5	6	7	8	9
1. Seriousness	--								
2. Susceptibility	.21 (.00 - .35)	--							
3. Exercise Benefits	.00 (.00 - .24)	.01 (.00 - .27)	--						
4. Exercise Barriers	.28 (.14 - .41)	.18 (.00 - .32)	-.11 (-.24 - .00)	--					
5. Calcium Benefits	.04 (.00 - .17)	-.11 (-.24 - .00)	.60 (.49 - .69)	-.10 (-.24 - .00)	--				
6. Calcium Barriers	.36 (.22 - .48)	.19 (.00 - .33)	-.07 (-.22 - .00)	.17 (.00 - .32)	-.01 (-.14 - .00)	--			
7. Health Motivation	-.26 (-.39 - .10)	-.11 (-.24 - .00)	.20 (.00 - .33)	-.33 (.20 - .46)	.11 (.00 - .24)	-.38	--		
8. Knowledge	.08 (.00 - .22)	-.04 (.00 - .17)	.13 (.00 - .26)	-.02 (-.14 - .00)	.11 (.00 - .24)	-.05 (-.20 - .00)	.18 (.00 - .32)	--	
9. Physical Activity	-.12 (-.26 - .00)	-.01 (-.14 - .00)	.00 (.00 - .24)	-.26 (-.39 - .10)	.03 (.00 - .17)	.03 (.00 - .17)	.27 (.14 - .40)	.03 (.00 - .17)	--

Note. All *r*'s greater than |.13| significant at $p < .05$ (one-tailed); ( ) = 95% Confidence Intervals.

Table 9

Baseline health beliefs predicting baseline physical activity

Variable	*B*	*SE B*	ß	95% CI
Condition	-286.96	195.70	-.11	-673.60 - 99.69
Susceptibility	140.326	169.77	.06	-195.08 - 475.74
Calcium Barriers	-110.84	226.27	-.04	-557.88 - 336.19
Calcium Benefits	-111.62	355.31	-.03	-813.61 - 590.36
Exercise Benefits	164.74	299.50	.05	-426.98 - 756.45
Seriousness	-130.89	177.72	-.06	-482.00 - 220.23
Health Motivation	494.28	215.60	.21*	68.32 - 920.24
Exercise Barriers	-717.03	190.05	-.33*	-1092.52 - -341.54
Total Knowledge	18.41	58.05	.02	-96.28 - 133.09

Note: $*p < .05$, 95% CI = 95% Confidence Intervals

Table 10

Baseline health beliefs predicting Time 2 physical activity

Variable	*B*	*SE B*	ß	95% CI
Condition	-24.37	253.06	-.01	-524.16 - 475.42
Susceptibility	296.54	214.22	.11	-126.54 - 719.63
Calcium Barriers	345.42	295.43	.10	-238.05 - 928.89
Calcium Benefits	284.47	452.23	.06	-608.69 - 1177.63
Exercise Benefits	789.89	378.91	.18*	41.54 - 1538.24
Seriousness	-63.93	226.30	-.02	-510.88 - 383.01
Health Motivation	517.41	281.29	.18	-38.14 - 1072.97
Exercise Barriers	-481.50	249.20	-.18	-973.67 - 10.68
Total Knowledge	-2.77	69.66	-.00	-140.35 - 134.81

Note: $^*p < .05$, 95% CI = 95% Confidence Intervals for *B*

Table 11

Analysis of Variance, Means and Standard Deviation at Four Weeks (T2) for Study Variables

		Baseline		Time 1		Time 2			ANOVA	
		M	*SD*	*M*	*SD*	*M*	*SD*		*F*	*p*
Seriousness	PSA	3.05	1.07	3.06	1.03	3.08	1.03	Time:	3.98	.02
	BS	3.10	.98	2.84	1.05	2.85	1.12	Condition:	.65	.53
	AC	3.25	.01	2.94	.90	3.00	.93	Interaction:	1.56	.19
Susceptibility	PSA	2.78	1.03	2.82	1.04	2.62	1.01	Time:	2.49	.09
	BS	2.49	.97	2.32	.90	2.40	.94	Condition:	2.06	.13
	AC	2.61	.95	2.58	.95	2.54	.92	Interaction:	1.53	.20
Calcium Benefits	PSA	3.98	.56	3.89	.62	4.15	.55	Time:	.37	.62
	BS	4.09	.55	4.08	.46	3.90	.89	Condition:	.18	.84
	AC	4.01	.51	3.98	.52	3.94	.66	Interaction:	3.33	.02
Calcium Barriers	PSA	1.89	.75	1.84	.68	1.90	.69	Time:	.96	.37
	BS	1.98	.75	1.96	.74	1.98	.77	Condition:	1.54	.22

	AC	2.14	.82	2.05	.79	2.07	.71	Interaction:	.15	.95
Exercise Benefits	PSA	3.95	.64	3.87	.60	3.96	.66	Time:	1.44	.24
	BS	3.82	.61	4.00	.52	3.83	.83	Condition:	1.99	.14
	AC	3.70	.64	3.84	.59	3.69	.65	Interaction:	1.70	.17
Exercise Barriers	PSA	2.68	1.04	2.56	1.06	2.80	2.04	Time:	.57	.54
	BS	2.72	.94	2.73	.90	2.67	.94	Condition:	1.63	.20
	AC	2.90	1.10	2.87	1.02	2.88	.83	Interaction:	.31	.85
Health Motivation	PSA	3.77	.94	3.87	.92	3.84	.96	Time:	.27	.66
	BS	3.83	1.07	3.86	1.01	3.86	.91	Condition:	.40	.67
	AC	3.74	.84	3.73	.73	3.70	.90	Interaction:	.22	.86
Knowledge	PSA	16.58	3.29	--	--	17.11	3.17	Time:	9.93	.00
	BS	16.31	2.94	--	--	16.68	3.27	Condition:	.28	.76
	AC	16.28	2.55	--	--	17.05	2.82	Interaction:	.31	.74
Physical Activity	PSA	4239.15	4259.41	--	--	3995.76	2967.74	Time:	2.97	.09
	BS	3509.41	2614.10	--	--	3509.41	2614.10	Condition:	.46	.63

	AC	3148.07	3492.25	--	--	3148.07	3492.25	Interaction:	.23	.80

Note. PSA = PSA Condition; BS = Bone Screening Condition; AC = Attention Control Condition.

Table 12

Time 2 Demographic, Lifestyle, and Medical Descriptive Statistics

	Condition		
	PSA	BS	AC
	% ($n = 57$)	% ($n = 60$)	% ($n = 57$)
Have visited the osteoporosis website	24.60 ($n = 14$) [a,b]	3.30 ($n = 2$)	5.30 ($n = 3$)
Have visited at least once	21.10 ($n = 12$) [a,b]	3.30 ($n = 2$)	3.50 ($n = 2$)
Have activity sought information	28.10 ($n = 16$)	10.00 ($n = 6$) [b]	21.10 ($n = 12$)
Physician has spoken about osteoporosis	45.60 ($n = 26$) [a]	31.70 ($n = 19$)	22.80 ($n = 13$)
Have viewed the PSA prior to study	1.80 ($n = 1$)	0 ($n = 0$) [b,c]	7.00 ($n = 4$)
Currently take Hormone Replacement Therapy	8.80 ($n = 5$)	8.30 ($n = 5$)	8.80 ($n = 5$)
Currently take calcium supplement	36.80 ($n = 21$)	51.70 ($n = 31$)	45.60 ($n = 26$)

Note: % = Percent reporting yes,
Significant differences between a: PSA and AC.
Significant differences between b: PSA and BS.
Significant differences between c: BS and AC.

Figure Caption

Figure 1. Non-significant differences in HEPA between conditions and over time.

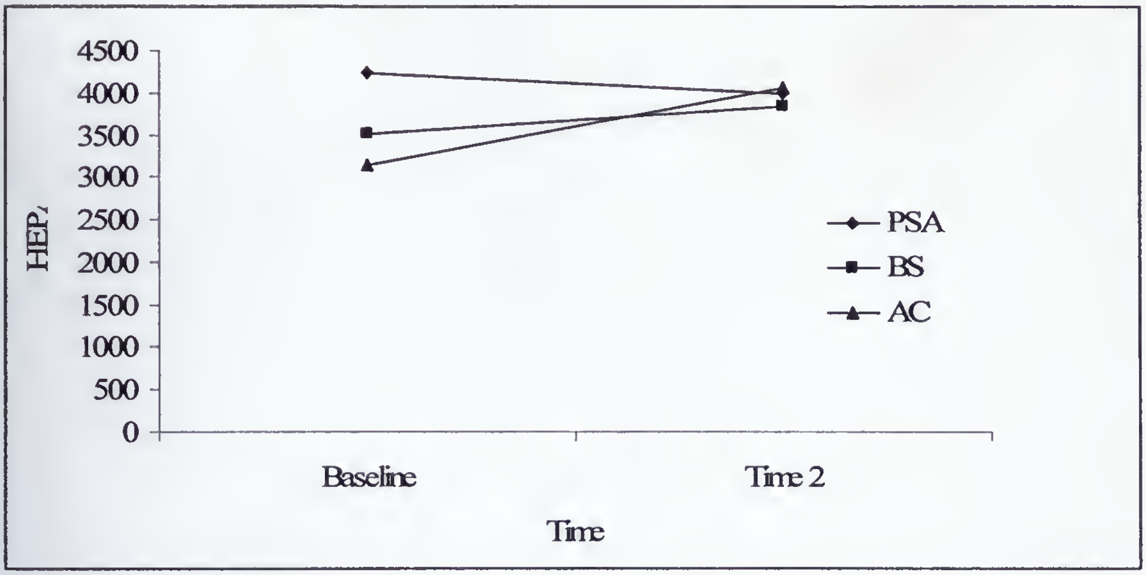
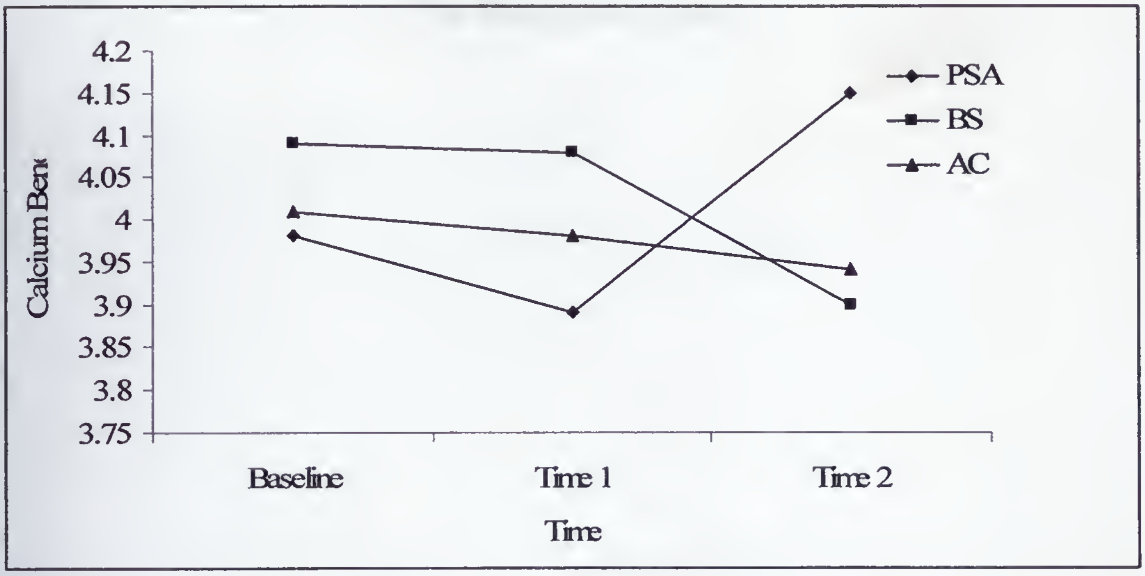

4500
4000
3500
3000
2500
2000
1500
1000
500
0
HEP
PSA
BS
AC
Baseline
Time 2
Time

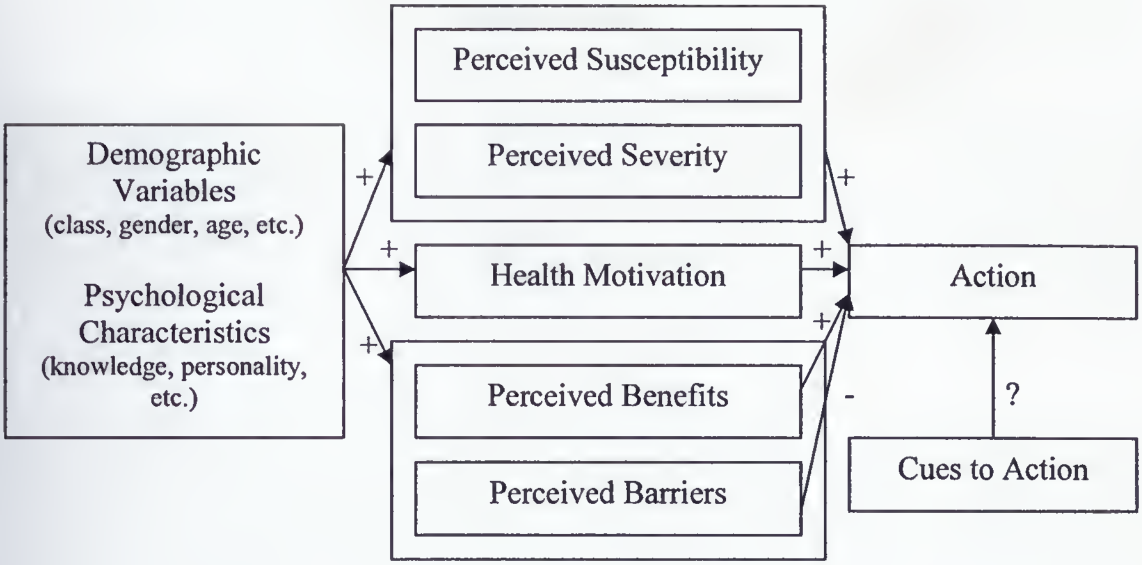
Figure 2. Significant interaction for calcium benefits.



4.2
4.15
4.1
4.05
4
3.95
3.9
3.85
3.8
3.75
Calcium Ben
PSA
BS
AC
Baseline
Time 1
Time 2
Time

Appendix A

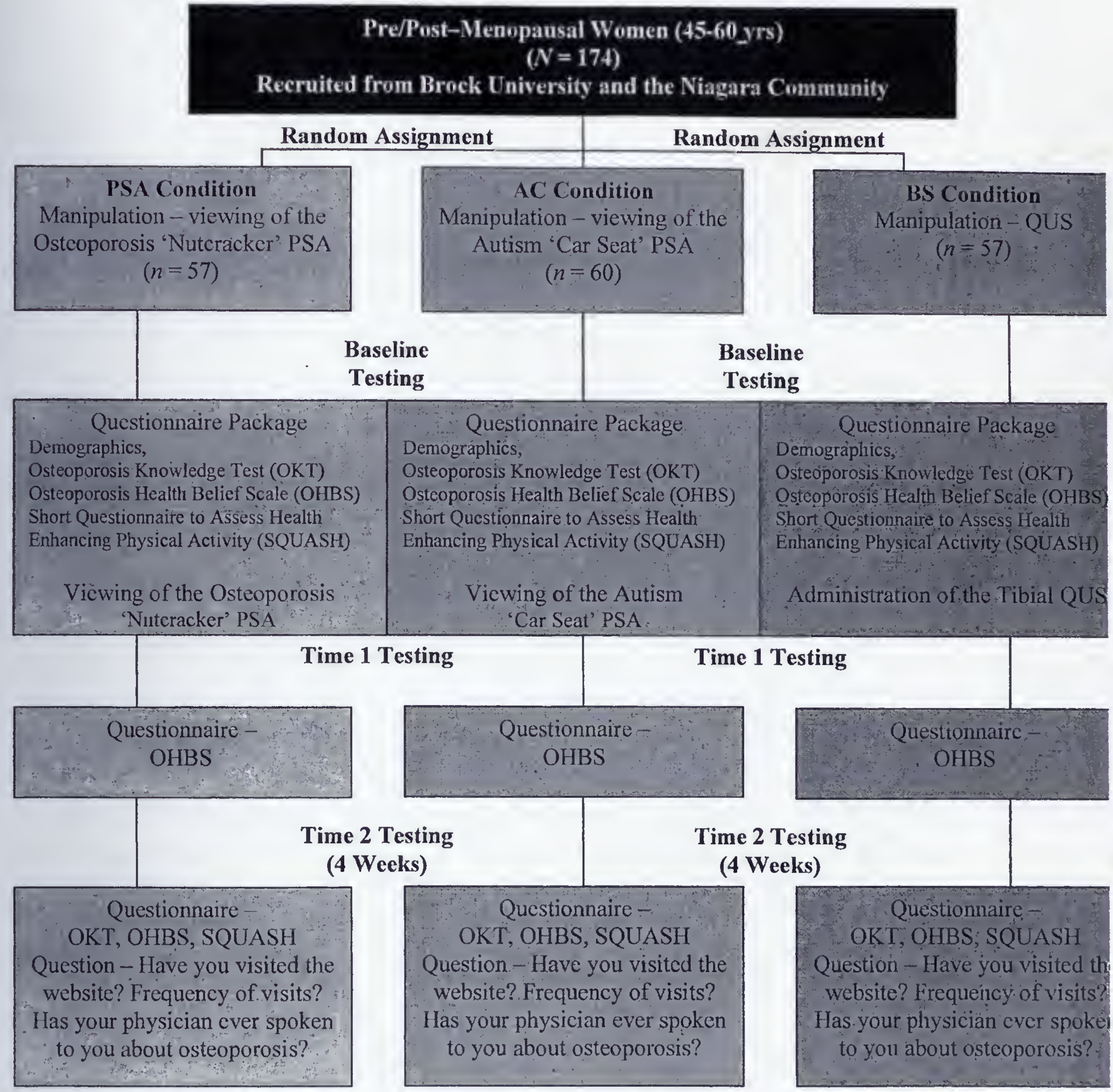
The Health Belief Model



Note: + = positive correlation posited between constructs; - = negative correlation posited by constructs; ? = indicates no direction hypothesized.

Appendix B

Study Design



Note: Participant recruitment and strategies will follow guidelines proposed by Dillman (2007)

Appendix C

Research Ethics Board Clearance Letters

DATE: February 9, 2007

FROM: Linda Rose-Krasnor, Chair
Research Ethics Board (REB)

TO: Diane Mack, PEKN
Jennifer GASPAROTTO

FILE: 06-178 Gasparotto

TITLE: Cues to Action: A Mechanism for Belief and Behavioural Change in Women

The Brock University Research Ethics Board has reviewed the above research proposal.

DECISION: Accepted as clarified.

This project has received ethics clearance for the period of February 9, 2007 to July 30, 2007 subject to full REB ratification at the Research Ethics Board's next scheduled meeting. The clearance period may be extended upon request. ***The study may now proceed.***

Please note that the Research Ethics Board (REB) requires that you adhere to the protocol as last reviewed and cleared by the REB. During the course of research no deviations from, or changes to, the protocol, recruitment, or consent form may be initiated without prior written clearance from the REB. The Board must provide clearance for any modifications before they can be implemented. If you wish to modify your research project, please refer to http://www.brocku.ca/researchservices/forms to complete the appropriate form **Revision or Modification to an Ongoing Application**.

Adverse or unexpected events must be reported to the REB as soon as possible with an indication of how these events affect, in the view of the Principal Investigator, the safety of the participants and the continuation of the protocol.

If research participants are in the care of a health facility, at a school, or other institution or community organization, it is the responsibility of the Principal Investigator to ensure that the ethical guidelines and clearance of those facilities or institutions are obtained and filed with the REB prior to the initiation of any research protocols.

The Tri-Council Policy Statement requires that ongoing research be monitored. A Final Report is required for all projects upon completion of the project. Researchers with projects lasting more than one year are required to submit a Continuing Review Report annually. The Office of Research Services will contact you when this form ***Continuing Review/Final Report*** is required.

Please quote your REB file number on all future correspondence.

LRK/bb

Brenda Brewster, Research Ethics Assistant
Office of Research Ethics, MC D250A
Brock University
Office of Research Services
500 Glenridge Avenue
St. Catharines, Ontario, Canada L2S 3A1
phone: (905)688-5550, ext. 3035 fax: (905)688-0748
email: reb@brocku.ca
http://www.brocku.ca/researchservices/ethics/humanethics/

FROM: Linda Rose-Krasnor, Chair
Research Ethics Board (REB)

TO: Diane Mack, PEKN
Jennifer Gasparotto

FILE: 06-178 - GASPAROTTO

DATE: March 23, 2007

END DATE: August 31, 2007

The Brock University Research Ethics Board has reviewed the research proposal:

Cues to Action: A Mechanism for Belief and Behavioural Change in Women

The Research Ethics Board finds that your ***modification request*** to an ongoing project involving human participants conforms to the Brock University guidelines set out for ethical research.

LRK/bb

Brenda Brewster, Research Ethics Assistant
Office of Research Ethics, MC D250A
Brock University
Office of Research Services
500 Glenridge Avenue
St. Catharines, Ontario, Canada L2S 3A1
phone: (905)688-5550, ext. 3035 fax: (905)688-0748
email: reb@brocku.ca

Appendix D

Sample Electronic Correspondence Guide

Sample Electronic Correspondence Guide – Participant
Brock University, Faculty of Applied Health Sciences
Title of Study: Cues to Action: A Mechanism for Belief and Behavioural Change in Women?
Principal Researcher: Jennifer Gasparotto, M.A. Candidate
Faculty Supervisor: Dr. Diane Mack, Associate Professor, Dept. of Physical Education and Kinesiology

November 23, 2006

Dear Ms. Smith,

Good morning/evening. I am contacting you on behalf of my Faculty Supervisor Dr. Diane Mack and myself Jennifer Gasparotto, M.A. candidate (Faculty of Applied Health Sciences) who are collecting information about the influence of cues to action (a specific stimuli that triggers an action) on various health beliefs and behaviour. You have been selected from a database of Brock University Community (defined for this project as all female Faculty and Staff) to participate in this project entitled "Cues to Action: A Mechanism for Belief and Behavioural Change in Women?" The project is designed to enhance our understanding of the influence of cues to action on various health beliefs and behaviour in female members of the Brock University and Niagara Community. With your assistance you will help us gain a greater understanding of health related cognitions and behaviours in our target sample.

In order to be eligible to participate in this study you should meet the following criteria:

- Peri- or post menopausal females between the ages of 45-60.
- Must have no restrictions to lifestyle physical activity on a regular basis.
- Must not have been diagnosed with osteoporosis.
- Must not have had a bone scan in the past 2 years.
- Willing to complete a questionnaire at 2 time points separated by 4 weeks.

If you know anyone (i.e., friends/family/contacts) that is eligible, we ask that you discuss this research with them to determine their interest in volunteering to participate. Those individuals interested in participation should then contact the research team to volunteer.

If you choose to participate, we do ask you complete a series of questions that will take approximately 30 minutes of your time on two occasions separated by a period of 4 weeks. Participants will be randomly assigned to receive one of three cues to action. Upon study completion, you will have the opportunity to receive the other cues to action at your discretion. Your participation is voluntary and all of the information that you provide will remain confidential which means that we will not be sharing your personal information with any other person or party in such a manner that you could be identified as a consequence of participating in this project.

Should you choose to participate, please respond to this e-mail and we will reply back to schedule an individual meeting. Remember that this is a voluntary activity and you are free to withdraw or not participate at any point in time simply by informing us of your decision. Upon study completion you will be provided the opportunity to receive feedback information. Participants regardless of assigned condition will have the opportunity to have their bone scanned as a token of our appreciation for participation. If you have any questions please ask. Thank you for your time and consideration. It is only with generous help of people like you that our research can be successful.

Sincerely,

Jennifer Gasparotto
MA Applied Health Sciences Candidate
Email: health@brocku.ca

Thesis Advisory Committee
Diane Mack PhD (Supervisor)
Philip Wilson PhD (Graduate Committee Member)
Bareket Falk PhD (Graduate Committee Member)

Appendix E

Poster

Brock University

Faculty of Applied Health Sciences
Department of **Physical Education & Kinesiology**

Participants Needed For Bone Health Study

Purpose: To investigate the influence of cues to action on health beliefs and behaviours.

Participants are required to be:

- **Peri- or post menopausal females between the ages of 45-60**
- **Must have no restrictions to lifestyle physical activity on a regular basis.**
- **Must not have been diagnoses with osteoporosis**
- **Must not have had a bone scan in the past 2 years**
- **Willing to complete a questionnaire at 2 time points separated by 4 weeks**

If interested, please contact:

Jennifer Gasparotto

health@brocku.ca

This research study has received ethics clearance by the Brock University Research Ethics Board (File:06-178)

Jennifer Gasparotto
health@brocku.ca

Jennifer Gasparotto
health@brocku.ca

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Jennifer Gasparotto
health@brocku.ca

Jennifer Gasparotto
health@brocku.ca

Jennifer Gasparotto
health@brocku.ca

Appendix F

Letter of Information

Letter of Information – Participant
Brock University, Faculty of Applied Health Sciences
Title of Study: Cues to Action: A Mechanism for Belief and Behavioural Change in Women?
Principal Researcher: Jennifer Gasparotto, M.A. Candidate
Faculty Supervisor: Dr. Diane Mack, Associate Professor, Dept. of Physical Education and Kinesiology

Dear Participant, February 21, 2007

The research that you are being invited to participate in is entitled, "Cues to Action: A Mechanism for Belief and Behavioural Change in Women?" The purpose of this study is to examine the influence of cues to action on a variety of health beliefs and health behaviours.

Your involvement and feedback are greatly appreciated and will help to further our understanding of the influence of cues to action on various health beliefs and behaviour. The questionnaire is expected to take approximately 30 minutes to complete and will focus on knowledge, health beliefs, and lifestyle physical activity behaviour. You will be randomly assigned into one of three groups of which a different cue to action will act as the intervention. One of the three conditions requires you to undergo a bone scan which will result in a measure of bone strength. Upon study completion, you will receive results. Interpretation of these results can be made by qualified medical professionals (e.g., your physician) The Quantitative Ultrasound (QUS) process consists of the measurement of bone strength through speed of sound (SOS) at the mid-shaft of the dominant tibia by a device that consists of a main unit and a hand-held probe. The SOS measurement is based on the fact that ultrasound waves travel faster through bone than through soft tissue. QUS is a non-invasive measure and will result in no physical harm or discomfort. A second meeting will be scheduled for Time 2 at which a second questionnaire will be administered. While we appreciate your participation at both Time points, participation at Time 1 does not necessitate participation at Time 2. Upon study completion, you will have the opportunity to receive the cues to action provided in the other conditions

The study that you are being asked to participate in will involve community members from Brock University and the Niagara Region. Results from this study will be used to enhance our understanding of the influence of cues to action on health beliefs and lifestyle physical activity behaviour in women between the ages of 50 and 60 years. A written summary of our results will be made available to you at the completion of the study. Further dissemination will occur in academic journals and conference presentations; however, the specific identity of the participants in the study will not be disclosed. Any information that arises from participants will be treated with confidentiality and access to information that might identify participants will be limited to Diane Mack (Faculty Supervisor) and Jennifer Gasparotto (Principal Investigator). The names of specific participants in the study will not be attached to comments or issues raised within project reports or presentations generated from this study. Data will be kept in the locked office of Diane Mack Ph.D., at Brock University. Only those listed below will have access to the data. All original written documents will be destroyed two years following the completion of the study. Participation in this study is voluntary and individuals may decline answering any question(s) within the questionnaire that they find invasive, offensive or inappropriate. Minimal risks (i.e. emotional response, embarrassment) associated with participation may exist. For those who experience emotional reactions to participation, they may contact members of the research team for support. Participants may withdraw from the study at any stage in the process. Of course, people may choose not to participate and will not experience any negative consequences.

The study has been reviewed and has received ethics clearance through the Research Ethics Board at Brock University (File: 06-178). Following the completion of our study we would be happy to send you an executive summary of our results. Should you wish a summary, please completer the Debriefing Form attached. Should you have any further questions concerning the study in general please feel free to contact Dr. Diane Mack at (905) 688-5550 extension 4360 or by e-mail at dmack@brocku.ca. Jennifer Gasparotto may be contacted by e-mail at health@brocku.ca. Additionally, concerns about your involvement in the study may also be directed to the Research Ethics Officer in the Office of Research Services at (905)688-5550 extension 3035.
Thank you for your interest and involvement in this study.
Sincerely,

Jennifer Gasparotto	Diane Mack Ph.D.
M.A. Candidate	Associate Professor,
Principal Researcher	Faculty of Applied Health Sciences

Appendix G

Informed Consent Form

[illegible]

[illegible]

Public Service Announcement Informed Consent Form – Participant
Brock University, Faculty of Applied Health Sciences
Title of Study: Cues to Action: A Mechanism for Belief and Behavioural Change in Women?
Principal Researcher: Jennifer Gasparotto, M.A. Candidate
Faculty Supervisor: Dr. Diane Mack, Associate Professor, Dept. of Physical Education and Kinesiology
Name of Participant: (Please print)

- I have been given and have read the Letter of Information provided to me by the Principal Investigator conducting the research.
- I understand that participation will involve completing a questionnaire that will take approximately 30 minutes.
- I understand that I will be contacted to participate in this research project on two occasions separated by 4 weeks.
- I understand that I will be given the opportunity to view a public service announcement that will take approximately 20 seconds.
- I understand that I am asked to refrain from discussion of the public service announcement with those in other conditions.
- I understand that I can choose to decline participation at the second test administration period.
- I understand that the purpose of this study is to examine the influence of cues to action on a variety of health beliefs and health behaviours.
- I understand that participation in this study may be associated with minimal risk/harm. Completion of the questionnaire package may induce feelings of embarrassment or anxiety. Contact information is included and support will be offered to those who require it.
- I understand that my participation in this study is voluntary and that I may withdraw from the study at any time and for any reason without penalty.
- I understand that I may ask questions of the researchers at any point during the research process.
- I understand that there is no obligation to answer any question that I feel is invasive, offensive or inappropriate.
- I understand that there will be no payment for my participation. I understand that upon study completion I will have the opportunity to receive feedback regarding my test results and will be offered the manipulations afforded to those participants in the other conditions.
- I understand that all personal information will be kept strictly confidential and that all information will be coded so that the name of individual participants will not be associated with my specific answers.
- I understand that only the Principal Investigator and Faculty Supervisor named above will have access to the data, and that information seen by the research assistants will not include my name. Data will be kept in a locked office at Brock University and will be shredded two years post-publication. I also understand that the research assistants have been asked to sign confidentially forms indicating that they will not discuss the study outside of research meetings with the Principal Investigator and Faculty Supervisor.
- I understand that participants may gain a better understanding of the influence of cues to action on health beliefs and health behaviours. I understand that an executive summary of the results will be made available to me at the completion of the study if I have requested this information.
- I understand that the results of this study will be distributed in academic journal articles and conference presentations.
- As indicated by my signature below, I acknowledge that I am participating freely and willingly and I am providing my consent.

Signature of Participant: Date:

The study has been reviewed and has received ethics clearance through the Research Ethics Board at Brock University (File: 06-178). If you have any questions or concerns regarding your participation in this study, you may contact Dr. Diane Mack at (905) 688-5550 extension 4360 or by email at dmack@brocku.ca. Jennifer Gasparotto may be contacted by email at health@brocku.ca. Concerns about your involvement in the study may also be directed to Research Ethics Officer in the Office of Research Services at (905) 688-5550 extension 3035.

Feedback about the use of the data collected will be available at completion of the study from Diane Mack in the Faculty of Applied Health Sciences at Brock University. A written explanation will be provided for you upon request.

I have fully explained the procedures of this study to the above volunteer participant.

Researchers Signature: Date:

Bone Screening Informed Consent Form – Participant
Brock University, Faculty of Applied Health Sciences
Title of Study: Cues to Action: A Mechanism for Belief and Behavioural Change in Women?
Principal Researcher: Jennifer Gasparotto, M.A. Candidate
Faculty Supervisor: Dr. Diane Mack, Associate Professor, Dept. of Physical Education and Kinesiology

Name of Participant: (Please print)

- I have been given and have read the Letter of Information provided to me by the Principal Investigator conducting the research.
- I understand that participation will involve completing a questionnaire that will take approximately 30 minutes.
- I understand that I will be contacted to participate in this research project on two occasions separated by 4 weeks.
- I understand that I will be given the opportunity to undergo Quantitative Ultrasound (QUS) of my dominate tibia that will take approximately 5 minutes. I understand that QUS is a non-invasive measure of bone strength.
- I understand that I am asked to refrain from discussion of QUS with those in other conditions.
- I understand that I can choose to decline participation at the second test administration period.
- I understand that the purpose of this study is to examine the influence of cues to action on a variety of health beliefs and health behaviours.
- I understand that participation in this study may be associated with minimal risk/harm. Completion of the questionnaire package may induce feelings of embarrassment or anxiety. Contact information is included and support will be offered to those who require it.
- I understand that my participation in this study is voluntary and that I may withdraw from the study at any time and for any reason without penalty.
- I understand that I may ask questions of the researchers at any point during the research process.
- I understand that there is no obligation to answer any question that I feel is invasive, offensive or inappropriate.
- I understand that there will be no payment for my participation. I understand that upon study completion I will have the opportunity to receive feedback regarding my test results and will be offered the manipulations afforded to those participants in the other conditions.
- I understand that all personal information will be kept strictly confidential and that all information will be coded so that the name of individual participants will not be associated with my specific answers.
- I understand that only the Principal Investigator and Faculty Supervisor named above will have access to the data, and that information seen by the research assistants will not include my name. Data will be kept in a locked office at Brock University and will be shredded two years post-publication. I also understand that the research assistants have been asked to sign confidentially forms indicating that they will not discuss the study outside of research meetings with the Principal Investigator and Faculty Supervisor.
- I understand that participants may gain a better understanding of the influence of cues to action on health beliefs and health behaviours. I understand that an executive summary of the results will be made available to me at the completion of the study if I have requested this information.
- I understand that the results of this study will be distributed in academic journal articles and conference presentations.
- As indicated by my signature below, I acknowledge that I am participating freely and willingly and I am providing my consent.

Signature of Participant: Date:

The study has been reviewed and has received ethics clearance through the Research Ethics Board at Brock University (File: 06-178). If you have any questions or concerns regarding your participation in this study, you may contact Dr. Diane Mack at (905) 688-5550 extension 4360 or by email at dmack@brocku.ca. Jennifer Gasparotto may be contacted by email at health@brocku.ca. Concerns about your involvement in the study may also be directed to Research Ethics Officer in the Office of Research Services at (905) 688-5550 extension 3035.

Feedback about the use of the data collected will be available at completion of the study from Diane Mack in the Faculty of Applied Health Sciences at Brock University. A written explanation will be provided for you upon request.

I have fully explained the procedures of this study to the above volunteer participant.

Researchers Signature: Date:

Appendix H

Sample Participant Resource Sheet

Sample Participant Resource Sheet
Brock University, Faculty of Applied Health Sciences
Title of Study: Cues to Action: A Mechanism for Belief and Behavioural Change in Women?
Principal Researcher: Jennifer Gasparotto, M.A. Candidate
Faculty Supervisor: Dr. Diane Mack, Associate Professor, Dept. of Physical Education and Kinesiology

Dear Ms. Smith,

The following is a list of reliable internet sites which provide valuable bone health information. For further information or to answer any future questions, we recommend utilizing the following internet sites. For more individualized information, we recommend that you contact your physician.

International Osteoporosis Foundation
www.iofbonehealth.org

National Osteoporosis Foundation
www.nof.org/

Osteoporosis Canada
www.osteoporosis.ca

Please accept our sincere thank you for your participation in this bone health study.
Sincerely,

Jennifer Gasparotto
M.A. Candidate
Principal Researcher

Diane Mack Ph.D.
Associate Professor,
Faculty of Applied Health Sciences

Appendix I

Participant Debriefing Form

Participants – Debriefing Form
Brock University, Faculty of Applied Health Sciences
Title of Study: Cues to Action: A Mechanism for Belief and Behavioural Change in Women?
Principal Researcher: Jennifer Gasparotto, M.A. Candidate
Faculty Supervisor: Dr. Diane Mack, Associate Professor, Dept. of Physical Education and Kinesiology

If you would like to receive a summary of the results of the study please completer the following information.

If you would like to receive the information by mail please provide your name and address:

Name: ____
(First Name) (Last Name)

Address: ____
(Street Number) (Street Name)

____
(City) (Province) (Postal Code)

If you would like to receive the information by email:

Name: ____

Email Address: ______________________________________

[illegible]
[illegible]
[illegible]
[illegible]
[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Appendix J

Questionnaire

THANK YOU FOR AGREEING TO PARTICIPATE IN THIS RESEARCH PROJECT

This package contains 9 pages in total, including this cover page. Page 2 includes a set of questions that tells us more about you and your lifestyle background. Pages 3 -7 include questions specific to health beliefs. Pages 8 – 9 include questions about your lifestyle physical activity behaviours.

Your name is **not** required anywhere in this package. All of your responses will remain confidential. No person other than the members of the research team will have access to your responses.

There are no "right" or "wrong" answers. Be as honest and as accurate as you can in answering each question.

ALL ANSWERS WILL REMAIN PRIVATE AND CONFIDENTIAL

Thank You for your participation!

INSTRUCTIONS: We are interested in learning more about your background. Please follow the directions carefully.

1. What is your age (in years)? ______________________________

2. What is your height (inches)? ______________________________

3. What is your weight (lbs)? ______________________________

4. Please indicate your race (circle one)

Caucasian   Asian   African American   Hispanic   Other

5. Have you ever experienced a fracture? (circle one)

Yes   No

6. Do you have a family member who suffers/suffered from osteoporosis? (circle one)

Yes   No

7. Have you had a medical check up in the last year? (circle one)

Yes   No

8. Are you on any medications? If so please list. ______________________________

9. Do you currently use hormone replacement therapy? (circle one)

Yes   No

10. Do you currently take calcium supplements? (circle one)

Yes   No

11-A. INSTRUCTIONS: Osteoporosis is a condition in which the bones become very brittle and weak so that they break easily. Below is a list of things that may affect a person's chance of getting osteoporosis. After each one, please circle the letters that indicate if you think the person is:

ML - MORE LIKELY TO GET OSTEOPOROSIS

LL - LESS LIKELY TO GET OSTEOPOROSIS

NT - IT HAS NOTHING TO DO WITH GETTING OSTEOPOROSIS

DK - YOU DON'T KNOW

1. Eating a diet Low in milk products.	ML	LL	NT	DK
2. Being menopausal; female "change of life".	ML	LL	NT	DK
3. Having big bones.	ML	LL	NT	DK
4. Eating a diet high in dark-green, leafy vegetables.	ML	LL	NT	DK
5. Having a parent or grandparent who had osteoporosis.	ML	LL	NT	DK
6. Being White with fair skin.	ML	LL	NT	DK
7. Having ovaries surgically removed.	ML	LL	NT	DK
8. Taking cortisone (steroids, e.g., Prednisone).	ML	LL	NT	DK
9. Exercising regularly.	ML	LL	NT	DK

11-B. INSTRUCTIONS: For the next group of questions, you will be asked to choose one answer from several choices. Be sure to choose only **one** answer. If you think there is more than one answer, choose the best answer. If you are not sure, choose "don't know".

10. **Which of the following exercises is the best way to reduce a person's chances of getting osteoporosis?**

A. Swimming
B. Walking briskly
C. Doing kitchen chores, such as washing dishes or cooking
D. Don't know

11. **Which of the following exercises is the best way to reduce a person's chances of getting osteoporosis?**

A. Bicycling
B. Yoga
C. House cleaning
D. Don't know

12. How many days a week do you think a person should exercise to strengthen the bones?

A. 1 day a week
B. 2 days a week
C. 3 or more days a week
D. Don't know

13. What is the least amount of time a person should exercise on each occasion to strengthen the bones?

A. Less than 15 minutes
B. 20 to 30 minutes
C. More than 45 minutes
D. Don't know

14. Exercise makes bones strong, but it must be hard enough to make breathing:

A. Just a little faster
B. Much faster, but talking is possible
C. So fast that talking is not possible
D. Don't know

15. Which of the following exercises is the best way to reduce a person's chances of getting osteoporosis?

A. Jogging or running for exercise
B. Golfing using a golf cart
C. Gardening
D. Don't know

16. Which of the following exercises is the best way to reduce a person's chances of getting osteoporosis?

A. Bowling
B. Doing laundry
C. Aerobic dancing
D. Don't know

17. Which of these is a good source of calcium?

A. Apple
B. Cheese
C. Cucumber
D. Don't know

18. Which of these is a good source of calcium?

A. Watermelon
B. Corn
C. Canned sardines
D. Don't know

19. Which of these is a good source of calcium?

A. Chicken
B. Broccoli
C. Grapes
D. Don't know

20. Which of these is a good source of calcium?
- A. Yogurt
- B. Strawberries
- C. Cabbage
- D. Don't know

21. Which of these is a good source of calcium?
- A. Ice cream
- B. Grapefruit
- C. Radishes
- D. Don't know

22. Which one of the following is the recommended amount of calcium intake for an adult?
- A. 100 mg – 300 mg daily
- B. 400 mg – 600 mg daily
- C. 800 mg or more daily
- D. Don't know

23. How much milk must an adult drink to meet the recommended amount of calcium?
- A. ½ glass daily
- B. 1 glass daily
- C. 2 or more glasses daily
- D. Don't know

24. Which of the following is the best reason for taking a calcium supplement?
- A. If a person skips breakfast
- B. If a person does not get enough calcium from diet
- C. If a person is over 45 years old
- D. Don't know

12. **INSTRUCTIONS:** Please indicate how strongly you agree or disagree with each statement by circling the appropriate number (1-5).

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
1. You feel your chance of getting osteoporosis in the future is good.	1	2	3	4	5
2. There is a good possibility that you will get osteoporosis.	1	2	3	4	5
3. Your physical health makes it more likely that you will get osteoporosis.	1	2	3	4	5
4. Your chances of getting osteoporosis are great.	1	2	3	4	5
5. Your family history makes it more likely that you will get osteoporosis.	1	2	3	4	5
6. Eating calcium rich foods requires changing your dietary habits which is difficult.	1	2	3	4	5
7. You are afraid you would not be able to always eat calcium rich foods.	1	2	3	4	5
8. Calcium rich foods do not agree with you.	1	2	3	4	5
9. Calcium rich foods are too expensive.	1	2	3	4	5
10. You dislike calcium rich foods.	1	2	3	4	5
11. You would not be so anxious about osteoporosis if you ate calcium rich foods.	1	2	3	4	5
12. Eating calcium rich foods reduces risks of broken bones.	1	2	3	4	5
13. Eating calcium rich foods helps to build bone.	1	2	3	4	5
14. Eating calcium rich foods prevents future problems from osteoporosis.	1	2	3	4	5
15. Eating calcium rich foods prevents future pain.	1	2	3	4	5
16. Exercising regularly reduces risks of broken bones.	1	2	3	4	5
17. You would not be so anxious about	1	2	3	4	5

osteoporosis if you exercised regularly.					
18. Exercising regularly prevents future pain.	1	2	3	4	5
19. Exercising regularly helps to build bones	1	2	3	4	5
20. Exercising regularly prevents future problems from osteoporosis.	1	2	3	4	5
21. Exercising regularly interferes with your daily activities.	1	2	3	4	5
22. Exercising regularly can be time consuming.	1	2	3	4	5
23. Exercising regularly can be painful.	1	2	3	4	5
24. Exercising regularly would require starting a new habit which is difficult.	1	2	3	4	5
25. You are not strong enough to exercise regularly.	1	2	3	4	5
26. If you had osteoporosis, your whole life would change.	1	2	3	4	5
27. Your feelings about yourself would change if you got osteoporosis.	1	2	3	4	5
28. The thought of osteoporosis scares you.	1	2	3	4	5
29. Osteoporosis would endanger your marriage (or significant relationship).	1	2	3	4	5
30. Having osteoporosis would make daily activities more difficult.	1	2	3	4	5
31. You frequently do things to improve your health.	1	2	3	4	5
32. You eat a well-balanced diet.	1	2	3	4	5
33. You search for new information related to your health.	1	2	3	4	5
34. You exercise regularly - at least 3 times/week.	1	2	3	4	5
35. Maintaining good health is extremely important to you.	1	2	3	4	5

13. INSTRUCTIONS: Think about an average week in the past months. Please indicate **how many days per week** you performed the following activities, how much time **on average** you were engaged in this, and (if applicable) how strenuous this activity was for you?

COMMUTING ACTIVITIES (round trip)	Days per week	Average time per day (hours/minutes)	Effort (circle please)
Walking to/from work or school			slow/moderate/fast
Bicycling to/from work or school			slow/moderate/fast
Not Applicable			slow/moderate/fast

LESIURE TIME ACTIVITIES	Days per week	Average time per day (hours/minutes)	Effort (circle please)
Walking			slow/moderate/fast
Bicycling			slow/moderate/fast
Gardening			slow/moderate/fast
Odd Jobs			slow/moderate/fast
Sports (please write down yourself) e.g., tennis, fitness, skating, swimming, dancing			
1.			slow/moderate/fast
2.			slow/moderate/fast
3.			slow/moderate/fast
4.			slow/moderate/fast

HOUSEHOLD ACTIVITIES	Days per week	Average time per day (hours/minutes)
Light Household Work (cooking, washing dishes, ironing, child care)		
Intense Household Work (scrubbing floor, walking with heavy shopping bags)		

ACTIVITIES AT WORK AND SCHOOL	Average time per day (hours/minutes)
Light Work (sitting/standing with some walking, e.g., a desk job)	
Intense Work (regularly lifting heavy objects at work)	
Not applicable	

ALL ANSWERS WILL REMAIN PRIVATE AND CONFIDENTIAL

Thank You for your participation!

Appendix K

Screening Questions

INSTRUCTIONS: Please follow the directions carefully.

1. Please indicate your menopausal status (circle one)

Peri-menopausal (up to 6 years prior to menopause (i.e., not having a menstrual period of 12 consecutive months) and up to 1 year after menopause)

Post-menopausal (Any time after menopause)

Other (please explain) ______________________________

2. Have you been screened (bone density test/bone scan) for osteoporosis in the last 2 years? (circle one)

Yes No

3. Have you been diagnosed with osteoporosis? (circle one)

Yes No

4. Are you able to physically perform lifestyle physical activity (i.e., walking up the stairs, gardening, housework) on a regular basis? (circle one)

Yes No

5. Do you have any physical disabilities? (circle one)

Yes No

ALL ANSWERS WILL REMAIN PRIVATE AND CONFIDENTIAL

Thanks for your participation!

Appendix L

Sample Thank You/Reminder

Sample Postcard Thank You/Reminder – Participant
Brock University, Faculty of Applied Health Sciences
Title of Study: Cues to Action: A Mechanism for Belief and Behavioural Change in Women?
Principal Researcher: Jennifer Gasparotto, M.A. Candidate
Faculty Supervisor: Dr. Diane Mack, Associate Professor, Dept. of Physical Education and Kinesiology

November 23, 2006

Dear Ms. Smith,

Two weeks ago you completed a questionnaire concerning health beliefs and behaviours. Please accept our sincere thanks for your participation in the first time period of our study. We are especially grateful for your help because it is only by asking people like you to share your thoughts that we can understand the influence of cues to action on knowledge, beliefs, and behaviour in women.

We would like to remind you of your second scheduled individual meeting on XX, XX, XX at which time you will be asked to complete a second questionnaire package containing questions specific to health beliefs and behaviours. At this time you will have the opportunity to receive the additional cues to action.

Sincerely,

Jennifer Gasparotto,
M.A. Applied Health Sciences Candidate
Brock University

Appendix M

Questions to be asked at the end of Time 2 only

INSTRUCTIONS: Please follow the directions carefully.

14. Over the course of the past 4 weeks have you gone to the Osteoporosis Canada Website? (circle one)

Yes (please answer question 32) No (please skip to question 33)

15. How many times have you gone to the Osteoporosis Canada Website?

Once Less than ore equal to 5 times Greater than 6 times

16. Over the course of the past 4 weeks have you actively sought more information on osteoporosis? (circle one)

Yes No

17. Has your physician ever spoken to you about osteoporosis? (circle one)

Yes No

18. Do you currently use hormone replacement therapy? (circle one)

Yes No

19. Do you currently take calcium supplements? (circle one)

Yes No

20. Have you ever view either of the Public Service Announcements? (circle one)

Yes No

ALL ANSWERS WILL REMAIN PRIVATE AND CONFIDENTIAL

Thanks for your participation!

Appendix N

Statement of Confidentiality for Research Assistant

Statement of Confidentiality
Brock University, Faculty of Applied Health Sciences
Title of Study: Cues to Action: A Mechanism for Belief and Behavioural Change in Women?
Principal Researcher: Jennifer Gasparotto, M.A. Candidate
Faculty Supervisor: Dr. Diane Mack, Associate Professor, Dept. of Physical Education and Kinesiology

Name of Technician (please print):

Please read the following before providing your signature.

Dignity and autonomy of human participant's provide the ethical basis for respecting privacy of research participants. Privacy is a fundamental value, perceived by many as essential for the protection and promotion of human dignity. Hence, the access, control, and dissemination of personal information are essential to ethical research. Information that is disclosed in the context of a professional or research relationship must remain confidential. Thus, when a research participant confides personal information to a researcher, the researcher has a duty not to share the information with others without the participant's free and informed consent. Breaches of confidentiality may cause harm to the trust established between the researcher and participant, to other individuals or groups, and/or to the reputation of the university (adapted from the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans, 1998 [with 2000 and 2002 updates]).

Out of respect for human dignity and autonomy, we ensure participant's right to privacy is maintained within this research project by protecting participant anonymity and confidentiality. Researchers protect the privacy of their participants by not disclosing their identity after information is collected and retaining the level of anonymity stipulated in the informed consent procedures for the study.

As a research assistant, you are being asked to respect each participant's right to confidentiality by not discussing or disclosing their response to any of the questionnaires to anyone not directly involved in this research project. The study and its participants are only to be discussed during research meetings with the principal investigator.

In signing below, you are indicating that you understand the following:

- I understand the importance of protecting anonymity and confidentiality of each participant.
- I understand that while I do not know participant's names, the content of their questionnaire responses may contain information that renders them identifiable to others. I understand that this information is to be kept confidential.
- I understand that the contents of the data collected during the course of this study are not to be discussed outside of research meetings with the principal investigator and Faculty Supervisor.
- When administering the bone scanning technique, I will be the only one who has access to the participant's scores and I will store them in a secure location during and after data entry.
- I understand that the data files (electronic and hard copy) are to be kept secure at all times.

I understand that by signing below, I agree to the above statements and promise to ensure the participants in this study anonymity and confidentiality to the best of my ability.

Signature of research assistant: Date:

Appendix O

List of Abbreviations

Abbreviation	Meaning
AC	Attention Control Condition
BMD	Bone Mineral Density
BS	Bone Screening Condition
CFLRI	Canadian Fitness and Lifestyle Research Institute
CHD	Coronary Heart Disease
DXA	Dual Energy X-ray Absorptiometry
HBM	Health Belief Model
HEPA	Health-Enhancing Physical Activity
HRT	Hormone Replacement Therapy
MET	Metabolic Equivalent Units
OHBS	Osteoporosis Health Belief Scale
OKT	Osteoporosis Knowledge Test
PSA	Public Service Announcement
QUS	Quantitative Ultrasound
REGWQ	Ryan Test
SQUASH	Short Questionnaire to Assess Health-enhancing Physical Activity
USDHHS	United States Department of Health and Human Services