

Abstract

Transgender Individuals and Osteoporosis Prevention

Introduction: Transgender individuals (TI) are a growing and under-identified health disparate population, with complex health needs and poor access to health care. Many TI self-treat with cross-sex hormones to induce/maintain physical and psychological characteristics of sex matching their gender identity. Risk behaviors and hormone use place TI at risk for altered bone health, specifically osteoporosis (OP).

Aims: For a sample of TI, the study aims were: Describe: 1) knowledge about OP prevention and management, 2) health beliefs about OP prevention and management, 3) osteoporosis preventing behaviors (OPB) (calcium intake, weight bearing exercise, not smoking, limited alcohol use), and 4) TI perceptions of bone health and OP.

Methods - Research Design: This pilot was a mixed-methods descriptive design. A convenience sample of 31 TI self-identified as transgender male-to-female (transwomen), or female-to-male (transmen), age 30 and older, was obtained for the quantitative aspect of the study, with 15 TI recruited for a qualitative follow-up interview.

Instruments: The Osteoporosis Bone Health Survey completed by participants was comprised of standardized and previously tested instruments (*Osteoporosis Knowledge Test, Osteoporosis Health Belief Scale, Osteoporosis Self-Efficacy Scale, Dietary Calcium Rapid Assessment Tool, Yale Physical Activity Survey*) that addressed osteoporosis knowledge, health beliefs, self-efficacy, calcium and vitamin D intake, and exercise. A qualitative interview provided insight into responses on the instruments for osteoporosis knowledge, health beliefs, and prevention behaviors.

Results/Discussion: TI performed poorly on the knowledge measure with 81% of participants failing the test. TI did not perceive themselves as being susceptible to developing OP, nor did they perceive the disease as a serious threat to them, but they did believe in the benefits of calcium and exercise in preventing OP. Participants did not perceive that there are barriers to taking calcium or conducting exercise, and they were motivated to engage in exercise and to take calcium to reduce the risk of developing OP. TIs rated their confidence about doing exercise and taking calcium as slightly above neutral. However, the daily mean dietary calcium intake of 144 milligrams and the daily mean walking activities of 11 minutes are less than the recommended 1,200 milligrams of daily calcium intake and below the recommended 30 minutes a day of weight bearing activity. TI perceptions of bone health and osteoporosis revealed two essential elements of TI perceptions of bone health and osteoporosis, that of *Knowing* and *Doing*. There were three dominant themes within the essential element of Knowing (what I know, what I don't know, and what I want to know) and two dominant themes within the essential element of Doing (what I do and what I need to do).

Conclusion: Determining TI perceptions of bone health and OP is important because of the unique healthcare issues TI have. The issue of improving osteoporosis prevention behaviors, particularly dietary calcium intake and weight bearing exercise are issues that both men and women face during aging as bone density decreases. However, the transgender population is faced with compounding issues of cross-sex hormone use, particularly when they self-manage their hormones by purchasing these online or sharing with one another. Self-management can result in hormone imbalance which can have a long term effect on bone health. Clearly, TI lack knowledge about behaviors that promote bone health and prevent OP. Healthcare providers need

to educate this at-risk minority population on how to be proactive in initiating and maintaining bone health including diet, exercise, risk factors, and cross-sex hormone use so that health beliefs about OP prevention and management can be enhanced.

1. Summary of Project Aims

Osteoporosis is a serious, debilitating age related public health concern that is important to nurses and health care providers (NOF, 2015). Characterized by compromised bone strength, osteoporosis results in bone loss and predisposes individuals to an increased risk of fractures (NOF, 2015). Often, fractures occur before a diagnosis of OP has been made, therefore primary prevention can play a major role for pre-osteoporotic individuals (Griffin, 2013).

Transgender individuals are at particular risk of OP because of their high risk lifestyle behaviors that include: smoking, alcohol use, decreased dietary calcium intake, sedentary lifestyle, and cross-sex hormone use. Osteoporosis affects the general population, TI being particularly vulnerable because of their multiple, interacting, and cumulative life style habits which may place them at higher risk.

Although there has been increasing awareness in addressing osteoporosis prevention and treatment in men and women, the promotion of bone health, prevention of OP, and addressing risk factors for TI has been untapped. Currently, the literature is lacking in all areas of healthcare needs for TI, especially in the area of bone health. This pilot study produced data on the knowledge, health beliefs, and osteoporosis preventing behaviors (OPB) of TI, expanding the scientific knowledge base about TI bone health and bone health behaviors.

Study Aims

In a sample of TI age 30 and older:

1. Describe the knowledge about OP prevention and management.
2. Describe the health beliefs (susceptibility, seriousness, benefits to calcium intake, benefits to weight bearing exercise, barriers to calcium intake, barriers to weight bearing exercise, motivation, self-efficacy calcium intake, self-efficacy exercise) about OP prevention and management.
3. Describe OPB (calcium intake, vitamin D intake, weight bearing exercise, not smoking, limited alcohol use).
4. Describe TI perceptions of bone health and OP.

2. Theoretical/Conceptual Framework

The Revised Health Belief Model (RHBM) guided this study. This theoretical framework is an adaptation of Rosenstock's (1966) initial work and revised by Rosenstock, Stretcher, and Becker (1988) to include Bandura's (1977) self-efficacy (SE) model and is used to explain why and under what conditions individuals take preventive actions. Understanding the processes by which people decide to practice preventive health behaviors is of value for nurses and other healthcare providers. Based on the HBM, people are more likely to engage in OPB if they (a) perceive themselves to be more susceptible to OP; (b) believe OP is a serious threat; (c) believe in the benefits of specific behaviors to prevent or modify their disease; (d) perceive fewer negative aspects (barriers) to be associated with preventive behaviors; and (e) have a concern and drive (benefits and motivation) for their general health.

Knowledge and sociodemographic factors may influence the individual's health belief perceptions (Champion & Skinner, 2008). Absence of or inadequate knowledge renders persons unable to understand the importance of adapting changes in behavior to decrease risk; knowledge alone has not been found to consistently influence people to change behavior. However, information about previous knowledge as part of OP assessment may help to understand how

individuals use information to reach a state of readiness to carry out necessary health behaviors to prevent or slow bone density loss.

Based on the RHBM, individuals may be more likely to try to learn more about OP, have a change in health beliefs, and participate in OPB to prevent or slow bone density loss if they have knowledge, particularly personal knowledge of their bone density. Empirical studies of the relationship between health beliefs and preventive behaviors helped to lay the foundation for understanding the influence of HBM variables (susceptibility, seriousness, benefits, barriers, motivation) on OPB. A meta-analysis of 46 HBM studies established that individuals who had certain health beliefs were more likely to carry out prevention behaviors (Janz & Becker, 1984). Perceived barriers and susceptibility were found to be the most powerful predictors of preventive behaviors. Specific HBM studies related to OPB (calcium intake, exercise) found in the literature are by Doheny, Sedlak, Hall, and Estok (2010), Doheny, Sedlak, Estok, and Zeller, (2011), Estok, Sedlak, Doheny, and Hall (2007), Kim, Horan, Gendler, and Patel (1991), and Sedlak, Doheny, Estok, Zeller, and Winchell (2007). Findings in several studies revealed that perceived susceptibility, seriousness, barriers, and benefits were related to OPB (Horan, Kim, Gendler, Froman, & Patel, 1998; Kim et al., 1991). Health motivation and knowledge appeared to also affect OPB (Kim et al., 1991; Sedlak et al., 2007).

3. Methods, Sampling, and Procedures

This was a mixed-methods descriptive study design to determine the knowledge, health beliefs, and OPB of TI who are aging. Second, qualitative data was obtained to provide insight into the answers on the standardized measures to understand knowledge and beliefs in an understudied population.

Twelve instruments were used in the quantitative portion of the study. *Osteoporosis Knowledge Test* (OKT-Revised 2011) (Gendler, Coviak, Martin, Kim, Dankers, Barclay, & Sanchez, 2014), *Osteoporosis Health Belief Scale* (OHBS) (Kim et al., 1991), *Osteoporosis Self-Efficacy Scale* (OSES) (Horan et al., 1998; Kim, Horan, & Gendler, 1991), *Daily Calcium Intake* measured by a 30-item Dietary Calcium Rapid Assessment Method (RAM) tool (Hertzler & Frary, 1994), *Supplemental Calcium and Vitamin D Intake*, *Total Calcium Intake* score obtained by adding the Dietary Calcium Rapid Assessment tool (RAM), (Hertzler & Frary, 1994), *Daily Activity* measured using the 39-item Yale Physical Activity Survey (YPAS) (Dipietro, Caspersen, Ostfeld, & Nadel, 1993), *Amount of Alcohol Intake*, *Amount of Smoking*, *Hormonal Drug Therapy*, *Non-Hormonal Drug Therapy*, and *Sociodemographic Data*.

Qualitatively, participants were asked to describe their experiences of bone health and OP, in order to better understand their perceptions. Interview questions were based on the three constructs of osteoporosis knowledge, health beliefs, and prevention behaviors. The multi-methods/mixed-methods nature of the data enhanced the coherence between measures and constructs, and aided in validation of the data from the measures.

A convenience sample of 31 TI self-identifying as transgender, age 30 and older, who read and speak English were recruited using two modes of recruitment, face-to-face and online. Participants were recruited face-to-face with flyers posted at a number of community agencies including the Lesbian Gay Bi-sexual and Transgender Community Center of Cleveland, Ohio (LGBT CCC), the TransAlive support group in Akron, Ohio and Dr. Daniel Weiss' office. Online recruitment included posting flyers on transgender websites, listservs, and online support groups. Accessing the TI community in Cleveland and the surrounding Ohio locales was conducted through in-person recruitment at TI support groups, a physician who provides primary

care to TI, and online recruitment. The total N for the qualitative sample of participants was 15 and was determined by random selection among those participants who agreed to participate in the study interview.

Instruments

The Osteoporosis Bone Health Survey for this study includes standardized and previously tested instruments.

Osteoporosis Knowledge Test (OKT-Revised 2011) (Gendler, Coviak, Martin, Kim, Dankers, Barclay, & Sanchez, 2014). This is a 32-item tool with a possible range of scores from 0 to 32. Eleven items are rated using a 4 point scale and 21 items are multiple choice. There are two subscales for the OKT: OKT Nutrition (items 1 to 11 and 18 to 32) and OKT Exercise (items 1 to 17 and 30 to 32). The OKT Nutrition and the OKT Exercise share 14 common items (1 to 11 and 30 to 32). KR-20 are: 0.85 for the total scale, 0.83 for the Nutrition subscale, and 0.81 for the Exercise subscale. Test-retest analysis resulted in a Pearson's r of 0.87. Validity was evaluated by content validity. For this study, knowledge was analyzed by assessing percentage of knowledge questions answered correctly. The percentage score is indicated by a letter grade with A $\geq 90\%$ to 100%, B is $\geq 80\%$ and $< 90\%$, C is $\geq 70\%$ and $< 80\%$, D is $\geq 60\%$ and $< 70\%$, and F is $< 60\%$.

Osteoporosis Health Belief Scale (OHBS) (Kim et al., 1991). The *Osteoporosis Health Belief Scale* (OHBS) (Kim et al., 1991) is a 42-item tool consisting of seven subscales (susceptibility, seriousness, benefits of calcium intake and exercise, barriers to calcium intake and exercise, and motivation), that assess osteoporosis-related health beliefs. Each of the seven health beliefs were measured by six Likert items, and each item was rated using a 5 point scale (1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree). The OHBS consists of scores for the seven subscales and a total score. The possible range of scores for each subscale is 6 to 30 for a total possible range of 42 to 210 for the total scale. Test-retest reliability for the total instrument is .90, and subscale reliabilities range from .71 to .82. Concurrent validity was established through assessment of calcium and exercise behaviors. Construct validity was established using factor analysis with factor loadings on the calcium and exercise subscale ranging from .40 to .80 (Kim et al., 1991). The score on the OHBS is an interval measure. The sample mean was calculated, and confidence levels were established for estimation of the population mean.

Osteoporosis Self-Efficacy Scale (OSES) (Horan et al., 1998; Kim, Horan, & Gendler, 1991). A 21-item scale with two subscales: exercise and calcium. Participants rate their confidence about doing exercise and performing calcium-intake activities by circling the appropriate number (0=least confident, 10=most confident). Reliability coefficients for internal consistency of subscales were .94 and .93, respectively. Construct validity was established by principal components factor and hierarchical regression analysis. Factor loadings on the calcium subscale ranged from .38 to .86; factor loadings on the exercise subscale ranged from .70 to .83.

The score on the Osteoporosis Self-Efficacy Scale was an interval measure. The sample mean was calculated and confidence levels were established for estimation of the population mean. Exercise was measured on a 10-point scale where 0 means "Not at all Confident" and 10 means "Very Confident." The 10 exercise items were summed, multiplied by 10, divided by 10 (the number of items) and converted to percentile scores for Exercise.

Calcium was measured on a 10-point scale where 0 means “Not at all Confident” and 10 means “Very Confident.” The 11 exercise items were summed, multiplied by 10, divided by 11 (the number of items) and converted to percentile scores for Calcium.

Daily Calcium Intake. Measured by a 30-item Dietary Calcium Rapid Assessment Method (RAM) tool (Hertzler & Frary, 1994). Food items are listed in five categories: (a) dairy (milk, yogurt, cheeses); (b) fruit and vegetables; (c) bread, cereal, rice and pasta; (d) meat, fish, poultry, dried beans and nuts; (e) fat, sugar and alcohol. Respondents indicate the number of servings they ate of each food on a typical day in the last week. Servings are converted to milligrams of calcium by multiplying servings by calcium values and summing. Test-retest reliability at 3 weeks was $r=.80$ (Hertzler & Frary, 1994). Construct validity was established by comparing RAM scores with 3-day food records $r= .68$; others reported an $r= .64$ to $.76$ between sections of the RAM and 7-day dietary records (Hertzler & Frary, 1994).

Supplemental Calcium and Vitamin D Intake. One researcher-developed item will ask respondents to identify the type of calcium supplement they take, amount of calcium in milligrams in each tablet/pill/unit, and number of tablets/pills/units taken/day. The mg/tablet will be multiplied by number/day to calculate a total calcium supplement intake. Another researcher-developed item will ask respondents to identify the type of vitamin D supplement they take and amount taken each day. The amount will be multiplied by number/day to calculate total vitamin D supplement intake.

Total Calcium Intake. Score obtained by adding the Dietary Calcium Rapid Assessment tool (RAM), (Hertzler & Frary, 1994) and an investigator developed question regarding supplemental intake.

Daily Activity. Measured using the 39-item Yale Physical Activity Survey (YPAS) (Dipietro, Caspersen, Ostfeld, & Nadel, 1993). This tool measures a broad range of activities in older adults. A weekly walking score is calculated by times per week walked and minutes spent walking. Daily activity scales have shown acceptable reliability (test-retest correlations over 2 weeks ranging from $.42$ -. $.65$). Construct validity has been established through known group (retirement home/community center elders) $t=8.41$, $p< .0001$; other self-report measures (i.e., CHAMPS $r= .68$, $p< .0001$); and physiologic measures (i.e., estimated oxygen capacity, VO_{2max} ; percent body fat; body mass index).

Amount of Alcohol Intake. Summed scores on three items from the Osteoporosis Survey (Section I), #20 to #22, asking about daily beer, wine, and liquor intake. Test-retest; $r=.86$; $p<.0001$.

Amount of smoking. Self-report of the number of cigarettes smoked per day from the Osteoporosis Survey (Section I), item #23. Test-retest; $r=.95$; $p<.0001$.

Hormonal drug therapy. Self-report response to items regarding use or nonuse of hormonal therapy on the Osteoporosis Survey (Section I), items #7, #8, #9, #12. Face validity.

Non-hormonal Drug Therapy. Self-report response to five questions regarding use or nonuse of non-hormonal drug therapy to prevent bone loss and/or to increase bone density, in the Osteoporosis Survey (Section I), #6, #10, #11, #13, #14, #15. Face validity.

Sociodemographic Data. Items include self-report of age, income, race, gender (gender identity, sexual orientation, sex assigned at birth), relationship status/living arrangement, occupation; self-report of fractures (hip, spine, neck, wrist); family history of osteoporosis indicated by subject’s self-report that a family member has/had osteoporosis or a history of a fracture of the hip, spine, neck, or wrist.

4. Summary of Findings

Sample Demographics

There were 31 participants; the goal was for a sample of 30 participants, however, there was an overwhelming response to taking the online survey and the final sample included 31 individuals who completed the survey. Participants were given the choice to take the survey either online via Qualtrics (2013) or via paper. Of the 31 participants, 30 completed the online Qualtrics survey and one completed the paper survey.

Ages of participants ranged from 30 to 71 years ($M=43$, $SD=11.5$) (see Table 1). One participant was African American and 30 were Caucasian. Twenty-eight TI reported their relationship status: 11 (35.5%) married, 7 (22.6%) single, 5 (16.1%) divorced/separated, and 5 (16.1%) monogamously coupled (ongoing relationship exclusively with one person).

In terms of educational attainment, two (6.4%) were high school graduates or less, 11 (36%) had some college or vocational education, 13 (42%) were college graduates, and 5 (15.1%) had postgraduate studies. Sixteen (52%) reported making \$35,000 or less per year (before taxes) (of these 10 (62%) were making \$15,000 or less), and 13 (42%) reported an income from \$35,001 to 70,000. For current employment status, 19 (61.3%) were employed, 12 (38.7%) were not employed. For participants' living arrangement, 16 (51.6%) reported living with a spouse or friend, 11 (35.5%) were living with other family members, and 4 (12.9%) lived alone.

Of the 27 participants who identified themselves as transgender, 14 (45.2%) identified as male-to-female (MtF) and 13 (41.9%) identified as female-to-male (FtM). The remaining four participants identified themselves as either gender queer ($N=1$), intersex ($N=1$), gender fluid ($N=1$), or misgendered at birth ($N=1$). Of the 31 participants, 16 (51.6%) were assigned to male gender at birth, and 15 (48.4%) were assigned to female gender. Fifteen (48.4%) participants had received transgender related surgeries.

Analysis

The research questions for this pilot study were as follows:

1. What is the knowledge about OP prevention in TI 30 years of age and older?
2. What are health beliefs (susceptibility, seriousness, benefits to calcium intake, benefits to weight bearing exercise, barriers to calcium intake, barriers to weight bearing exercise, motivation, self-efficacy calcium intake, self-efficacy exercise) about OP prevention in TI 30 years of age and older?
3. What are the OPB (calcium intake, vitamin D intake, weight bearing exercise, not smoking, limited alcohol use) that TI 30 years of age and older engage in?
4. What are TI perceptions of bone health and OP?

For research questions #1, # 2, and #3, in order to describe the knowledge of OP prevention, health beliefs about OP prevention, and OPB in TI, descriptive statistics were used (mean, standard deviation, distribution form, 95% confidence interval). Given the exploratory nature of this project, evidence of subgroup differences (e.g. MtF; FtM) were descriptively explored. Statistical analyses were carried out using the Statistical Package for Social Sciences (SPSS) (2012) version 21.0 statistical software.

Results

Question 1: Knowledge of Osteoporosis

The following are the results for the first research question: What is the knowledge about OP prevention in TI 30 years of age and older?

Results from this study of 31 participants revealed that the percentage score on the OKT ranged from 15.6% to 90.3%, with a mean of 50.2, SD 16.33, and 95 % CI 44.2 to 56.19. The percentages expressed in letter grades were: 1 A, 3 C's, 0 D's, and 27 F's. Thus, the TI performed poorly on the knowledge measure with 81% of participants failing the test.

There was no statistically significant difference between MtF's and FtM's osteoporosis knowledge score ($p = .21$, α at .05). Neither the MtF's nor the FtM's performed at a high level on this measure of knowledge. On the grade scale, the mean score for the MtF's was 46.2 which is a letter grade of an F on knowledge of osteoporosis, whereas the mean score for the FtM's was 54.5, indicated also by the letter grade of an F on the knowledge of osteoporosis.

Question 2: Health Beliefs and Self-Efficacy

The following are the results for the second research question: What are the health beliefs (susceptibility, seriousness, benefits to calcium intake, benefits to weight bearing exercise, barriers to calcium intake, barriers to weight bearing exercise, motivation, self-efficacy calcium intake, self-efficacy exercise) about osteoporosis prevention in TI 30 years of age and older? (See Table 2).

Susceptibility. The items were summed, divided by 6 resulting in a "susceptibility" score with a range of 1 to 5. The mean susceptibility score was 2.68 with a standard deviation of .80. The 95% confidence interval for the mean of 2.68 indicated that the population mean is likely to be within the range of 2.38 to 2.97. TI did not perceive themselves as being susceptible to developing osteoporosis (mean susceptibility score of 2.68 indicating they fall between 'disagree' and 'neutral' on susceptibility).

Seriousness. The items were summed, divided by 6 resulting in a "seriousness" score with a range of 1.3 to 4.5. The mean seriousness score was 2.66 with a standard deviation of .72. The 95% confidence interval for the mean of 2.66 indicated that the population mean is likely to be within the range of 2.39 to 2.93. TI did not perceive osteoporosis as a serious threat (mean seriousness score of 2.66 indicating they fall between 'disagree' and 'neutral' to what degree osteoporosis is a serious threat).

Benefits of calcium. The items were summed, divided by 6 resulting in a "benefits calcium" score with a range of 2.50 to 5.00. The mean benefits of calcium score was 3.50 with a standard deviation of .57. The 95% confidence interval for the mean of 3.50 indicated that the population mean is likely to be within the range of 3.36 to 3.79. TI perceived somewhat in the benefits of calcium in preventing the development of osteoporosis (mean benefits of calcium score of 3.50 falling between 'neutral' and 'agree' in terms of benefits of calcium).

Benefits of exercise. The items were summed, divided by 6 resulting in a "benefits exercise" score with a range of 2.30 to 5.00. The mean benefits of exercise score was 3.80 with a standard deviation of .54. The 95% confidence interval for the mean of 3.80 indicated that the population mean is likely to be within the range of 3.65 to 4.05. TI believed somewhat in the benefits of exercise in preventing the development of osteoporosis (mean benefits of exercise score of 3.80 close to 'agree').

Barriers to calcium intake. The items were summed, divided by 6 resulting in a "barriers to calcium intake" score with a range of 1.00 to 3.50. The mean barriers to calcium

intake score was 2.17 with a standard deviation of .70. The 95% confidence interval for the mean of 2.17 indicated that the population mean is likely to be within the range of 1.91 to 2.43. The TIs did not perceive that there are barriers to taking calcium to prevent osteoporosis (mean barriers to calcium intake score of 2.17).

Barriers to exercise. The items were summed, divided by 6 resulting in a “barriers to exercise” score with a range of 1.0 to 4.0. The mean barrier to exercise score was 2.19 with a standard deviation of .84. The 95% confidence interval for the mean of 2.19 indicated that the population mean is likely to be within the range of 2.19 to 2.80. The TI do not perceive that there are barriers to conducting exercise (mean barriers to exercise score of 2.19).

Health motivation. The items were summed, divided by 6 resulting in a “health motivation” score with a range of 2.33 to 4.67. The mean health motivation score was 3.60 with a standard deviation of .53. The 95% confidence interval for the mean of 3.60 indicated that the population mean is likely to be within the range of 3.41 to 3.81. The TI have some motivation or readiness for engaging in general health behaviors to reduce the risk of developing osteoporosis (mean health motivation score of 3.60 between ‘neutral’ and ‘agree’).

Total score of OHBS (for the seven subscales). The mean of the total OHBS score was 3.01 with a standard deviation of .29. The 95% confidence interval for the mean of 3.01 indicated that the population mean is likely to be within the range of 2.90 to 3.11. Thus, when averaging across all subscales, osteoporosis health beliefs of TIs are right at a score of 3 (neutral). The previously presented subscale results, however, indicate that health beliefs vary greatly across different subdomains of osteoporosis health beliefs. Thus, the overall score obscures differences at the subdomains and attention should be paid to the latter rather than the former.

There was no statistically significant difference between MtF’s and FtM’s total health belief score. However, there was a statistically significant difference for their health motivation scores ($p = .012$, α at .05). The mean health motivation score for FtM was 23.07 vs. 20.42 for MtF. This indicates that FtM’s have higher motivation or readiness for engaging in general health behaviors to reduce the risk of developing osteoporosis compared to the MtF’s.

The Osteoporosis Self-Efficacy Scale (OSES). (See Table 2). The mean OSES exercise score was 52.2 with a standard deviation of 22.8. The 95% confidence interval for the mean of 52.2 indicated that the population mean is likely to be within the range of 43.8 to 60.6.

The mean OSES calcium score was 63.8 with a standard deviation of 22. The 95% confidence interval for the mean of 63.8 indicated that the population mean is likely to be within the range of 55.7 to 71.9.

There was no statistically significant difference between MtF’s and FtM’s OSES exercise score ($p = .617$, α at .05). The mean self-efficacy exercise for FtM was 53 versus 48.6 MtF. There was no statistically significant difference between MtF’s and FtM’s OSES calcium score ($p = .68$, α at .05). The mean self-efficacy calcium for FtM was 64.1 vs. 60.6 MtF.

Total Osteoporosis Self-efficacy (OSES) score (for the two subscales). The mean of the total OSES score was 116.1 with a standard deviation of 35.1. The 95% confidence interval for the mean of 116.1 indicated that the population means is likely to be within the range of 103.2 to 129.0. Thus, when averaging across all subscales, osteoporosis health beliefs of TIs are at a score of 5.8 which is slightly above neutral.

There was no statistically significant difference between MtF’s and FtM’s total OSES score ($p = .577$, α at .05). The mean total OSES for FtM was 117.2 versus 109.2 MtF. There was no statistically significant difference between MtF’s and FtM’s OSES exercise score ($p =$

.617, α at .05). The mean self-efficacy exercise for FtM was 53 versus 48.6 MtF. There was no statistically significant difference between MtF's and FtM's OSES calcium score ($p = .68$, α at .05). The mean self-efficacy calcium score for FtM was 64.1 vs. 60.6 MtF.

Question 3: Osteoporosis Prevention Behaviors (OPB)

The following are the results for the third research question: What are the OPB (calcium intake, vitamin D intake, weight bearing exercise, not smoking, limited alcohol use) that TI 30 years of age and older engage in?

Daily Calcium Intake. The daily dietary calcium intake means score range from 0 to 435 milligram (mg.) daily, with a mean of 144 mg. and standard deviation of 111. The 95% confidence interval for the mean of 144 mg. indicated that the population mean is likely to be within the range of 103 to 186. These numbers are excluding the addition of 250 mg. that the National Osteoporosis Foundation suggests that individuals can obtain from supplements and other dietary nondairy sources (NOF, 2014). Thus, TI daily calcium intake is less than the recommended daily 1,200mg. There were 27 (87%) participants who reported taking daily calcium supplements ranging between 220 mg to 500 mg daily.

Vitamin D Intake. There were seven (22.6%) participants of the 31 who reported taking a vitamin D supplement. The recommended amount of vitamin needed for women and men under age 50 is 400 to 800 IU daily, and for those age 50 and older it is 800 to 1000 IU daily (NOF, 2014; IOM, 2010). One participant (3.2%) took 200 International Units (IU) per day, two (6.5%) took 1,000 IU per day, and two (6.5%) took 2,000 IU per day. Two participants reported taking a vitamin D supplement but did not specify the amount. Thus, the range of daily vitamin D via supplements was 200 IU to 2000 IU, with a mean of 1240 IU, and SD= 766.9 IU per day.

Weight Bearing Exercise. For this study, weight-bearing exercise was calculated from the activity dimension score for walking. The total time for this activity is expressed as minutes per day. The walking activities (causing large increase in breathing, heart rate or leg fatigue or caused one to perspire) mean score range from 0 to 51 minutes per day, with a mean of 11 minutes a day and standard deviation of 15.3. The 95% confidence interval for the mean of 11 indicated that the population mean is likely to be within the range of 5.4 to 16.9. This is below the recommended 30 minutes a day of weight bearing exercise (NOF, 2015).

Smoking and Alcohol Use. The majority ($n=24$, 77.4%) of the participants did not smoke cigarettes. About half ($n=18$, 58%) reported not using alcohol. However, for those who reported alcohol use, the mean score ranged from 0 to .74 glasses of alcohol per day, with a mean of .46 and standard deviation of .74. The 95% confidence interval for the mean of .46 indicated that the population mean is likely to be within the range of .18 to .74.

Cross-Sex Hormone Use. Twenty-eight (90%) of the 31 participants reported using cross-sex hormones.

OPB MtF and FtM. There was no statistical significance between MtF's and FtM's in any of the osteoporosis prevention behaviors (calcium intake, vitamin D intake, weight bearing exercise, not smoking, limited alcohol use). The mean calcium intake score for FtM was 128 mg. versus 147 mg a day for MtF. The mean vitamin D intake via supplement for FtM was 1,066 IU per day versus 1,500 IU per day for MtF.

For alcohol use score ($p = .60$, α at .05), the mean alcohol use score for FtM was .52 glasses vs. .37 for MtF. For the vigorous activities score ($p = .15$, α at .05), the mean vigorous activities score for FtM was 25.1 minutes a day versus 14.1 minutes a day for MtF. For the

walking activities score ($p = .66$, α at .05) the mean walking activities score for FtM was 12.3 minutes a day versus for MtF 9.6 minutes a day.

Question 4: Perceptions of Bone Health and Osteoporosis

The following are results for the fourth research question: What are TI perceptions of bone health and OP? To better understand perceptions of knowledge, health beliefs, and OPB for bone health and osteoporosis prevention based on the focus of the research questions, participants were asked to describe their experiences of bone health and OP. The qualitative data was transcribed and entered into NVivo 10 (QSR, 2012) software. Open coding and category formation was used to identify common themes. Two members of the research team, four nursing graduate assistants (two graduate, two doctoral), and one faculty independently analyzed the 15 TI interview transcripts. Content analysis was conducted to determine recurrent themes throughout the interviews. Data were coded and like components were then extracted from the transcript text into broad groups. Once common themes and contrasting statements were ascertained, these were then discussed in the team meetings so that consensus was confirmed.

Data were analyzed using constant comparison techniques (Glaser, 1967). Credibility was supported using memos to record decisions related to coding the data, identifying and linking categories to determine themes. Member checks were used as part of an ongoing process and will include presenting the emerging findings to TI interviewed who were asked to comment about how the findings are related to their experience. The Health Belief Model (Rosenstock, 1966) was used to guide the analysis and interpretation of results

Demographics

For the subsample of the 15 TI who agreed to participate in an interview, participants were interviewed after completing the Osteoporosis Bone Health Survey. Ages ranged from 30 to 71 years of age; 60% were between ages 30 to 40 years and 40% were between ages 47 to 71. All were Caucasian. Fourteen participants answered the question about relationship status, results included: 7 (46.7%) married, 2 (13.3%) single, 2 (13.3%) divorced/separated, and 3 (20%) monogamously coupled. Four (26.7%) had some college or vocational education, 6 (40%) were college graduates, and 5 (33.3%) had postgraduate studies. For total yearly family income (before taxes), 5 (33.3%) reported making \$20,000 or less per year, and 6 (40%) made \$50,000 or more. Twelve (80%) were employed. For living arrangement, 9 (60%) reported living with a spouse or friend, 5 (33%) lived with family members, and 1 (7%) lived alone.

All participants identified themselves as transgender. Nine (60%) identified as female-to-male (FtM) and six (40%) male-to-female (MtF). Six (40%) were assigned to male gender at birth, and nine (60%) were assigned to female gender. Eleven (73.3%) of the participants had transgender related surgeries.

Essential Elements

Findings of this study revealed two essential elements of TI perceptions of bone health and osteoporosis: Knowing and Doing. There were 3 dominant themes within the essential element of Knowing (what I know, what I don't know, and what I want to know) and 2 dominant themes within the essential element of Doing (what I do and what I should do).

Knowing

Knowing is to perceive or understand as fact or truth: to apprehend clearly and with certainty (Dictionary.com, 2015). Most of the participants knew (*what I know*) something about bone health and OP. Many stated that they did not know enough or what they did know was incorrect (*what I don't know*). All participants stated they wanted to know more especially about how their cross-sex hormones effect bone health (*what I want to know*).

What I know. The first dominant theme of knowing was “*what I know.*” Many of the participants have some knowledge about bone health and OP. One transwoman stated, “What I know is that as we age, the bones get less dense, they become more porous and, and more fragile.”

Some of the participants stated that they knew diet, activity level, weight bearing exercise, and smoking can effect bone health, “Yeah, weight bearing exercises mostly and increasing my calcium intake ... I get my calcium from the milk and yogurt.”

Another said,

Um, I do know that smoking makes it worse. A lot of soda um, hurts your bones. Um, um basically I know that it makes your... bones are less dense and easier to break in osteoporosis. That's about all I know.

In addressing activity and weight bearing exercise, one participant stated, “I know that me being more active is more conducive to proper bone density and bone health.”

What I don't know. The next dominant theme of knowing was “*what I don't know.*” Many participants revealed that they did not know much about bone health maintenance and OP prevention. Many participants said they did not know much if anything at all about bone health and OP. One stated “I don't know an awful lot about um, bone health.” There were some participants who stated that they knew about bone health and OP but had incorrect knowledge. Once participant said, “...if you donate bone marrow, it can help your bone health.” Later in the interview he stated,

I know that weight bearing exercises are good for your bones because the strain that they put on your bones like, helps create these like, micro fissures which then fill in with new bone, which makes your bones better.

When asked about the recommended dose of calcium per day to prevent OP, one transwoman stated, “I want to say 2,000 milligrams a day.”

There were many who also stated that they did not know anything about long term use of cross-sex hormones and the effects on bone health maintenance and OP prevention. One participant stated, “I don't know a whole lot about how the trans experience [taking cross-sex hormones] affects [bones].”

What I want to know. The final theme of the element of Knowledge is “*what I want to know.*” This theme reveals that participants wanted more knowledge about maintaining bone health and preventing OP. One participant stated, “I'd like to know how being on hormones is going to affect my bone health and what kind of risks that puts me at” [for OP].

Many of the participants wanted to know how hormones affect bone health. One participant wanted to know what dose of hormones “won't be, dangerous in terms of, contributing to blood clots or other cancers or other issues, but will also protect against uh, bone loss.” A few

participants stated that no one is providing them with information about hormone use and bone health “not one person in the 13 years that I’ve been on hormones has anyone ever spoken to me about my bone health.” Another participant in regard to wanting more information stated

I would like for there to be more information in general for people that are making the decisions to use testosterone and also how much they’re going to use. And if there was more, if it was more clear about how to assess the impact (testosterone) on my bone ...that would help me to know whether what I’m doing is safe or not.”

Doing

Doing is defined as taking action (Dictionary.com, 2015). In this study, a few participants spoke openly about the actions they were taking to maintain bone health and prevent OP (*What I do*). Some participants spoke about the actions they knew they should be doing (*What I should do*) but admitted that they weren’t doing such as engaging in weight bearing exercises or eating a diet high in calcium. *What I do* and *what I should do* are the two dominant themes within the essential element of *Doing*.

What I do. The first dominant theme of Doing is *What I do*. There were participants who spoke about taking action to maintain bone health. They spoke about exercise, diet, and the use of supplements. A transwoman stated “I take the vitamin supplements, I get out, I exercise, I drink milk.”

One transman put it all together when he stated,

I’ve been doing some strengthening techniques, I’ve been taking supplements just recently. I did [get], one of those fitness things that does your calorie and nutrition things. And it was basically saying that I’m really lacking in calcium so I started-taking a supplement. It’s calcium, magnesium, zinc, and D.

What I should do. The second dominant theme of Doing is *What I should do*. Some participants said that they knew about exercise and diet, and they were aware that they needed to do more in order to maintain bone health. One transman stated, “I know that I need to exercise more than I do and I have a pretty uh, pretty solid diet, a pretty good diet so it’s not really come up.” Another transman stated that “walking is basically what I do in terms of exercise.” But a few minutes later he stated, “I know that I need to do more in terms of physical exercise ...So ... the things that I should be doing and the things that I am doing, it, it, it is concerning ...I would definitely say that I uh, need to start doing more and thinking about it more.”

5. Recommendations

Determining TI perceptions of bone health and OP is important because of the unique healthcare issues TI have. The issue of improving osteoporosis prevention behaviors, particularly dietary calcium intake and weight bearing exercise are issues that both men and women face during aging as bone density decreases. However, the transgender population is faced with compounding issues of cross-sex hormone use, particularly when they self-manage their hormones by purchasing these online or sharing with one another. Self-management can result in hormone imbalance which can have a long term effect on bone health. Clearly, TI lack knowledge about behaviors that promote bone health and prevent OP. Healthcare providers need to educate this at-risk minority population on how to be proactive in maintaining bone health

including diet, exercise, risk factors, and cross-sex hormone use so that health beliefs about OP prevention and management can be enhanced.

Testimonial

Receiving the Sigma Theta Tau International/American Nurses Foundation Grant for the study "Transgender Individuals and Osteoporosis Prevention" helped to produce pilot data on the knowledge, health beliefs, and osteoporosis preventing behaviors of transgender individuals. This serves to help expand the scientific knowledge base about bone health, bone health behaviors, and health knowledge/beliefs of transgender individuals so that interventions can be planned for preventing osteoporosis. This served as an important step in my research for recognizing the need for bone health care in the transgender population, an underserved group, with limited access to healthcare, so that a new direction can be established for my long standing work over the past decade related to osteoporosis prevention and behavior change in men and women.

References

- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, *84*, 191-215.
- Champion, V., & Skinner, C. (2008). The health belief model. In K. Glanz, B. Rimer, & K. Viswanath (Eds.), *Health behaviors and health education: Theory, research, and practice* (4 ed., pp. 45-65). San Francisco: CA: Jossey-Bass.
- Dictionary.com (2015). *Knowing*. Retrieved from <http://dictionary.reference.com/browse/knowning?s=t>
- Dictionary.com (2015). *Doing*. Retrieved from <http://dictionary.reference.com/browse/doing?s=t>
- Dipietro, L., Caspersen, C. J., Ostfeld, A. M., & Nadel, E. R. (1993). A survey for assessing physical activity among older adults. *Medicine and Science in Sports and Exercise*, *25*, 628-642.
- Doheny, M. O., Sedlak, C. A., Estok, P. J., & Zeller, R. A. (2011). Bone density, health beliefs, and osteoporosis preventing behaviors in men. *Orthopaedic Nursing*, *30*(4), 266-272.
- Doheny, M. O., Sedlak, C. A., Hall, R. J., & Estok, P. J. (2010). Structural model for osteoporosis preventing behavior in men. *American Journal of Men's Health*, *4*(4), 334-343.
- Estok, P. J., Sedlak, C. A., Doheny, M. O., & Hall, R. (2007). Structural model for osteoporosis preventing behavior in postmenopausal women. *Nursing Research*, *56*(3), 148-158.
- Gendler, P. E., Coviak, C. P., Martin, J. T., Kim, K. K., Dankers, J. K., Barclay, J. M., & Sanchez, T. A. (2014). Revision of the Osteoporosis Knowledge Test: Reliability and validity. *Western Journal of Nursing Research*.
<http://wjn.sagepub.com/content/early/2014/06/11/0193945914537565.full.pdf+html>
- Glaser, B. G. (1967). The discovery of grounded theory; strategies for qualitative research [by] Barney G. Glaser and Anselm L. Strauss., x, 271. Aldine Publishing.
- Griffin, S. (2013). Primary prevention of osteoporosis. *InnovAiT*, *6*(3), 148-154.
- Hertzler, A. A., & Frary, R. B. (1994). A dietary calcium rapid assessment method (RAM). *Topics in Clinical Nutrition*, *9*(3), 76-85.
- Horan, M. L., Kim, K. K., Gendler, P., Froman, R. D., & Patel, M. D. (1998). Development and evaluation of the Osteoporosis Self-Efficacy Scale. *Research in Nursing and Health*, *21*, 395-403.

- Institute of Medicine [IOM]. (2010). *Dietary Reference Intakes for Calcium and Vitamin D*. Washington, DC: The National Academies. <http://www.iom.edu/Reports/2010/Dietary-Reference-Intakes-for-Calcium-and-Vitamin-D.aspx>
- Janz, N. K., & Becker, M. H. (1984). The Health Belief Model: A decade later. *Health Education Quarterly*, *11*, 1-47.
- Kim, K., Horan, M., & Gendler, P. (2011). Osteoporosis Knowledge Test (Revised 2011). Grand Valley State University, MI.
- Kim, K. K., Horan, M. L., & Gendler, P. (1991). *Osteoporosis Knowledge Test, Osteoporosis Health Belief Scale, and Osteoporosis Self-efficacy Scale*. Grand Valley State University, Allendale: MI.
- Kim, K. K., Horan, M. L., Gendler, P., & Patel, M. K. (1991). Development and evaluation of the Osteoporosis Health Belief Scale. *Research in Nursing and Health*, *14*(4), 155-163.
- National Osteoporosis Foundation [NOF]. (2015). Retrieved from <http://nof.org/learn/basics>
- National Osteoporosis Foundation [NOF]. (2014). *Clinician's guide to prevention and treatment of osteoporosis*. Washington DC, MD, National Osteoporosis Foundation. Retrieved from <http://nof.org/files/nof/public/content/file/2791/upload/919.pdf>
- QSR International Pty Ltd. (2012). *NVivo qualitative data analysis software*, Version 10.
- Qualtrics, (2013). *Online surveys*. Provo, UT, USA. <http://www.qualtrics.com>
- Rosenstock, I. M. (1966). Why people use health services. *Milbank Memorial Fund Quarterly*, *44*(3) (Suppl), 94-127.
- Rosenstock, I. M., Strecher, V. J., & Becker, M. H. (1988). Social learning theory and the Health Belief Model. *Health Education Quarterly*, *15*(Summer), 175-183.
- Sedlak, C. A., Doheny, M. O., Estok, P. J., Zeller, R. A., & Winchell, J. (2007). DXA, health beliefs, and osteoporosis prevention behaviors. *Journal of Aging & Health*, *19*(5), 742-756.
- Statistical Package for Social Sciences (SPSS). (2012). *SPSS Statistics*, Version 21.0. Armonk, NY: IBM Corp

Table 1 Demographics

Mean Age	43 years	
Age Range	30 to 71 years	
	N	%
Race		
Caucasian	30	96.8
African American	1	3.2
Gender		
Female-to-Male / FtM	13	41.9
Male-to-Female / MtF	14	45.2
Other	4	12.9
Education		
High-school, some college or vocational ed.	13	42.4
College Graduate or Post Graduate	18	57.1

Table 2 Health Beliefs (N=31)

Health Belief Subscales (HBS)	Mean Score for Each Scale (range 1 to 5)
Susceptibility	2.68
Seriousness	2.66
Benefits of calcium intake	3.50
Benefits to exercise	3.80
Barriers to calcium intake	2.17
Barriers to exercise	2.19
Health Motivation	3.60
Total Health Belief Score	3.0 (SD= .29)
Self-Efficacy (SE) Subscales	Mean Score for Each Scale (SE calcium intake subscale range is 0 to 100; SE exercise subscale range is 0 to 100; total SE scale range is 0 to 200).
Confidence about calcium intake	63.8
Confidence about exercise	52.2
Total SE Score	116.1 (SD=35)