CE

1.5 ANCC Contact Hours

Transgender Individuals and Osteoporosis Prevention

Carol A. Sedlak ▼ Cyndi Gale Roller ▼ Manfred van Dulmen ▼ Homood A. Alharbi ▼ Jessica D. Sanata ▼ Marci A. Leifson ▼ Amy J. Veney ▼ Hossam Alhawatmeh ▼ Margaret O'Bryan Doheny

BACKGROUND: Risk behaviors and hormone use place transgender individuals (TIs) in jeopardy for osteoporosis.
PURPOSE: The purpose of this study was to expand the science about the knowledge, health beliefs, and osteoporosis (OP) preventing behaviors of TIs.
METHODS: This was a mixed-methods pilot study of a convenience sample of 31 TIs 30 years and older. Participants completed an online Osteoporosis Bone Health Survey. Fifteen participants were randomly selected for an interview to describe their perceptions of bone health.
RESULTS: Transgender individuals performed poorly on the knowledge measure. There were no significant findings for osteoporosis health beliefs. Participants' daily dietary dairy calcium intake was 800 mg and daily walking activity was 17 minutes. Perceptions of bone health revealed two essential elements, *knowing* and *doing*.
CONCLUSION: Determining TIs' bone health perception is important because of their unique healthcare issues. Healthcare providers need to be aware of TIs' bone health needs to help enhance TIs' OP knowledge, health beliefs, and preventing behaviors.

Introduction

Transgender individuals' (TIs') healthcare needs are many and complex. The healthcare disparity they experience results in poor and limited access to healthcare and health information, placing TIs at a higher risk for reduced health status. Because of stigma, discrimination, and insensitive care, when TIs decide to obtain healthcare, they struggle with navigating the healthcare system to get their unique healthcare needs met (Roller, Sedlak, & Draucker, 2015). This stigma and discrimination also results in risk behaviors that include self-medicating with cross-sex hormones (CSHs) and hormone blockers often obtained via the Internet or from friends (Center of Excellence [CoE], 2012; Institute of Medicine [IOM], 2011a). Use of CSHs can potentially affect bone mineral density (BMD) and place TIs at risk for developing osteoporosis (OP) (IOM, 2011a). Despite TIs' unique health profiles, risk behaviors, and use of CSH therapy, the research is sparse in addressing bone health and OP prevention among TIs. In fact, the research addressing TIs has been limited, with a focus on human immunodeficiency virus prevention, mental health issues, and violence prevention (Baguso, Gay, & Lee, 2016; Blosnich et al., 2016; Frye et al., 2015; Mustanski, Andrews, & Pucket, 2016; Sun, Reboussin, Mann, Garcia, & Rhodes, 2016; Wilson, Arayasirikul, & Johnson, 2013).

The lack of research addressing TIs limits the understanding about this marginalized population. Although there are studies that have included the lesbian, gay, and bisexual community, few studies have included TIs as part of the study population. Consistent with the IOM report on the health of lesbian, gay, bisexual, and transgender (LGBT) people (IOM, 2011a), the National Institutes of Health LGBT Research Coordinating Committee (National Institutes of Health, 2012) acknowledged that there are large research gaps and many areas of opportunity to increase the understanding of TIs' health needs and concerns. This includes understanding and addressing TIs' health inequities, and increasing healthcare-seeking

Carol A. Sedlak, PhD, RN, CNS, FAAN, Professor Emeritus, College of Nursing, Kent State University, Kent, OH.

Cyndi Gale Roller, PhD, RN, CNP, CNM (deceased), Associate Professor and Director Women's Health, College of Nursing, Kent State University, Kent OH.

Manfred van Dulmen, PhD, Professor and Associate Chair, Department of Psychological Services, Kent State University, Kent, OH.

Homood A. Alharbi, PhD, MSN, RN, Assistant Professor, Nursing College, King Saud University, Riyadh, Saudi Arabia.

Jessica D. Sanata, MSN, MBA, RN, CEN, Doctoral Student, Oregon Health and Science University School of Public Health, Portland, OR.

Marci A. Leifson, MSN, RN, AGCNS-BC, Stroke Nurse Coordinator, Boston Medical Center, Boston, MA.

Amy J. Veney, MSN, RN, CNE, Lecturer, College of Nursing, Kent State University, Kent, OH.

Hossam Alhawatmeh, PhD, RN, Assistant Professor, Jordan University of Science and Technology (as of September, 2017).

Margaret O'Bryan Doheny, PhD, RN, CNS, FAAN, Professor Emeritus, College of Nursing, Kent State University, Kent, OH.

This research was funded through a Sigma Theta Tau International/ American Nurses' Foundation Grant, October 2014.

The authors and planners have disclosed no other potential conflicts of interest, financial or otherwise.

DOI: 10.1097/NOR.0000000000000364

behaviors for routine screenings, preventive care, and care for acute and/or chronic illnesses.

Primary care is an essential component of healthcare for TIs because their risk for chronic conditions is comparable to the population at large. However, TIs are at even higher risk for long-term adverse health outcomes because of multiple health disparities and not accessing needed healthcare (Grant et al., 2011; IOM, 2011a). Just as the general public with cisgender individuals (gender matches the sex assigned at birth), TIs are at risk for cancer, cardiovascular disease, diabetes mellitus, and osteoporosis (CoE, 2012).

Osteoporosis is a serious, debilitating, age-related public health problem important to nurses and healthcare providers. Osteoporosis is characterized by loss of bone and bone strength, with an increased risk of fractures (Cosman et al., 2014). It is estimated that the cost of OP will soar to $25.3 billion by 2025 (Burge et al., 2007). Maximum BMD is reached by age 30 years and then begins to gradually decrease after age 30, with a more rapid loss for women at menopause (American Academy of Orthopaedic Surgeons, 2012; National Institutes of Health, 2015). Modifiable risk factors for OP include diet low in calcium and vitamin D, lack of exercise, smoking, alcohol use, substance use, use of steroids, and hormonal factors (Cosman et al., 2014; Radix & Deutsch, 2016).

Like the cisgender population, transgender individuals experience these modifiable risk factors as part of their multiple, interacting, and cumulative lifestyle habits (IOM, 2011a). These risk factors along with TIs' use of CSHs may put them at increased risk for OP. Although evidence supports that there is an increased awareness of OP among the general population, there is no evidence of OP awareness among TIs in the nursing research.

Background

"Transgender" is a term used to describe individuals whose gender identity and/or gender expression differs from their designated sex at birth (Fenway Health, 2010). Although prevalence statistics on the number of TIs in the United States is limited, it is estimated that approximately 0.3% of adults (700,000 individuals) self-identify as transgender and these numbers are growing (Gates, 2011). Male-to-female TIs are known as MtF (transgender females or transwomen), whereas female-to-male TIs are known as FtM (transgender males or transmen) (Fenway Health, 2010; IOM, 2011a).

Transgender individuals often delay accessing healthcare, placing them at risk for poor short- and long-term health outcomes (Thrasher, Clay, Ford, & Stewart, 2012). The World Professional Association for Transgender Health (2012) Standards of Care emphasizes access to evidence-based healthcare as a right for TIs. Recently, the American Academy of Nursing on Policy published a position statement on healthcare services for TIs (Sedlak, Boyd, & American Academy of Nursing Lesbian, Gay, Bisexual, Transgender, Queer Health Expert Panel, 2016). Although there has been an abundance of nursing research addressing bone health and OP prevention, and individuals' knowledge, health beliefs for carrying out health behaviors, there is no research on TIs' knowledge, health beliefs, or OP preventing behaviors in this disparate population who are often using self-administered cross-sex hormones. Therefore, it would be a logical step to examine these variables in TIs.

Use of CSHs is the most common body modification that TIs can access to bring endocrine and psychological systems into balance (CoE, 2012), but this can potentially affect one's BMD. The stigma surrounding TIs has led to growing numbers of individuals obtaining hormones and hormone blockers via the Internet and self-medicating (CoE, 2012; The Lancet, 2013). Self-treatment with CSH therapy may increase the risk for developing OP (IOM, 2011a).

The research is limited on the use of nonphysician, unprescribed CSHs (Mepham, Bouman, Arcelus, Hayter, & Wylie, 2014). Without medical advice and knowledge required to minimize health risks from self-prescribed use of CSHs, TIs may develop misperceptions and inaccurate health beliefs that may lead to unhealthy behaviors with severe risks that include altered bone health and OP. There are no randomized controlled trials on the use of long-term CSHs and little is known about the long-term effects (Wierckx et al., 2012). With the increasing numbers of adolescents and young adults who are taking CSHs, effects of pubertal suppression on BMD have not been systematically explored and need to be studied over the long term (Smith, Madison, & Milne, 2014).

The research on fractures in TIs is also sparse (Weinand & Safer, 2015). In a systematic literature review by Weinand and Safer (2015) of CSH safety for adult TIs, results indicated that a considerable amount of the existing data has been generated from case reports with very few large cohort studies addressing long-term effects of hormone therapy. A cross-sectional study conducted in Belgium by Wierckx et al. (2012), a pioneer in transgender research, explored the side effects of CSH use in 100 TIs after sex assignment surgery who had on average a 10-year use of CSHs. Results indicated that TI men did not have OP as a side effect but TI women had significantly more low bone density and OP at the lumbar spine and radius.

The evolution of bone density, geometry, and bone turnover in transwomen in Belgium during the initial 2 years of monitored use of CSHs was investigated by Van Caenegem et al. (2015) and is recognized as one of the first prospective studies in this area. Transwomen at the onset of the study before using CSHs had lower bone density and smaller bone size compared with age-matched control men. With the monitored use of prescribed CSHs, bone turnover decreased but there was a significant decrease in muscle mass and strength. Research recommendations include lengthening the time of follow-up for addressing the long-term effects of CSHs on bone and the effect in older individuals. The time is ripe for educating TIs about the use of CSHs to increase knowledge about OP prevention and bone health awareness.

The purpose of this mixed-methods pilot study was to examine knowledge, OP health beliefs, and OP preventing behaviors of TIs. The research questions were: What knowledge do TIs 30 years and older have about OP prevention? What are the health beliefs that TIs have about OP prevention? What are the OP preventing behaviors that TIs engage in? What are TIs' perceptions of bone health and OP?

Theoretical/Conceptual Framework

The framework that guided this pilot study was the Revised Health Belief Model composed of the health belief variables susceptibility, seriousness, benefits, barriers, and motivation (Rosenstock, Stretcher, & Becker, 1988) and also incorporates Bandura's (1977) self-efficacy model that focuses on one's confidence to conduct OP preventing behaviors. On the basis of this model, individuals are more apt to engage in OP preventing behaviors such as daily calcium intake and exercise, not smoking, and limiting alcohol use, if they (a) perceive themselves to be susceptible to getting OP; (b) believe that OP is a serious threat; (c) believe that there are benefits (advantages) of specific behaviors to prevent/modify the disease; (d) perceive fewer negative aspects (barriers) to be associated with engaging in prevention behaviors; (e) have a concern and drive (benefits and motivation) for their general health; and (f) have self-efficacy or confidence to carry out the OP preventing behaviors such as daily calcium intake and daily weight-bearing exercise. Thus, individuals may be more likely to try to learn more about OP, have a change in health beliefs, and participate in OP preventing behaviors (calcium intake, weight-bearing exercise, not smoking, limit alcohol use).

Empirical studies of the relationship between health beliefs and OP preventing behaviors helped lay the foundation for understanding the influence of the health belief variables. Specific health belief studies related to OP preventing behaviors (calcium intake, exercise) include research by Doheny, Sedlak, Estok, and Zeller (2011); Doheny, Sedlak, Hall, and Estok (2010); Kim, Horan, Gendler, and Patel (1991); and Sedlak, Doheny, Estok, Zeller, and Winchell (2007). Findings in several health belief studies revealed that perceived susceptibility, seriousness, barriers, and benefits were related to OP preventing behaviors (Kim et al., 1991; McLeod & Johnson, 2011). Although knowledge about OP is not a sole predictor of behavior change, OP knowledge can influence health behavior change (Doheny, Sedlak, Estok, & Zeller, 2007; Gammage, Gasparotto, Mack, & Klentrou, 2012; Janiszewska, Kulik, Dziedzic, Żołnierczuk-Kieliszek, & Jarosz, 2014; Malak & Toama, 2015; Singh, Foster, & Khan, 2011).

Methods

Research Design

This mixed-methods descriptive pilot study was designed to determine the knowledge, OP health beliefs, and OP preventing behaviors of TIs. Institutional review board approval was obtained from Kent State University, Kent, Ohio.

Sample and Setting

Participants for this pilot study were recruited locally using an advertising flyer posted at LGBT community agency support groups and on transgender websites and listservs that provide information about services for TIs and support groups. To broaden the recruitment of TIs, participants were recruited nationally via transgender websites. Participants were located across the United States with most living in the Midwest. A convenience sample of 31 individuals who self-identified as transgender, 30 years or older, and who read and spoke English were recruited.

Procedure

Participants completed the online Osteoporosis Bone Health Survey. This was composed 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)*.

Fifteen TIs were randomly selected from the sample of 31 to participate in a qualitative interview using open-ended questions to describe their perceptions of bone health and OP. The primary reason that random sampling of the total sample was used is that this was an exploratory study with a focus on overall TIs' bone health; therefore, the interviews did not focus on FtM and MtF group differences.

Electronic communication technologies (Skype and FaceTime) were used for conducting the interviews. A member of the research team with a nursing doctorate and expertise in qualitative research conducted the interviews that were 45 to 60 minutes in length.

Instruments

Osteoporosis Knowledge

The Osteoporosis Knowledge Test (OKT-Revised) (Gendler et al., 2015) is a 32-item tool with two subscales on nutrition and exercise knowledge for OP prevention, with 11 items rated on a four-point scale; 21 items are multiple choice. Higher scores represent having more knowledge. 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 .87. The instrument has content validity as described by Gendler et al. (2015).

Osteoporosis Health Beliefs

The *Osteoporosis Health Belief Scale* (OHBS) (Kim et al., 1991) is a 42-item tool with seven subscales (susceptibility, seriousness, benefits and barriers to calcium and exercise, motivation) that assess osteoporosis-related health beliefs. Subscales were measured by five Likert items scored as strongly agree = 5, agree = 4, neutral = 3, disagree = 2, and strongly disagree = 1, indicating an individual's health belief perceptions for each of the seven health beliefs ranging from greater to lesser (e.g., having greater perceived susceptibility of OP, greater perceived seriousness of OP, greater perceived benefits of taking calcium and exercising, greater perceived barriers to taking calcium and exercising, and greater motivation for engaging in OP health activities). Test-retest reliability for the total instrument is .90, and subscale reliabilities range from .71 to .82. Construct validity was determined by factor analysis. Concurrent validity has been established in previous studies (Kim et al., 1991).

Osteoporosis Self-Efficacy Scale

The *Osteoporosis Self-Efficacy Scale (OSES)* (Horan, Kim, Gendler, Froman, & Patel, 1998) is a 21-item scale with two subscales (exercise and calcium) used to determine one's self-efficacy (confidence) for engaging in behaviors related to physical activity and calcium intake with a range of least to most confident. Previous research demonstrates well-established psychometric properties for this measure (Horan et al., 1998). Reliability coefficients for internal consistency of subscales were 0.94 and 0.93, respectively. Construct validity was established by principal components factor and hierarchical regression analysis (Horan et al., 1998).

Osteoporosis Preventing Behaviors

Daily Calcium

Daily calcium intake was measured by the dietary calcium rapid assessment method (RAM) tool (Hertzler & Frary, 1994). Food items (30) 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 number of servings of each food eaten on a typical day in the last week. Servings are converted to milligrams (mg) of calcium by multiplying servings by calcium values and summing. Test-retest reliability at 3 weeks was $r = .80$ (Hertzler & Frary, 1994). Construct validity 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 were measured by respondents' response to the self-report question about the calcium supplement they take, milligram of calcium in each tablet/pill/unit, and number of tablets/pills/units taken/day. The milligram/tablet is multiplied by number/day to calculate a total calcium supplement intake. Another item asks respondents about the vitamin D supplement taken each day and amount in international units (IU). Amount is multiplied by number/day to calculate total vitamin D supplement intake.

Activity

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

Alcohol and Smoking

Alcohol intake and smoking were measured by summed scores from three items asking about daily beer, wine, and liquor intake (test-retest $r = .86$, $p < .0001$) and self-report of the number of cigarettes smoked per day (test-retest $r = .95$, $p < .0001$).

Hormone Use

Hormonal drug therapy was reported by five self-report items, and nonhormonal drug therapy was reported in five self-report items. Both have face validity.

Analysis

The research questions addressing knowledge of OP, OP health beliefs, and OP preventing behaviors from the data in the Bone Health Survey were analyzed with descriptive statistics (mean, standard deviation, distribution form, 95% confidence interval) for the entire sample and for subgroup differences (e.g., MtF and FtM) using the Statistical Package for Social Sciences (2012) Version 21.0 software. To better understand TIs' knowledge, health beliefs, and OP preventing behaviors, the quantitative analyses were followed up with qualitative analyses using interview data. Interviews were recorded using a digital recorder and transcribed verbatim. Transcripts were then entered into NVivo 10 (QSR, 2012) software.

Content analysis of the interviews was conducted to determine recurrent themes (Graneheim & Lundman, 2004). The research team, consisting of two doctorally prepared nurse researchers, four nursing graduate assistants (two graduate, two doctoral), and one faculty, met weekly to analyze transcripts. Individual team members assigned codes to the text to capture the meaning of the text. Codes were then developed into common themes (Elo et al., 2014). Once common themes and contrasting statements were ascertained, these were discussed in the team meetings so that consensus was confirmed. Credibility was supported using memos to record decisions related to coding the data, and identifying and linking categories to determine themes.

Results

Demographics

The 31 participants ranged in age from 30 to 71 years ($M = 43.0$, $SD = 11.5$) (see Table 1). Thirty were white. Eleven (38.8%) had some college or technical school education and 18 (58%) were college graduates/postgraduates. Nineteen (61.3%) were employed. Of the 29 who reported annual income, 16 (52%) made $35,000 or less per year. Sixteen (51.6%) reported living with a spouse or friend. One participant (3.2%) reported having OP. Five (16.1%) reported a fracture history of the hip, spine, wrist, or neck; 11 (35.5%) reported having a family member who either had or currently has OP.

Osteoporosis Knowledge

The TIs performed poorly on the Osteoporosis Knowledge Test (OKT-Revised) with 81% failing. The knowledge score ranged from 15.6% to 90.3%: $M = 50.2$, $SD = 16.33$, 95% *CI* [44.2, 56.19]. On a standard school grading scale with percentages expressed in letter grades of A = 90%–100%, B = 80%–89%,

Table 1. Demographics

	N (%)
Race	
White	30 (96.8)
African American	1 (3.2)
Gender identity	
Female to male	13 (41.9)
Male to female	14 (45.2)
Other (1 gender fluid, 1 misgendered at birth)	4 (12.9)
Sex assigned at birth	
Male	16 (51.6)
Female	15 (48.4)
Cross-sex hormone use (30 responded)	
Yes	28 (90.0)
No	2 (10.0)
Transgender-related surgery	
Yes	15 (48.4)
No	16 (51.6)
Sexual orientation (29 responded)	
Pansexual	3 (10.3)
Heterosexual	6 (20.7)
Gay	2 (6.9)
Lesbian	5 (17.2)
Bisexual	7 (24.1)
Queer	4 (13.9)
Other (1 sexually attracted to men but not acting on it)	2 (6.9)
Relationship status (30 responded)	
Single	7 (23.2)
Married	11 (36.7)
Separated/divorced	5 (16.7)
Monogamously coupled	5 (16.7)
Other (1 polyamorous coupled, 1 complicated with people)	2 (6.7)

C = 70%–79%, D = 60%–69%, and F = 59% or less, a majority (81%) failed the knowledge test attaining a score of 59% or less. There were 1 A, 0 B, 3 Cs, 2 Ds, and 25 Fs. There was no statistically significant difference between MtF and FtM OP knowledge score (p = .21).

Osteoporosis Health Beliefs

The seven OHBS subscales were explored (refer to Table 2). There were no significant findings for the total OHBS nor for each OHBS subscale. There was no statistical significant difference between MtF and FtM total OHBS score. However, there was a statistically significant difference for their health motivation score (p = .012). The mean health motivation score for FtM was 23.07 versus 20.42 for MtF indicating that the FtM were more motivated than MtF.

Transgender individuals' self-efficacy was explored by rating their confidence about performing calcium intake activities and doing exercise (0 = least confident; 10 = most confident) on the OSES. Items for each subscale were summed and divided by 10. Possible range of scores for the total OSES is 0–200, and 0–100 for each of the two OSES subscales (calcium, exercise). There were no significant findings for either OSES subscale or the total OSES (see Table 2) and no significant difference between MtF and FtM on the OSES exercise score, the OSES calcium score, or the total OSES score.

Osteoporosis Preventing Behaviors

The following are the results of TIs' OP preventing behaviors (calcium and vitamin D intake, activity, smoking and alcohol use, CSH use).

Daily Calcium Intake

The daily dairy dietary calcium intake ranged from 0 to 3850 mg; M = 1052 mg, SD = 922, 95% *CI* [707, 1397]. Both the mean and the median (800 mg) are well below the recommended 1200 mg of calcium a day for women 51 years and older, and men 71 years and older (Cosman et al., 2014; IOM, 2011b). In further review of participants' individual daily dairy food items, there were two participants who reported an extremely large daily intake of milk (six servings [cups] a day) that is 1800 mg of calcium a day, and five or more servings of yogurt a day or 1750 mg of calcium. There were similar findings for servings of cheese. Because the amounts of servings were not realistic for a daily intake, these individuals were removed from the daily calcium analysis. There were only four (12.9%) participants who reported taking daily calcium supplements, with a daily intake that ranged between 220 and 500 mg daily. Mean daily dairy calcium intake for FtM was 898 mg versus 1142 mg for MtF; median for FtM was 750 mg versus 800 mg for MtF.

Vitamin D Intake

Seven (22.6%) participants reported taking a vitamin D supplement. The recommended amount of vitamin D for women and men younger than 50 years is 400–800 IU daily, and for 50 years and older it is 800–1000 IU daily (Cosman et al., 2014; IOM, 2011b). One participant (3.2%) took 200 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 200–2000 IU, with a mean of 1240 IU, and SD = 766.9 IU per day. Mean vitamin D supplement use was 1066 IU per day for FtM versus 1500 IU per day for MtF.

Activity

For this study, vigorous activity was calculated from the number of times during a month the individual participated in vigorous activity that lasted at least 10 minutes and caused an increase in breathing, heart rate, leg fatigue, or perspiration. The daily vigorous activity was on average 16.67 minutes (SD = 14.46). This is below the recommended 30 minutes a day of exercise (Cosman et al., 2014). Walking was calculated from the activity

Table 2. Health Beliefs ($N = 31$)

Health Belief Subscales	Mean Score for Each Scale[a]	Minimum Score Range	Maximum Score Range	*SD*	95% *CI* [Lower Limit, Upper Limit]
Susceptibility	2.68	1.00	4.00	0.80	[2.38, 2.97]
Seriousness	2.66	1.33	4.50	0.72	[2.39, 2.93]
Benefits of calcium intake	3.58	2.50	5.00	0.57	[3.36, 3.79]
Benefits to exercise	3.85	2.83	5.00	0.54	[3.65, 4.05]
Barriers to calcium intake	2.17	1.00	3.50	0.70	[1.91, 2.43]
Barriers to exercise	2.50	1.00	4.00	0.84	[2.19, 2.80]
Health motivation	3.61	2.33	4.67	0.53	[3.41, 3.81]
Total Health Belief Score	3.01	2.31	3.55	0.29	[2.90, 3.11]
Self-Efficacy Subscales	**Mean Score for Each Scale[b]**				
Confidence about calcium intake	63.88	21.82	100.00	22.05	[43.86, 60.62]
Confidence about exercise	52.24	10.00	98.00	22.84	[43.86, 60.62]
Total self-efficacy score	116.13	37.82	195.00	35.14	[103.23, 129.02]

[a]Range 1–5 (strongly disagree to strongly agree).
[b]Self-efficacy calcium intake subscale range is 0–100; self-efficacy exercise subscale range is 0–100; total self-efficacy scale range is 0–200.

dimension score for number of times per month the individual walked at least 10 minutes or more without stopping, which was not strenuous enough to cause large increases in breathing, heart rate, or leg fatigue or cause one to perspire. The daily walking activity was on average 17.94 minutes ($SD = 12.35$). Patterns of daily walking for the FtM and MtF were similar.

Smoking and Alcohol Use

The majority of participants ($n = 24$, 77.4%) did not smoke cigarettes. About half ($n = 18$, 58%) reported not using alcohol. For those who used alcohol, the mean score ranged from 0 to 0.74 glasses of alcohol per day; $M = 0.46$, $SD = 0.74$, 95% *CI* [0.18, 0.74]. The mean alcohol use for FtM was 0.52 glasses versus 0.37 for MtF.

Hormone Use

The majority of participants ($n = 28$, 90.3%) responded that they were using hormone(s). There were 14 participants taking testosterone and 14 using estrogen.

Perceptions of Bone Health and Osteoporosis

The age of the 15 TIs in the subsample who were interviewed ranged from 30 to 71 years ($M = 43.0$, $SD = 12.1$). There were nine FtM and six MtF TIs. Five dominant themes emerged from participants' narratives, *what I know*, *what I don't know*, *what I want to know, what I do,* and *what I should do*. These five were reduced to two essential elements of *knowing* and *doing*, as they relate to bone health and OP.

Knowing

The research team labeled the first essential theme as *knowing*. Knowing is to perceive or understand as fact or truth (Dictionary.com, 2015a). 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*.

A few participants knew something about bone health and OP. One transwoman stated, "What I know is that as we age, bones get less dense, become more porous and more fragile." Most said they did not know much about bone health and OP. Some participants stated that they knew about bone health and OP but had incorrect knowledge. One transman stated, "… 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 helps create micro fissures which then fill in with new bone, which makes your bones better."

There were many who also stated that they did not know anything about long-term use of CSHs 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 CSHs] affects [bones]."

All stated they wanted to know more about bone health especially how CSHs affects bone health. The theme of *what I want to know* reveals that participants wanted more knowledge about maintaining bone health and preventing OP. One transwoman 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." A few 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." A transman participant, when expressing his desire to know more about the impact of CSHs on bone health, stated:

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

Doing

The second essential theme identified was labeled *doing*. Doing is taking action (Dictionary.com, 2015b). There were two dominant themes within the essential element of *doing*: *what I do* and *what I should do*. A few participants spoke openly about what they did to maintain bone health and prevent OP. Some spoke about being motivated to do "things" to maintain bone health and prevent OP. They spoke about exercise, diet, and use of supplements. A transwoman stated, "I take vitamin supplements, I get out, I exercise, I drink milk."

Some were aware of what they should do in the way of exercise and diet to maintain bone health. One transman stated:

> Walking is basically what I do in terms of exercise … I know 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 is concerning …I would definitely say that I uh, need to start doing more and thinking about it more.

Another transman put it all together when he addressed his motivation by stating:

> 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.

Discussion

Results addressed the bone health of a group of transgender men and women. The focus was on knowledge, health beliefs, and OP preventing behaviors.

Osteoporosis Knowledge

Findings of this study suggest that TIs have very limited knowledge about OP. This is consistent with the limited knowledge about OP documented in research studies among other groups in the general population that includes men and women, and individuals of various ethnicities, ages, and education (Doheny et al., 2007; Gammage et al., 2012; Malak & Toama, 2015). The general public's knowledge of OP prevention and osteoporosis health behaviors also appears to be insufficient worldwide as described in a literature review by Janiszewska et al. (2014). There is concern that healthcare providers are not taking the time to educate patients about OP or about OP preventing behaviors. Additional concerns include suboptimal treatment of OP in individuals who have OP and present with an OP-related fragility fracture (Singh et al., 2011).

Osteoporosis Health Beliefs

The lack of significant findings for each of the seven health belief subscales of the OHBS and the OSES used in this study that addressed TIs' perceptions of OP-related health beliefs (susceptibility, seriousness, benefits and barriers to calcium and exercise, motivation, self-efficacy) is contrary to much of the research literature. McLeod and Johnson (2011) reviewed studies from 1991 through 2010 that used these tools in adult men and women. Women had greater perceived susceptibility to OP, greater perceived benefits of calcium intake, fewer perceived barriers to calcium intake, and lesser health motivation (Doheny et al., 2007, 2010; Tan et al., 2009). Men 50 years and older in a study by Doheny et al. (2011) had limited awareness of their susceptibility to osteoporosis. Women in Endicott's (2013) research with a family history of OP had greater perceived susceptibility than those without an OP family history. The results of the current pilot study of TIs may be attributed to the sample being composed of younger individuals (mean age 43 years) with possible perceptions of OP as being an "old woman's disease" or a disease of old age and they may not perceive OP as a risk. Because there has been no published research addressing TIs' bone health and health beliefs, their limited access to healthcare as an underidentified health disparate population with unique healthcare needs may subsume any perception that they too are at risk for the same health issues faced by the general public such as OP.

Although there were no significant findings for OP health beliefs, the findings supported that FtM were more motivated to engage in OP health activities than MtF. McLeod and Johnson's (2011) systematic review revealed higher health motivation in older men and women. However, in some studies, women lacked perceived health motivation to perform OP preventing behaviors compared with men (Doheny et al., 2007). Further research is needed to identify the reasons for these differences.

There were no significant findings for self-efficacy (calcium intake, exercise) and no significant findings for MtF and the FtM. This is supported by McLeod and Johnson's (2011) systematic review findings of self-efficacy of calcium intake and exercise. Endicott (2013) found no significant findings for self-efficacy between groups of women with and without a family history of OP.

Osteoporosis Preventing Behaviors

The OP preventing behavior results for daily dietary calcium intake were on average below the recommended intake of 1200 mg/day. This finding is consistent with the calcium intake results reported in the OP research. Daily activity was also low, approximately 17 minutes, which is lower than the recommended 30 minutes a day. Calcium intake and/or exercise have consistently been below the recommended guidelines in studies (Doheny et al., 2010, 2011; Nguyen, 2015; Sedlak et al., 2007; Zhang et al., 2014). Even in younger individuals, inadequate calcium intake and limited daily activity exist (Ediriweera de Silva et al., 2014; Edmonds, Turner, & Usdan, 2012).

The results for use of a vitamin D supplement by the majority of participants indicated that they were not taking a supplement and this finding is consistent with the research literature (IOM, 2012b). It is interesting that four of the seven who were taking vitamin D had a daily intake of 1,000–1500 IU. It is difficult to determine an explanation for this result. Perhaps these TIs were

having their vitamin D blood level monitored by a physician and were prescribed vitamin D for a low blood level. It is of interest to note that the Institute of Medicine (IOM, 2011b) states that the safe upper limit of vitamin D is 4,000 IU per day for most adults.

The TIs in our study did well with the modifiable risk factors of not smoking and drinking alcohol in moderation. Smoking is highly prevalent among TIs (Burkhalter, Warren, Shuk, Primavera, & Ostroff, 2009); on the basis of a national survey, 30.7% of TIs smoke and many work in smoke-filled bars resulting in exposure to secondhand smoke (Grant et al., 2010). An estimated 25% of TIs misuse alcohol or drugs to cope with the discrimination they face because of their gender identity or expression (Grant et al., 2010). Perhaps many of the TIs in this pilot did not smoke and did not use alcohol because of their higher education level. Although the majority of participants were using CSHs, it would be useful in future studies to address whether or not this is self-regulated use or regulated by a health professional.

Perceptions of Bone Health and Osteoporosis Knowing and Doing

Transgender individuals' perceptions of bone health and OP revealed two essential elements, that of *knowing* and *doing*. These findings coincide with findings of other qualitative studies on bone health and OP with individuals in the general population.

Women's knowledge of OP and OP health beliefs were examined by Williams, Cullen, and Barlow (2002), who found that women who had knowledge about OP preventing behaviors and were encouraged by their healthcare provider were "willing to take action" (Hsieh, Novielli, Diamond, & Cheruva, 2001). These women were committed to taking the correct dose of supplements, engaging in OP preventing exercises for the recommended amount of time, and taking only the recommended dose of hormones, to enhance bone health and prevent OP.

Women's experience of living with OP and lifestyle changes included the essential elements of *knowing* and *doing* in a grounded theory study conducted by Hjalmarson, Straudmark, and Klässbo (2007). Women living with OP wanted to decrease their risk behaviors and expressed their "need to learn" (p. 240) about OP and risk reduction behaviors. Once these women were educated and had more knowledge about OP, they wanted to know what they could do to prevent OP and resultant fractures.

Limitations

The findings of this pilot study should be considered in light of its limitations. The major limitation of this study is that all but one participant, who identified as African American, were Caucasian; therefore, this sample was not ethnically diverse. The researchers recognized that those who agreed to participate may have already been proactive about their health or even less likely to have risky behaviors. Although data were collected about participants' use of CSHs, an item should have been included that addressed whether the CSH use was self-regulated or regulated by a health professional.

Implications and Conclusion

Currently, there is no published nursing research on TIs' bone health and OP prevention. This is an important area for future research, with the growing number of TIs who are not only at risk for OP and possible fractures just as the general public is at risk, but who are at an additional risk because of long-term use of CSHs. Little is known about the long-term use of CSHs, particularly when initiated in young adulthood and continued into adulthood.

Determining TIs' health belief perceptions of bone health and OP is important because of their unique healthcare issues. Improving OP preventing 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 CSH use, particularly when they self-manage use of hormones. Self-management can result in hormone imbalance, which can have a long-term effect on bone health. This study revealed that TIs lack knowledge about bone health and behaviors that promote bone health and prevent OP.

This pilot study serves to assist healthcare providers in understanding TIs' knowledge deficits related to osteoporosis prevention and bone health promotion. Clinical implications include nurses working to make a difference by conducting appropriate assessments and providing education when caring for TIs. Thorough assessments are needed to screen TIs on use of CSHs (self-regulated or regulated by a health professional) and determining TIs' knowledge and health beliefs regarding osteoporosis prevention and promotion of bone health. Nurses can play a pivotal role in establishing respectful communication with TIs so that conversations about risk behaviors and hormone use can easily occur. By identifying gaps in TIs' knowledge, nurses and other healthcare providers can educate this at-risk minority population on how to be proactive in maintaining bone health through awareness of risk factors (such as hormone use) and prevention behaviors (diet, exercise). Nurses can influence positive bone health behaviors by taking on critical roles as a caregiver, educator, and advocate. By identifying OP knowledge gaps for TIs, healthcare providers can better devise prevention and wellness plans, as well as promote overall health and well-being. Nurses have the ability to help promote best standards of care for TIs.

Future research includes replicating this pilot study with a larger sample and developing longitudinal studies to investigate the long-term impact of CSH use on bone health. A larger sample would provide the opportunity to analyze daily calcium and vitamin D intake by participant age. Most importantly, intervention studies are needed to determine the best ways to access and educate this historically private population regarding bone health and OP preventing behaviors. Including ethnic and cultural considerations of TIs in future research would provide a diverse perspective of the use of CSHs and bone health, and prevention of OP. Healthcare providers, especially orthopaedic nurses and physicians, can play a key role in helping promote TIs' awareness for bone health.

References

American Academy of Orthopaedic Surgeons. (2012). *Healthy bones at every age*. Retrieved from http://orthoinfo.aaos.org/topic.cfm?topic=a00127

Baguso, G. N., Gay, C. L., & Lee, K. A. (2016). Medication adherence among transgender women living with HIV. *AIDS Care*, *28*(8), 976–981. doi:10.1080/09540121.2016.1146401

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, *84*(2), 191–215.

Blosnich, J. R., Marsiglio, M. C., Gao, S., Gordon, A. J., Shipherd, J. C., Kauth, M. ... Fine, M. J. (2016). Mental health of transgender veterans in US states with and without discrimination and hate crime legal protection. *American Journal of Public Health*, *106*(3), 534–540. doi:10.2105/AJPH.2015.302981

Burge, R., Dawson-Hughes, B., Solomon, D. H., Wong, J. B., King, A., & Tosteson, A. (2007). Incidence and economic burden of osteoporosis-related fractures in the United States, 2005–2025. *Journal of Bone and Mineral Research*, *22*(3), 465–475. doi:10.1359/JBMR.061113

Burkhalter, J. E., Warren, B., Shuk, E., Primavera, L., & Ostroff, J. S. (2009). Intention to quit smoking among lesbian, gay, bisexual, and transgender smokers. *Nicotine & Tobacco Research*, *11*(11), 1312–1320.

Center of Excellence for Transgender Health at the University of California San Francisco [COE]. (2012). *General prevention and screening*. Retrieved from http://transhealth.ucsf.edu/trans?page=protocol-screening

Cosman, F., de Beur, S. J., LeBoff, M. S., Lewiecki, E. M., Tanner, B., Randall, S., & Lindsay, R. (2014). Clinician's guide to prevention and treatment of osteoporosis. *Osteoporosis International*, *25*(10), 2359–2381. doi:10.1007/s00198-014-2794-2

Dictionary.com. (2015a). *Knowing*. Retrieved from http://dictionary.reference.com/browse/knowing?s=t

Dictionary.com. (2015b). *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., & Zeller, R. (2007). Osteoporosis knowledge, health beliefs and DXA T-scores in men and women 50 years of age and older. *Orthopaedic Nursing*, *26*(4), 243–250.

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. doi:10.1097/NOR.0b013e3182247a84

Doheny, M. O., Sedlak, C. A., Hall, R. J., & Estok, P. J. (2010). Structural model for osteoporosis preventing behavior in men. *American Journal of Mens Health*, *4*(4), 334–343.

Ediriweera de Silva, R. E., Haniffa, M. R., Gunathillaka, K. D., Atukorala, I., Fernando, E. D., & Perera, W. L. (2014). A descriptive study of knowledge, beliefs and practices regarding osteoporosis among female medical school entrants in Sri Lanka. *Asia Pacific Family Medicine*, *13*(1). doi:10.1186/s12930-014-0015-y

Edmonds, E., Turner, L., & Usdan, S. (2012). *Osteoporosis* knowledge, beliefs, and calcium intake of college students: Utilization of the health belief model. *Open Journal of Preventive Medicine*, *2*, 27–34. doi:10.4236/ojpm.2012.21005

Elo, S., Kääriäinen, M., Kanste, O., Pölkki, T., Utriainen, K., & Kyngäs, H. (2014). Qualitative content analysis: A focus on trustworthiness. *SAGE Open*, *4*(1). doi:10.1177/2158244014522633

Endicott, R. (2013). Knowledge, health beliefs, and self-efficacy regarding osteoporosis in perimenopausal women. *Journal of Osteoporosis*, *2013*, 1–6. doi:10.1155/2013/853531

Fenway Health. (2010). *Glossary of gender and transgender terms*. Retrieved from http://www.fenwayhealth.org/documents/the-fenway-institute/handouts/Handout_7- C_Glossary_of_Gender_and_Transgender_Terms__fi.pdf

Frye, V., Wilton, L., Hirshfied, S., Chiasson, M. A., Usher, D., Lucy, D. ... Koblin, B. (2015). "Just because it's out there, people aren't going to use it." HIV self-testing among young, black MSM, and transgender women. *AIDS Patient Care and STDs*, *29*(11), 617–624.

Gammage, K. L., Gasparotto, J., Mack, D.E., & Klentrou, P. (2012). Gender differences in osteoporosis health beliefs and knowledge and their relation to vigorous physical activity in university students. *Journal of American College Health*, *60*(1), 58–64. doi:10.1080/07448481.2011.570399

Gates, G. (2011). *How many people are lesbian, gay, bisexual, and transgender?* The Williams Institute, UCLA School of Law. Retrieved from http://escholarship.org/uc/item/09h684×2

Gendler, P. E., Coviak, C. P., Martin, J. T., Kim, K. K., Dankers, J. K., Barclay, J. M., & Sanchez, T. A. (2015). Revision of the osteoporosis knowledge test: Reliability and validity. *Western Journal of Nursing Research*, *37*(12), 1623–1643. doi:10.1177/0193945914537565

Graneheim, U. H., & Lundman, B. (2004). Qualitative content analysis in nursing research: Concepts, procedures and measures to achieve trustworthiness. *Nurse Education Today*, *24*(2), 105–112.

Grant, J. M., Mottet, L. A., Tanis, J. with Herman, J. L., Harrison, J., & Keisling, M. (2010). National transgender discrimination survey: Report on health and health care. Findings of a Study by the National Center for Transgender Equality and the National Gay and Lesbian Task Force. Retrieved from http://www.thetaskforce.org/static_html/downloads/resources_and_tools/ntds_report_on_health.pdf

Grant, J. M., Mottet, L. A., Tanis, J., Harrison, J., Herman, J. L., & Keisling, M. (2011). *Injustice at every turn: A report of the National Transgender Discrimination Survey*. Washington, DC: National Center for Transgender Equality and National Gay and Lesbian Task Force. Retrieved from http://www.thetaskforce.org/static_html/downloads/reports/reports/ntds_full.pdf

Hertzler, A. A., & Frary, R. B. (1994). A dietary calcium rapid assessment method (RAM). *Topics in Clinical Nutrition*, *9*(3), 76–85.

Hjalmarson, H. V., Straudmark, M., & Klässbo, M. (2007). Healthy risk awareness motivates fracture prevention behaviour: A grounded theory study of women with osteoporosis. *International Journal of Qualitative Studies on Health and Well-being*, *2*(4), 236–245.

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*(5), 395–403.

Hsieh, C., Novielli, K. D., Diamond, J. J., & Cheruva, D. (2001). Health beliefs and attitudes toward the prevention of osteoporosis in older women. *Menopause: The Journal of The North American Menopause Society*, *8*(5), 372–376.

Institute of Medicine. (2011a). *The health of lesbian, gay, bisexual, and transgender people: Building a foundation for better understanding*. Washington, DC: The National Academies. Retrieved from http://www.nap.edu/catalog.php?record_id=13128

Institute of Medicine. (2011b). *Dietary reference intakes for calcium and vitamin D*. Washington, DC: The National

Academies. Retrieved from http://www.ncbi.nlm.nih.gov/books/NBK56070/pdf/Bookshelf_NBK56070.pdf

Janiszewska, M., Kulik, T. B., Dziedzic, M. A., Żołnierczuk-Kieliszek, D. U., & Jarosz, M. J. (2014). Knowledge of osteoporosis prophylaxis and health behaviours of the population of chosen countries of the world. *Annals of Agricultural and Environmental Medicine*, *21*(2), 364–368.

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*(2), 155–163.

Malak, M. Z., & Toama, Z. T. (2015). The effect of osteoporosis health education program based on health belief model on knowledge and health beliefs towards osteoporosis among Jordanian female teachers. *European Scientific Journal*, *1*, 385–398.

McLeod, K. M., & Johnson, C. S. (2011). A systematic review of osteoporosis health beliefs in adult men and women. *Journal of Osteoporosis*, *2011*, 197454–197465. doi:10.4061/2011/197454

Mepham, N., Bouman, W. P., Arcelus, J., Hayter, M., & Wylie, K. R. (2014). People with gender dysphoria who self-prescribe cross-sex hormones: Prevalence, sources, and side effects knowledge. *The Journal of Sexual Medicine*, *11*, 2995–3001. doi:10.1111/jsm.12691

Mustanski, B., Andrews, R., & Pucket, J. A. (2016). The effects of cumulative victimization on mental health among lesbian, gay, bisexual, and transgender adolescents and young adults. *American Journal of Public Health*, *106*(3), 527–533. doi:10.2105/AJPH.2015.302976

National Institutes of Health. (2015). *Osteoporosis*: *Peak bone mass in women*. NIH Pub. No. 15-7891. Retrieved from http://www.niams.nih.gov/Health_Info/Bone/Osteoporosis/bone_mass.asp

National Institutes of Health, LGBT Research Coordinating Committee. (2012). *Consideration of the IOM report on the health of lesbian, gay, bisexual, and transgender (LGBT) individuals*. Retrieved from https://report.nih.gov/UploadDocs/LGBT%20Health%20Report_FINAL_2013-01-03-508%20compliant.pdf

Nguyen, V. H. (2015). Osteoporosis-preventive behaviors and their promotion for young men. *BoneKEy Reports*, *4*(729), 1–5.

QSR International Pty Ltd. (2012). *NVivo qualitative data analysis software*, *Version 10*.

Radix, A., & Deutsch, B. (2016). *Bone health and osteoporosis*. Center of Excellence for Transgender Health at the University of California San Francisco. Retrieved from http://transhealth.ucsf.edu/tcoe?page=guidelines-bone-health

Roller, C. G., Sedlak, C., & Draucker, C. B. (2015). Navigating the system: How transgender individuals engage in health care services. *Journal of Nursing Scholarship*, *47*(5), 417–424. doi:10.1111/jnu.12160

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., & Boyd, C.J. American Academy of Nursing Lesbian, Gay, Bisexual, Transgender, Queer Health Expert Panel. (2016). American Academy of Nursing on Policy Health care services for transgender individuals: Position Statement. *Nursing Outlook*, *64*(5), 510–512. doi:http://dx.doi.org/10.1016/j.outlook.2016.07.002

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 and Health*, *19*(5), 742–756.

Singh, S., Foster, R., & Khan, K. (2011). Accident or osteoporosis? Survey of community follow-up after low-trauma fracture. *Canadian Family Physician*, *57*(4), e128–e133.

Smith, K. P., Madison, C. M., & Milne, N. M. (2014). Gonadal suppressive and cross-sex hormone therapy for gender dysphoria in adolescents and adults. *Pharmacotherapy*, *34*(12), 1282–1297. doi:10.1002/phar.1487.

Statistical Package for Social Sciences. (2012). *SPSS Statistics, Version 21.0*. Armonk, NY: IBM Corp.

Sun, C. J., Reboussin, B., Mann, L., Garcia, M., & Rhodes, S. D. (2016). The HIV risk profiles of Latino sexual minorities and transgender persons who use websites or apps designed for social and sexual networking. *Health Education & Behavior*, *43*, 86–93.

Tan, S., Ji, L., Tsai, J., Eng, J., Ko, H. J., & Yau, A. ... Edwards, B. J. (2009). Greater osteoporosis educational outreach is desirable among Chinese immigrants in Chinatown, Chicago. *Osteoporosis International*, *20*(9), 1517–1522.

The Lancet (2013). New guidelines on transgender health. *Lancet*, *382*(9903), 1460.

Thrasher, A. D., Clay, O. J., Ford, C. L., & Stewart, A. L. (2012). Theory-guided selection of discrimination measures for racial/ethnic health disparities research among older adults. *Journal of Aging and Health*, *24*(6), 1018–1043. doi:10.1177/0898264312440322

Van Caenegem, E., Wierckx, K., Taes, Y., Schreiner, T., Vandewalle, S., Toye, K., ... T'Sjoen, G. (2015). Preservation of volumetric bone density and geometry in trans women during cross-sex hormonal therapy: A prospective observational study. *Osteoporosis International*, *26*, 35–47. doi:10.1007/s00198-014-2805-3.

Weinand, J. D., & Safer, J. D. (2015). Hormone therapy in transgender adults is safe with provider supervision: A review of hormone therapy sequelae for transgender individuals. *Journal of Clinical and Translational Endocrinology*, *2*(2), 55–60. doi:http://dx.doi.org/10.1016/j.jcte.2015.02.003

Wierckx, K., Mueller, S., Weyers, S., Van Caenegem, E., Roef, G., Heylens, G., & T'sjoen, G. (2012). Long-term evaluation of cross-sex hormone treatment in transsexual persons. *The Journal of Sexual Medicine*, *9*(10), 2641–2651. doi:10.1111/j.1743- 6109.2012.02876

Williams, B., Cullen, L., & Barlow, J. H. (2002). "I never realised how little I knew!": A pilot study of osteoporosis knowledge, beliefs, and behaviours. *Health Care Women International*, *23*(4), 344–350.

Wilson, E. C., Arayasirikul, S., & Johnson, K. (2013). Access to HIV care and support services for African American transwomen living with HIV. *International Journal of Transgenderism*, *14*(4), 182–195.

World Professional Association for Transgender Health. (2012). *Standards of care for the health of transsexual, transgender, and gender-nonconforming people, Version 7*. Minneapolis, MN: Author.

Zhang, Y. P., Xia, R. Y., Zhang, B., Zhang, F., Zhao, X. S., Zhang, L. L., & Li, H. (2014). Gender differences on osteoporosis health beliefs and related behaviors in non-academic community Chinese. *Journal of Community Health*, *39*(3), 545–551. doi:10.1007/s10900-013-9795-5

