2016

Bone Mineral Density, Preventative Behaviors And Risk Factors In African American And Caucasian Mother-Daughter Pairs

Mary Haskins Haskins
University of Mississippi

BONE MINERAL DENSITY, PREVENTATIVE BEHAVIORS AND RISK FACTORS IN AFRICAN AMERICAN AND CAUCASIAN MOTHER-DAUGHTER PAIRS

DISSERTATION

A dissertation
presented in partial fulfillment of the requirements
for the degree of Doctor of Philosophy
in the Department of Health, Exercise Science and Recreation Management
The University of Mississippi

By

MARY AMANDA HASKINS

December 2016

ABSTRACT

It is expected that by 2030, elderly minorities will comprise 20.2 million of the total 72.8 million population of Americans over 65 years (Pollard, 2013). For African American women over the age of 50, 5% have osteoporosis and an estimated 35% have low bone mass (NOF, n.d.). It is estimated that while over 40% of African American women over 80 years meet criteria for treatment, yet less than 12% are actually treated (Cauley, 2011). Striking disparities exist between African American and Caucasian women's likelihood for dual-energy x-ray absorptiometry (DXA) referral, the measurement tool that is used to diagnosis osteoporosis. (Hamrick, Cao, Agbafe-Mosley & Cummings, 2012; Miller et al., 2005; Wanko, 2003). When African American females suffer a hip fracture, they show a higher morbidity and mortality rate when compared to their Caucasian counterparts (Geller & Derman, 2001; Kidambi, Partington, & Binkley, 2005; NOF, 2014). A disproportionate number of African Americans are limited in their physical and mental abilities after a fracture compared to Caucasian patients (Bohannon, 1999; Geller & Derman, 2005; Furstenberg & Mezey, 1987). African American women are twice more likely to die from a hip fracture than Caucasian women within the first year of the fall (Geller & Derman, 2001). Interventions are needed to identify health care provider biases regarding osteoporosis screening (Neuner, J., Zhang, X., Sparapani, R., Laud, P. & Nattinger, A., 2007). Many, including African Americans, perceive only Caucasians to be susceptible to the disease (Geller & Derman, 2001; NOF, 2013). Further, the National Osteoporosis Foundation (NOF) found the average age for discussion initiation between mothers and daughters about osteoporosis does not occur until after peak bone mass is reached (2011). **Purpose:** This

research project aimed to investigate the relationship between osteoporosis knowledge, bone mineral density (BMD), risk factors of low BMD, and preventative behaviors among African American and Caucasian mothers and their biological adolescent daughters. Additionally, this study seeks to explore whether mothers and daughter discuss osteoporosis preventative behaviors. **Methods:** Thirty-seven pairs of African American and Caucasian mothers and their 13-18 year old biological daughters participated in this study. Femoral and spinal BMD using DXA were obtained. Participants also completed the Osteoporosis Risk Factor Assessment (ORFA), Osteoporosis Knowledge Test (OKT), Health Communication Survey and an online calcium quiz to measure preventative behaviors, knowledge, calcium intake, and osteoporosis discussion engagement. **Results:** Over a third (33%) of African American and 26% of Caucasian mothers in this study had osteopenic BMD at the hip and spine. African American mothers and daughters had lower overall spinal and hip bone density compared to their Caucasian counterparts. Body fat and BMI among African American and Caucasians were significantly different. There were no significant differences in mean spinal or femoral BMD based on the predictor variables. Independent t-tests for significant differences in each observed mother-daughter pair between races was measures and compared across BMD, calcium intake and physical activity. Paired samples test indicated significant differences between African American and Caucasian mother-daughter pairs at the L-4 of the lumbar spine ($p<0.05$), but not for any other bone density measurement. A small percentage of mothers and daughters were aware of their calcium Recommended Daily Allowance (RDA). **Conclusions:** Future research should continue to investigate premenopausal African American mothers and daughters, possibly

expanding to include a third generation of relatives. Preventative health programs should begin before peak BMD occurs and be racially inclusive.

DEDICATION

I am so fortunate to have been instilled the value of an education from someone who truly worked harder than anyone I have ever known to earn his bachelors, masters and doctorate degrees. My late grandfather, Lt. Col. Edward Brennan, E.D., pursued his education after serving our nation in the U.S. Army Air Corps and while simultaneously raising a family. He often told his children and grandchildren that no one could ever take away your education; I know how invaluable an education is because of him. My grandfather's wise words and reliably fair judgement have left a profound mark on my view of what learning means and have set a high standard for what it means to teach others. Grandpa, you are missed, respected and loved.

LIST OF ABBREVIATIONS

1. BMC = Bone mineral content
2. BMD = Bone mineral density
3. BMI = Body mass index
4. BUA = Broadband ultrasound attenuation
5. COPA = Calcium, Osteoporosis, Physical Activity Questionnaire
6. CSFI = Continuing Survey of Food Intake
7. DXA = Dual-energy x-ray absorptiometry
8. FDR = First degree relative
9. FFM = Fat-free mass
10. ISCD = International Society for Clinical Densitometry
11. MET = Metabolic equivalent
12. NDSR = Nutrition Data System for Research
13. NHANES = National Nutrition and Health Examination Survey
14. NIH = National Institutes of Health
15. NOF =National Osteoporosis Foundation
16. OC = Oral contraceptive
17. OKT = Osteoporosis Knowledge Test
18. OP = Osteoporosis
19. ORFA = Osteoporosis Risk Factor Assessment
20. OSI = Osteo sono-assessment index

21. PBM = Peak bone mass

22. PE = Physical educaiton

23. PI = Principle investigator

24. PTH = Parathyroid hormone

25. pQCT = Peripheral quantitative computed tomography

26. QUS = Quantitative ultrasonometer

27. RCT = Randomized controlled trial

28. RDA = Recommended Daily Allowance

29. SGFHHP = Surgeon General's Family Health History Portrait

30. SI = Stiffness Index

ACKNOWLEDGEMENTS

I am so grateful to my family for their continual support throughout my entire academic career and every challenge in life. My parents, Phillip and Beth, deserve endless thanks for their ceaseless encouragement and championing behind me every time. Thank you also to my adviser, Dr. Allison Ford-Wade, for being a positive source of direction and believing in and guiding me as I navigated through this project and the entire doctoral journey. Your patience and supervision have seen me through every step of the process of completing my PhD. I appreciate all the help and camaraderie from fellow graduate students, including Vinny Nahar; on stressful days, I can't say just how much reassuring words from Ms. Dale meant to keep moving along. Thank you to all of my family members, friends, and academic supporters who have provided optimism and humor when needed.

TABLE OF CONTENTS

CHAPTER I

INTRODUCTION

The National Osteoporosis Foundation (NOF) describes osteoporosis as a bone disease that results in loss of bone density and mass and meaning "porous bone" (NOF, 2014). Bone is a dynamic, living tissue, primarily made of the soft supportive protein collagen (National Institutes of Health [NIH], 2012). The harder mineral calcium phosphate also composes bone tissue and surrounds the softer interior, giving supportive framework (NIH, 2012). Continual bone remodeling occurs when both osteoclasts and osteoblasts engage in bone formation and resorption, respectively removing old bone while shaping new bone cells in the skeleton (Repovich, Hamdy, Hudgins, & Moore, 2014). Both collagen and calcium enable bones to withstand constant stress, until bone fragility occurs with low bone mass (NIH, 2012). The skeleton is mainly composed of cortical bone, which comprises 80% of the skeleton and is also referred to as compact bone (Brandi, 2009). Cortical bone is found along outer surfaces of the tibia, femur and radius along with the skull and jaw and other flatter surfaces (2009). An individual's total bone mass is extensively composed of cortical bone (Fonesca, Moreira-Goncalves, Coriolano & Duarte, 2014). The thinner interior trabecular bone has a larger surface to volume ratio, experiencing bone loss to a greater degree than harder cortical bone (Braindi, 2009; Fonesca, et al., 2014).

Each year, a healthy person experiences approximately 10% of the skeleton remodeling (Brandi, 2009). Adolescents experience faster bone formation than resorption, acquiring larger, denser and heavier bones (NIH, 2012). This higher rate of remodeling versus loss occurs until peak bone mass (PBM) is reached, approximately near age 30 years (NIH, 2012). Other researchers have estimated PBM occurs between the ages of 18-25 years (Cosman et al., 2014). Typically, bone reformation occurs over a six-month period (Brandi, 2009). When the rate of bone turnover exceeds the rate at which new bone forms, this imbalance leads to bone loss

(Cosman et al., 2014). As age increases after PBM, bone mass decreases and bone weakens with a lower ability to handle mechanical loading (Repovich et al., 2014). As bone mass decreases, so does skeletal tissue, strength and architecture (Cosman et al., 2014). Leaving bones susceptible to fractures after a fall or minor event, the NOF describes the irregular structure of bone tissue after bone loss as similar to a honeycomb shape. Fractures are common at the hip (proximal femur), spine (vertebrae) and wrist (distal forearm), and are painful with lasting effects (Cosman et al., 2014; NOF, 2014). While falls may lead to fractures in populations at risk for osteoporosis, it is also possible for spontaneous fractures to occur when bones are extremely fragile and then result in a fall (Repovich et al., 2014).

Osteoporosis may lead to burdensome national economic and quality of life consequences. Approximately nine million Americans currently suffer from osteoporosis, annually accountable for $19 billion in healthcare costs and two million broken bones (NOF, 2014). The NOF (2014) also predicts that by 2025, an estimated three million fractures will increase the financial burden of osteoporosis to $25.3 billion. Independence and mobility are often compromised after a fracture, with other complications or needing of long-term health assistance common. Post-fracture, an individual may have difficulty resuming normal activities and may require rehabilitation (NOF, 2014). While recovery is possible, chronic pain and long-term disability, or even death, are all also potential outcomes of fractures (Cosman et al., 2014).

An estimated 20% of hip fracture patients typically require extended home care and only 40% may expect to progress back to prior autonomy; these patients are 2.5 more times likely to experience future femoral fractures (Cosman et al., 2014). Spinal fractures may result in chronic pain, impairment and physical deformity; distorted posture changes after a fracture may also inhibit normal functioning such as bending and reaching (2014). This change resulting in a

spinal curve (kyphosis) is particularly disabling (Cosman et al., 2014; Repovich et al., 2014). Vertebral fractures of the lumbar area may also change structure of one's abdomen and result in constipation, pain, distention and/or decreased appetite; these patients are five times more likely to experience another vertebral fracture and two-three times more likely to experience some other fracture (Cosman et al., 2014). Lifestyle and appearance changes may also cause depression and decreased esteem as individuals post-fracture experience pain and physical restrictions (Cosman et al., 2014).

Bone Mineral Density and Gender

While both men and women may experience osteoporosis, the NIH defines women as having a greater risk of developing osteoporosis. Women lose bone mass at a more rapid rate than men due to menopause and have less initial bone tissue as well as smaller skeletons than men (Repovich et al., 2014; NIH, 2012). Women also experience a diminishing amount of trabecular bone architecture and intensified trabecular separation compared to men (Cosman et al., 2014). Both sexes experience about a 1% decrease in BMD after PBM is reached, but five years after menopause, the rate of loss is substantially increased among women (Eastell, 2013). Early menopause particularly increases this risk (2013). Women may experience amenorrhea, or absence or normal menstrual periods, often associated with eating disorders and athletic women (Cosman et al., 2014). This also increases risk for poor bone health.

Bone Mineral Density and Race

Caucasian and Asian women are at the highest risk for developing osteoporosis, but the NIH describes African American and Hispanics as still being at a significant risk (2012). The disease is often undertreated among African American women (NOF, 2006). Between 80-95% of fractures occurring in African American women are the result of osteoporosis (Kidambi,

Partington, & Binkley, 2005). Many times African American women do not receive treatment for bone loss as they were never identified for the disease (NOF, 2012). As minority populations and life expectancy increases, it is projected that by the year 2030, 20.2 million minorities will comprise the expected 72.8 million population of all Americans over 65 years (Pollard, 2013). Since the year 2000, there has been a 48% increase in the older minority population, accounting for nearly half of all 6.3 million Americans over the age 65 (2013). The fracture rate among non-White populations is expected to comprise 21% of all fractures by 2025 (Burge et al., 2007).

While women of all races may have osteoporosis, it is a common misperception that only older, Caucasian women are affected (NOF, 2014). The protective role of race in osteoporosis has been overstressed (Geller & Derman, 2001). For African American women over the age of 50, 5% have osteoporosis and an estimated 35% have low bone mass, otherwise known as osteopenia (NOF, n.d.). Using the NOF's treatment guidelines, it is estimated that over 40% of African American women over 80 years of age met criteria for treatment, yet less than 12% are actually treated (Cauley, 2011). The NOF encourages clinicians to consider BMD testing for all women over 65 years and men over 70 years, regardless of prior fracture history (2014). Health care providers are also encouraged to recommend BMD measurement for younger menopausal women in the transitional stages of menopause and men 50-69 years with additional clinical risk factors (2014). Any adult over age 50 years who has experienced a fracture should be screened as well as those taking medications or living with a disease/condition known to affect bone metabolism (2014).

In general, an at-risk woman of any background may miss screening, but disparities exist between Caucasian and African American women's likelihood for DXA referral (Hamrick, Cao, Agbafe-Mosley & Cummings, 2012; Miller et al., 2005; Wanko & Inouye, 2003). Comparing

Medicare enrollees, only 5% of African American women had BMD screenings compared to 33% of Caucasian women (Cauley, 2011). One study evaluating at-risk elderly African American and Caucasian female patients in an out-patient clinic found that physicians were significantly less likely to note any concern for osteoporosis for minority patients in their medical charts (Mudano et al., 2003).

Wanko and Inouye (2003) describe 50% of postmenopausal African American women at an academic medical center as meeting criteria for osteoporosis, yet only 8% were validated with a DXA scan. The rate of osteoporosis was similar between African American and Caucasian patients; however, over a third of Caucasian patients received DXA scanning (2003). Physicians are significantly less likely to prescribe medication for low bone density for older African American women, even after a diagnosis of osteopenia or osteoporosis (Hamrick et al., 2012). Mudano et al. (2003) reported African American women are less likely to receive physician-recommended BMD testing or drug therapies to treat osteoporosis, such as bisphosphonates.

Physicians are also less likely to recommend calcium or vitamin D supplementation to African American women compared to their Caucasian counterparts (Miller et al., 2005; Mudano et al., 2003). Even among patients with a high risk for falls and/or fracture, African American women report fewer physician encounters and medical supervision (Mudano et al., 2003). A national sample of 5% of Medicare beneficiaries' hip fracture claims found Caucasians to have the lowest mortality rate post fracture than all other races (Lu-Yao, Baron, Barrett & Fisher, 1994).

Screening inequalities contribute to misunderstandings regarding osteoporosis risk in non-White individuals by both health care providers and African American patients (Wilkins & Goldfeder, 2004). Many preventative and screening initiatives target Asian and/or Caucasian

populations. Wilkins and Goldfeder's study of 252 at-risk African American and Caucasian patients' medical records indicated a significant number of osteopenic/osteoporotic African American women, with 40.4% of African American patients having low bone density (2004). In this investigation, however, only 11.5% of all subjects indicated osteoporosis screening (2004).

Health care providers may consider all non-White populations to be at low risk for osteoporosis, but such stereotyping may contribute to biases in osteoporosis care (Neuner, Zhang, Sparapani, Laud & Nattinger, 2007). A study of over 35,000 female Medicare patients ages 65-89 years in three states investigated osteoporosis testing and care before and after a hip fracture (2007). African American women comprised 48% of all patients and racial differences were noted in screening both before and after a fracture (2007). Racial disparities exist surrounding primary preventative strategies for osteoporosis between African American and Caucasian patients before a fracture. Also, two years after African American women suffered a hip fracture, Neuner and colleagues found they found were still less likely to receive follow-up screening (2007). Race should not exclude an individual from OP screening or secondary evaluation.

It has been argued that risk factors for postmenopausal non-White women may not be identical to Caucasian postmenopausal women (Castro et al., 2005). An increase in body mass index (BMI), for example, was found to be less predictive of BMD among African American than Caucasian women. Precedent for risk factors based on studies from exclusively or predominately Caucasian populations may not be applicable to underrepresented minority groups (Castro et al., 2005).

Because there is no current consensus for osteoporosis screening in non-White populations, confusion among clinicians may prevent timely detection. Gourlay, Callahan,

Preisser and Sloane (2007) identified racial disparities in preventative recommendations by physicians among African American and Caucasian patients over 45 years in a family medicine community-based research. Of the 275 participants, 16.3% of the African American participants reported a fracture history and both races reported similarly high rates of concern about osteoporosis. Significantly more Caucasian women, however, reported having a prior bone density test. African American women also reported lower rates of physician counseling regarding fractures, calcium/dairy intake, and BMD testing than Caucasian women in the study. African American participants also reported fewer prescribed osteoporosis-related medications such as calcium, estrogen, and bisphosphonates (Gourlay et al., 2007). With prevention and treatment guidelines addressing only postmenopausal Caucasian women, it is possibly that health care providers are unfamiliar with osteoporosis risk and screening among non-White patients (2007).

African Americans' risk of hip fracture significantly progresses with age, doubling every seven years (NOF, 2012). When African American females do suffer a fracture, they show a higher morbidity and mortality rate (Geller & Derman, 2001; Kidambi, Partington, & Binkley, 2005; NOF, 2012). African American women are twice more likely to die from a hip fracture than Caucasian women within the first year (Geller & Derman, 2001).

A disproportionate number of African Americans are limited in their physical abilities after a fracture (Bohannon, 1999; Furstenberg & Mezey, 1987; Geller & Derman, 2005). A retrospective medical chart review by Furstenburg and Mezey (1987) concluded African American patients experience longer hospital stays. They also experience mental impairment during hospital stays at nearly twice the rate of Caucasian patients as well as post-surgical limitations. Delays prior to surgery were also shown among African American patients compared

to Caucasians. Additionally, African Americans with a hip fracture were significantly more likely to be non-ambulatory after hospitalization compared to Caucasians (Furstenburg & Mezey, 1987). There are disproportionate gaps between patients of different races with respect to OP prevention, screening and outcomes.

Bone Mineral Density and Risk Factors

Calcium is an essential mineral in health, supporting and giving structure to bones and teeth. The NIH has specific guidelines for women's daily calcium intake depending on age. Girls 9-18 years should consume 1300 mg of calcium daily (NIH, 2013). The recommended daily allowance (RDA) for adult females is 1000 mg until age 50, when it increases to 1200 mg (NIH, 2013).

The NIH describes calcium intake as a barrier for many African American women, as approximately 75% are lactose intolerant (2012). In fact, one osteoporosis study of African American Wisconsin females reported 50% were lactose intolerant (Kidambi, Partington & Brinkley, 2005). Those with lactose intolerance may not consume the ideal amount of calcium, as they lack the lactase enzyme to digest lactose, which is common in dairy and calcium-rich foods. Further, many do not consume adequate amounts of vitamin D, limiting the bioavilaiblity of calcium (NOF, 2012). The NIH states that African American women's calcium intake is only half of the RDA (2012). A recent study of 100 premenopausal female African American Mississippians ages 18-40 found only 20% met or exceeded the RDA for calcium (Tidwell & Valliant, 2011). A national examination of African American diets from the 1999-2000 National Nutrition and Health Examination Survey (NHANES) and Continuing Survey of Food Intakes (CSFI) from 1994-1996 and 1998 found in all age groups, African Americans consumed fewer dairy products than Caucasians including milk, cheese and yogurt (Fulgoni et al., 2007). This

study also found all African Americans' diets compiled into the CSFI and NHANES data failed to meet the calcium RDA (2007).

Heaney (2005) describes differences in calcium absorption between African Americans and those of different backgrounds. African Americans biologically make more efficient use of dietary calcium when compared to Caucasians and East Asians. Besides having better bone accumulation and retention even when calcium intake is lower than other populations, African Americans also have better skeletal protection against bone resorption. Parathyroid hormone (PTH) is often associated with inadequate calcium uptake, and African Americans are known to exhibit a better resistance to PTH. Lower calcium urinary excretion, lower levels of biomarkers of bone loss, and higher calcium absorption are found among African Americans than in Caucasians (2005).

African Americans may be affected by certain conditions and these treatments increase osteoporosis risk (Bohannon, 1999; NOF, 2012). Autoimmune diseases such as lupus and endocrine diseases, including diabetes mellitus and hyperparathyroidism, are of particular concern as these diseases are often treated with glucocorticoid therapy, which increases one's risk for osteoporosis (Bohannon, 1999; NOF, 2012). African American women have reported higher incidences of diabetes than Caucasian women (Wallace, Ballary, Holiday & Wells, 2005). Other medications known to negatively affect bone health include prescriptions for asthma, thyroid deficiencies, and seizures (NOF, 2013).

African American women may also perceive themselves to be at a lower risk for osteoporosis or be unaware of their risk for developing this disease (Geller & Derman, 2001; Kidambi, Partington & Binkley, 2005). Kidambi et al. (2005) measured African American women's self-perceived risk for osteoporosis, asking if they perceived themselves to be at a high,

medium or low risk. After yielding a bone mass measurement from a quantitative ultrasonomenter (QUS) at the calcaneal heel, over 33% of the participants were found to have low bone mass, despite a subjectively young mean age of 54±7 years (Kidambi et al., 2005). Over 23% of African American women in this study were classified as osteopenic, and over 9% as osteoporotic (Kidambi, 2005). Of the participants over 60 years, nearly half had low bone mass from QUS criteria (Kidambi, 2005). In spite of considerable low bone mass, Kidambi et al. (2005) showed that 46% did not know if they were at any risk for osteoporosis, and 21% perceived themselves to be at low risk.

A qualitative study by Unson et al. (2003) identifying barriers to osteoporosis prevention and treatment among minority women discovered a common theme among African American women and their perceived risk for hip fractures. Some felt the disease exclusively affects Caucasian populations and identified themselves as being resilient to falls and fractures. Many African American women in the focus group felt their body build was also protective against fractures and underestimated the consequences of a fall (Unson, 2003). Minority women may perceive other health issues more threatening and serious than osteoporosis (Geller & Derman, 2001). African American and Hispanic adult women not actively engaging in osteoporosis preventative behaviors identified osteoporosis to be less threatening than breast cancer and diabetes mellitus, although they are actually more likely to experience osteopenia or osteoporosis some time during their lifetime (Geller & Derman, 2001).

Osteoporosis prevention should begin before menopause rather than waiting for a fracture to occur. Puberty may be an appropriate age to promote bone building behaviors, as 50-60% of peak bone mass (PBM) is achieved during these years (Runyan et al., 2003). According to Runyan et al.'s 2003 study, mothers' BMD measurements may predict their daughters' future

peak bone mass. During adolescence, key behaviors critical to bone health are known to change. Martin and colleagues (2004) describe these years as a time when calcium intake and exercise, specifically weight-bearing activities, are known to decrease. Girls 11-17 years may lack knowledge of risk factors for osteoporosis. Unable to identify sources of non-dairy calcium-rich foods or types of weight-bearing exercise, adolescent girls may need educational strategies to prevent osteoporosis (Martin et al., 2004).

Knowing one's bone health through generations demands the focus of both patient and physician (Hamerman, 2005). Even relatives of those with osteoporosis may lack knowledge or engagement in preventative behaviors (Chang, Hong & Yang, 2007). One study found that first degree relatives (FDR) with osteoporosis have higher perceived susceptibility of the disease, yet when compared to a control group with no FDRs, have no difference in knowledge of the disease (Werner et al., 2003). Besides regular screenings, individuals with an FDR with osteoporosis did not engage in preventative behaviors.

There is some uncertainty surrounding the genetic influence on bone density, with some studies reporting 60-90% of osteoporosis is genetic among Western populations (Park et al., 2012). Other studies have concluded heredity accounts for 40-60% in determining BMD (Kuroda et al., 2009). Lifestyle factors such as exercise and dietary behaviors are thought to contribute between 20-40% of bone mass (Howell et al., 2009). There is no current consensus on the absolute influence of family history on OP likelihood.

Bone Mineral Density and Environmental Influence

Mothers not only share genetic predispositions or risk factors for osteoporosis with their daughters, but lifestyle factors as well (Kuroda et al., 2009). Shared habits among spouses, parents, children and siblings may contribute to one's risk for osteoporosis or engaging in

preventative behaviors (Krall & Dawson-Huges, 1993). Mothers also influence habits that contribute to peak bone mass of their daughters during adolescence (Kuroda et al., 2009). Kuroda and colleagues found a correlation between pre-menarche daughters and their mothers regarding vitamin D and K intakes, but not exercise. Post-menarche daughters and their mothers mothers, however, indicated a correlation between nutrition and activity habits. This study confirmed the strong correlation between daughters and mothers in BMD and lifestyle factors.

Focusing on the importance of family in influencing preventative practices may be more economical and successful than relying on clinical or school programs. Hovell et al. (2009) concluded through a parent/preteen training intervention, preadolescent males and females increased calcium intake and bone-building physical activity. The familial effect between premenopausal mothers and daughters was found to be significantly correlated to physical activity parameters and calcium and vitamin D intake (Ohta et al., 2010).

Studies have examined the relationships between BMD, calcium intake and activity in young daughters, premenopausal mothers and postmenopausal maternal grandmothers. This study focused on behaviors and bone characteristics but did not examine if family histories of osteoporosis were discussed among generations (Runyan et al., 2003). This study found physical activity was strongly predictive for high and low BMD in the femoral neck, suggesting that maternal influence on exercise may have lead to familial similarity in BMD (Runyan et al., 2003). This study also hypothesized that regular activity may actually compensate for low calcium intake found among mother-daughter pairs.

A two-year randomized controlled trial investigating the effect of a lifestyle intervention found osteoporosis preventative behaviors adopted by mothers impact their children as well (Winzenburg, Oldenburg, Frendin, Wit & Jones, 2006). Winzenburg et al. (2006) found South

African Caucasian mothers assigned to a small educational group sessions reported higher calcium consumption, which was predictive at increasing calcium intake in their children. Mothers who also reported calcium supplementation were more likely to increase their children's intake.

A later descriptive study by Winzenburg, Hansen and Jones (2008) found mothers' osteoporosis preventative behaviors significantly influenced their children's preventative behaviors. The participants were prior members of the two-year randomized controlled trial (RCT). Through semi structured interviews, ways to increase calcium in their children's diet emerged as a common concern. General strategies to overcome environmental barriers to physical activity were also discussed, yet nutritional concerns were more frequently identified. Mothers also identified the importance of role modeling, as well as allowing children more responsibility for lifestyle choices as they grew and became less dependent (2008).

Ulrich, Georgiou, Snow-Harter and Gillis (1996) investigated both genetic and lifestyle factors influencing BMD among postmenopausal mothers and premenopausal daughters (with a mean age of 41 years). Milk consumption, weight-bearing exercise and BMD throughout one's lifetime were assessed. Lifetime weight-bearing exercise was a predictor of BMD; additionally, mothers' lifetime milk consumption was positively associated with daughters' consumption, illustrating an intergenerational influence on milk consumption (Ulrich et al, 1996).

The mother's dietary behavior has a great influence on her daughter's nutritional choices. A positive correlation of calcium intake has been demonstrated in a study that investigated Japanese mothers and their high-school daughters (Yoneyama, Shimizu & Beppu, 2008). Using QUS to yield an osteo-sono assessment index (OSI), a correlation was found between OSI and calcium intake in the mother-daughter pairs (Yoneyama et al., 2008). High scores on the OSI

were found among pairs who engaged in routine physical activity. This study reinforces the primary role of the mother in changing lifestyle habits that may help prevent osteoporosis, as the mother's diet was influential on the daughter's (Yoneyama et al., 2008).

Those with a family history of osteoporosis are considered to be at risk for developing the disease later in life or for related fractures. Previous studies showed that females with a healthy BMD were more likely to be knowledgeable about osteoporosis and engage in preventative behaviors than those with poor BMD (Kroger et al., 2003). Chang, Yang, Chung, Chen and Cheng (2010) retrospectively investigated Taiwanese females over 30 years who had recently undergone a DXA scan and reported family history of osteoporosis were asked to complete a questionnaire on their osteoporosis knowledge, beliefs and preventative behaviors. A majority of Chang's participants did not believe that family history, small body frame and diet were factors for osteoporosis. Chang et al. also found 86% of females who were at-risk were unaware that osteoporosis could be inherited (2010). The average BMD of participants approached osteopenia status and many reported difficulties and barriers in implementing preventative behaviors (Chang et al., 2010).

Bone Mineral Density and Risk Awareness

Knowing one's family history of osteoporosis is critical in the prevention of the disease. According to the NOF, 94% of mothers and daughters admit they are not concerned with osteoporosis as a health condition (2001). The NOF has found only 26% of mothers and daughters have had conversations about the disease with one another (2011). The NOF's survey found mothers and daughters are not initiating bone health strategies until about 33 years old (2011). While the majority are aware of the primary consequences of bone loss, many are

unaware of the potential decrease in quality of life as independence and mobility may be limited (NOF, 2011)

Being aware of one's family history of osteoporosis may influence osteoporosis preventative lifestyle behaviors. One study by Lonzer and colleagues (1996) found that families with children between 5-20 years with a family history of osteoporosis had significantly higher calcium intakes than children in families with no history of osteoporosis. The authors discuss the possible higher sensitivity to the disease and calcium increase due to awareness of family history.

Specific Aims:

The research questions posted below list the objectives of this study and include aims never before published among the target population.

1. To investigate and compare risk factors, knowledge and preventative behaviors of BMD between African American and Caucasian biological mother and daughter pairs.
2. To determine whether African American and Caucasian mothers and daughters discuss health related information.

Null Hypotheses

H_{01}: There will be no significant difference between BMD of African American and Caucasian mothers and daughters

H_{02}: There will be no significant difference between calcium intake of African American and Caucasian mothers and daughters

H_{03}: There will be no significant difference between physical activity of African American and Caucasian mothers and daughters

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

Osteoporosis is described by the NIH (2012) as an often symptomless metabolic bone disease diagnosed as a result of low bone mass. Low BMD increases bone's fragility and vulnerability to fracture and injury (2012). Osteoporosis-related fractures can have lasting effects, such as persistent pain and change in one's posture (2012). Limited freedom and mobility may be other consequences of a bone break due to osteoporosis, affecting one's quality of life (2012).

Osteoporosis Risk Factors

The NIH has identified several controllable and uncontrollable risk factors for osteoporosis: thin fame; previous or family history of osteoporosis; early menopause; prolonged amenorrhea or the absence of normal menstruation; age; low consumption of calcium and vitamin D, smoking, excessive alcohol, and certain medications (2012). Non-modifiable risk factors include being over 50 years, being female, menopause, family history, low weight, prior broken bones or loss of height (NIH, 2012). Modifiable risk factors for osteoporosis include lack of calcium and vitamin D, excessive protein, sodium and caffeine consumption, inactive lifestyle, smoking, drinking in excess and weight loss (NIH, 2012). While many women do not think they are at risk for developing osteoporosis, it is in fact equal to her chances of breast, ovarian and uterine cancer combined (NIH, 2012).

Hamerman (2005) outlines bone health strategies for females during specific life stages. Peak Bone Mass (PBM) is the greatest bone mineral density one has in early adulthood during growth (2005). For adolescents, certain factors can inhibit accrual of PBM such as late age of menarche (2005). Genetic factors that can also limit PBM include polycystic ovarian syndrome, Turner's syndrome, and growth hormone deficiencies (2005). Behavioral factors to be aware of with adolescents also include restricted calcium and protein intake, consuming colas and

smoking (2005). PBM with this life stage can be limited further by amenorrhea as a result of excessive exercise as well as eating disorders (2005).

During reproductive years, Hamerman (2005) describes a slight loss in bone mineral content among lactating mothers; however, the fall in estrogen levels before weaning does not have long-term effects on bone. In fact, the skeleton is restored after lactation (2005). A family health history discussion between patients and physicians is essential, as the daughter of a mother who has suffered a vertebral fracture is likely to already have low BMD when she begins menopause (Hamerman, 2005).

Behavioral Influence and BMD

Lifestyle factors are also strongly correlated between mothers, daughters and BMD (Kuroda et al., 2009). Kuroda and colleagues (2009) identified both genetic and environmental influences on mother-daughter Japanese pairs. Among the cohort of 12-18 year old girls and mothers, BMD, height, weight, vitamin D intake, vitamin K intake, birth weight, age and lifestyle factors (using the Diet History Questionnaire and frequency of exercise) were assessed from 387 pairs (2009). Between the pre-menarche daughters and their mothers, BMD height, weight, vitamin D and vitamin K intake were positively correlated (2009). Factors positively correlated between pairs of post-menarche daughters and their mothers include BMD, birth weight, age at menarche, and lifestyle factors (2009). Future prediction of a daughter's PBM may be calculated from the mother's BMD.

Calcium is a particularly important micronutrient affecting bone health. PBM is contingent upon optimal calcium intake throughout life (Cosman et al., 2014; NIH, 2012). Fracture risk is reduced and bone mass is increased with adequate consumption, particularly if sufficient amounts are consumed prior to puberty (Repovich et al., 2014).

Cheng et al. (2008) compared effects of dietary calcium intake through dairy products, calcium supplements, calcium and vitamin D supplements, and a placebo on healthy 10-12 year old girls' BMD. Measurements of bone density with DXA and peripheral quantitative computed tomography (pQCT) found dietary calcium intakes of 1000 mg through cheese products most beneficial for bone mass accrual (2008). Cortical thickness of the tibia was significantly increased for the girls assigned to the cheese group compared to other groups and total body BMD was higher than the placebo after two years (Chen et al., 2008).

Dietary intake as well as genetic predisposition to osteoporosis is shared between mothers and daughters. Lutz and Tesar (1990) investigated the effects of diet and BMD between Caucasian mother-daughter adult pairs; 23 pairs included premenopausal mothers while 17 pairs included postmenopausal mothers. After assessing dietary intake with 3-day diet records and the Nutrition Data System for Research (NDSR) software, DXA analyzed BMD of the femoral neck and spine. Between pairs, a significant correlation for BMD at the lumbar spine and femur was measured (1990). Calcium correlated with BMD among daughters only and not mothers (1990). Premenopausal mothers had higher correlations between their daughter's BMD and their own, except at the trochanter (1990). Familiar resemblance is thought to be predictive for PBM as well as bone loss later at menopause (1990).

Postmenopausal Caucasian mothers and premenopausal daughters share many other lifestyle factors thought to influence bone health. Mothers' lifetime milk consumption was positively associated with and predictive of their respective daughters' intake (Ulrich, Georgiou, Snow-Harter, & Gillis; 1996). Ulrich et al. suggest an intergenerational effect regarding consumption of milk in pairs of elderly mothers and their premenopausal daughters (1996).

Physical activity is another lifestyle factor influencing bone health, which is also influenced by family tendencies. Runyan, Stadler, Bainbridge, Miller and Moyer-Mileur (2003) examined the familial effect of BMD with calcium intake and physical activity with White mother-daughter pairs and maternal grandmothers. DXA measurement of the hip and spine, calcium intake and physical activity recalls were analyzed between mother-daughter pairs as well as mother-grandmother pairs and daughter-mother-grandmother triads (2003). Calcium intake was not significantly related to any pair or triad; height, weight, and spinal BMD were significantly correlated between mother-daughter pairs (2003). Pairs of mothers and daughters reporting low levels of activity also had low BMD at the femoral neck, while triads reporting higher physical activity levels had higher femoral neck BMD (2003).

African American adolescents may be at a high risk for developing sedentary lifestyle and health consequences associated with lack of physical activity. The Bone Health Study of South Africa has compared diet and activity patterns among Black and White youths, with one study observing a cohort of participants (McVeigh, Norris & Pittifor, 2007). Observing children for one year of the larger longitudinal study showed white children consumed higher amounts of calcium and engaged in higher levels of activity, especially with the amount of mechanical loading known to increase bone density (2007). A ten year study by the National Heart, Lung and Blood Institute followed 2400 girls starting at ages nine/ten years and ending at 18/19 years, including over 1200 African American girls (Kimm et al., 2002). After recoding weekly metabolic equivalents (METs) and BMI, over 56% of African Americans enrolled in the study reported no leisure activity (2002). This decline occurred at a higher rate than Caucasian girls, with BMI increasing as activity levels declined. The rate of this decline was particularly

accelerated at ten years, with the majority of the participants noting engaging in no activities outside of school at the ten-year conclusion (2002).

Barbeau et al. (2007) initiated an after-school activity program for African American girls ages 8-12 years while using DXA to note changes in BMD before and after the ten month intervention. This intervention offered daily sessions after class including 80 minutes of physical activity, with both cardiovascular activity and strengthening and stretching components. Participants with higher attendance rates yielded the highest increases in BMD and decreases in body fat percentages (2007). Girls attending activity classes after school for at least two days per week indicated the most beneficial changes in bone health (2007).

A two-year RCT of mothers and their osteoporosis preventative behaviors reflected behavior changes affecting their children's diet (Winzenberg, Oldenburg, Frendin, De Wit & Jones, 2006). Maternal influence extends to calcium intake and physical activity engagement, as children whose mothers became more active also did, as reported by the mothers (2006). Children's adoption of behavior change is largely dependent upon and may be predicted by maternal behaviors.

Although many mothers are aware of bone health importance, some mothers agree certain barriers make osteoporosis prevention difficult. A qualitative approach utilizing semi-structured interviews with mothers in an osteoporosis-prevention trial in Tasmania examined family strategies and practices (Winzenburg, Hansen & Jones; 2008). Winzenberg et al. identified approaches mothers discussed to improve their children's calcium intake and physical activity, with role modeling noted as an essential theme among mothers (2008). Many mothers shared difficulties in feeding children calcium-rich foods and expressed shared similar strategies for improvement (2008). Winzenberg recommends a parent-focused approach as a consideration

for future osteoporosis prevention programs, as mothers have an important influence on behavioral factors known to influence bone health (2008).

Other studies have also concluded the role of environmental factors increases as adolescents age, which may inhibit achieving their genetically determined PBM (Yoneyama, Hiroyuki, & Beppu, 2008). Often, routines may be well-established in some families, making it especially challenging to adopt new diet or activity habits (2008). Helping both mothers and daughters understand the need for preventative measures to reduce osteoporosis risk like exercising is encouraged, particularly if they are inactive (2008).

Smoking and Alcohol and BMD

The NOF (2014) and NIH (2012) identify cigarette smoking and excessive consumption of alcohol as risk factors that increase likelihood for developing osteoporosis. Drinks in excess of two per day for women or three per day for men may decrease bone health while increasing fall risk (Cosman et al., 2014). There are many ways smoking affects bone health, but many smokers engage in other unhealthy behaviors that decrease bone density such as typically being low calcium consumers and not receiving adequate sun exposure for vitamin D synthesis (Yoon, Maalouf & Sakhaee, 2012). Female smokers reach menopause at an earlier age than non-smokers, also increasing osteoporosis risk (2012). Lower BMD and increased fracture risk at all skeletal sites are seen among smokers and increased risk occurs as smoking frequency increases, with risk attenuated more for women than men who smoke (2012). Tobacco use interferes with many factors contributing to bone health, including altering circulating vitamin D levels, binding of the sex hormone estradiol, interfering with collagen metabolism, and inhibiting the growth of new bone cells (2012).

Hormonal Contraceptives and BMD

There are conflicting studies regarding bone density and the use of oral contraceptives, with some studies showing an increase in BMD while others show women may decrease BMD with its use. Shoepe and Snow (2005) investigated 18-25 year olds' BMD in a cross-sectional study, identifying contraceptive users as those who had been exposed to hormonal contraceptives for at least six months and comparing them to non-users. The contraceptive users had lower BMD at the spine and hip, while controls had greater BMD at both sites at 1-2.6% and 0.8-1.8%, respectively after DXA comparison (2005). Another cross-sectional study observing bone mass quality in participants of Australia's Childhood Determinants of Adult Health longitudinal study found contrary results (Wei, Jones, Thomson, Dwyer & Venn, 2011). Women 26-36 years were identified as progestogen-only users, combined hormonal contraceptive users, and non-users. Bone quality was measured with QUS scanning at the mid-calcaneus part of the heel (2011). Those taking a combined oral contraceptive had higher outcomes of bone mass including higher broadband ultrasound attenuation (BUA), speed of sound and QUS than those taking a progestogen-only contraceptive had non-significantly yet higher BUA compared to non-users (2011).

Osteoporosis Knowledge and Beliefs and BMD

Psychosocial factors along with other determinants are thought to influence each other as well as disease and behavior outcomes, as hypothesized by Sharma, Hoelscher, Kelder, Day and Hergenroeder (2009). A cohort of over 700 adolescent girls in Texas participating in a larger study completed a survey, Calcium, Osteoporosis, Physical Activity questionnaire (COPA), a food frequency questionnaire and bone quality measurement (2009). A QUS heel-scanning device, which yields a score for bone quality with a Stiffness Index (SI), assessed participants.

Higher bone quality was significantly associated with several psychosocial measurements, including knowledge of foods' calcium content, self-efficacy for consuming good sources of calcium, self-efficacy for physical activity and outcome expectations (2009). Sharma and colleagues also found significant correlations between high SI scores and family encouragement for physical activity, friend encouragement for activity and participating in sport teams among adolescent girls (2009).

Chang, Yang, Chen & Chen (2010) assessed at-risk Taiwanese women over 30 years at a university medical center to determine the relationship between BMD and other factors. Participants self-reported a family history of osteoporosis and most were already osteopenic. After DXA screening, participants completed questionnaires regarding osteoporosis knowledge, beliefs and preventative behaviors. Variation in BMD was positively correlated with self-rated health, osteoporosis knowledge scores and preventative behaviors such as tobacco and alcohol avoidance (2010). Health care professionals should educate women as well as their families on preventative osteoporosis strategies (Chang et al., 2010).

Adopting precautionary behaviors to prevent osteoporosis may begin with initial knowledge of bone density quality. Having knowledge of one's current bone density status may lead many women who adopt osteoporosis preventative behaviors after knowing DXA scores (Hamerman, 2005). When bone density is known through DXA assessments, women may implement dietary, activity, behavioral and fall-preventative strategies to lessen disease risk or severity (2005).

Genetic influence and BMD

Previous osteoporosis studies show a strong genetic influence among family members. A study by Krall and Dawwson-Hughes (1993) examined both shared biological and familial traits

among mother-father son/daughter family units in Europe. After measuring bone density and lifestyle factors, it was estimated between 46-62% of the variance in bone density is due to genetic influence (1993). It is noted that these estimates are exclusive to the study sample and as age increases, familial influence decreases while the role of the environment grows (1993).

Many researchers have examined the genetic influence of BMD among twin pairs and first-degree relatives. Park et al. (2012) investigated the role of genetic factors on BMD among a Korean population of twin pairs and first-degree relatives including parents and siblings. DXA measurements of the hip and spine yielded a highly inheritable effect of BMD between all pairs, similar to Western populations (2012). Genetic testing by Park and colleagues also analyzed the correlation with BMD and specific sites, finding a positive genetic correlation between BMD and hereditary influence at the femoral neck and lumbar spine (2012).

White and Black adolescents and their mothers participated in a South African cohort, following bone mass and fracture history from birth – 20 years (Thandrayen, Norris, Micklesfield & Pettifor, 2014). Thandrayen et al. found an association between maternal lumbar spine BMC and adolescent fracture risk; each standard deviation unit increase in mother's BMD Z-score yielded a 24% decrease in fracture risk among her adolescent sons/daughters (2014).

CHAPTER III

METHODOLOGY

Purpose

The purpose of this study was to investigate the associations between bone mineral density, osteoporosis knowledge, psychosocial factors, and preventative behaviors among African American and Caucasian biological mother-daughter pairs. An additional purpose is to explore the relationships between mother/daughter pairs regarding conversations about general and bone health. Participants include pairs of adolescent African American and Caucasian females 13-18 years and their biological mothers. A convenient sample of Oxford, Mississippi residents and surrounding communities near The University of Mississippi were recruited for the current study, which this chapter outlines. This chapter is divided into the following sections: (1) participants, (2) procedures, (3) instruments, and (4) statistical analysis.

Participants

Participants included African American and Caucasian females ages 13-18 and their respective biological mothers. Inclusion criteria of the study limited participation to healthy individuals without known diseases or prescribed medications known to affect bone metabolism. Each adolescent gave her assent to participate and her respective parent consented for her daughter's participation (Appendices A and B, respectively). Mothers gave their own consent on a separate form, indicating they were over the age of 18 years (Appendix C). The target population was chosen for investigation because no published study, evident to the researcher, has explored bone density between pairs of African American and Caucasian mothers and daughters. Another reason African Americans were included for this study is because of known disparities surrounding osteoporosis and race. Many people, including African Americans, perceive only Caucasians to be susceptible to the disease. Further, the NOF (2011) explains the

average age for discussion initiation between mothers and daughters about osteoporosis does not occur until after peak bone mass is reached.

Subject Selection

Participants were recruited through University email and flyers (Appendix D), University bulletin boards, the on-campus health center, campus newspaper, word of mouth, social media, local churches, and community schools. Preliminary telephone/email screening was first conducted to ensure eligibility. According to the NOF (2014), a number of diseases and conditions may increase one's risk for osteoporosis including certain autoimmune, gastrointestinal, and hormonal disorders. Certain medications, including steroids and being underweight are also known to increase bone loss. Participants were excluded if they did not meet initial screening criteria. Once primary eligibility was determined, the mother-daughter(s) were scheduled to come to the University for data collection. This study was approved by The University of Mississippi's Institutional Review Board (IRB Protocol 15-029).

Potential participants contacted the researcher by phone or email to set up a phone screening conference (Appendix G). After communicating with the principal investigator (PI), eligibility was determined for the mother and daughter after the mother answered questions about potential confounding risk factors. Mother-daughter pairs deemed eligible were scheduled for a time to come in to the DXA Lab (Turner 248A) for further BMD screening. After a negative pre-DXA pregnancy test result required before a BMD scan, each mother and daughter completed additional bone health assessments. All participants completed an Osteoporosis Risk Factor Assessment (ORFA), Osteoporosis Knowledge Test (OKT), an online calcium food frequency questionnaire, and a Health Communication Survey utilized by the NOF's study among non-paired mothers and daughters (2011). Each mother and each daughter received a $10

Walmart gift card and the daughters additionally received age-appropriate educational materials about osteoporosis from the NOF.

Procedures

Each participant's BMD was assessed with a Hologic Delphi-W DXA machine, yielding BMD (g/cm^2), bone mineral content (BMC, g), and body composition measurements. Results for bone health are given in t-scores, comparing an individual's BMD to that of a gender and race-matched healthy 30 year old individual. The NOF categorizes bone density test results based off observed-scores. Normal bone density is described as including a T-score of -1.0 and above. Those at risk for osteoporosis or having osteopenia include individuals with a bone density test result T-score between -1 and -2.5 standard deviations below normal bone density. A resulting T-score of -2.5 and below is considered a diagnosis of osteoporosis (NOF, 2014).

The NOF states health professionals should utilize Z-scores when assessing children and teens but T-scores when assessing older adults (2014). Since adolescents have not yet reached peak bone mass, using T-scores comparing children and teenagers to the reference group of healthy young adult bones is not recommended (Bachrach & Sills, 2011). Z-scores compare one's BMD to that of the same age and size, and are considered a more appropriate measure of adolescent bone health. The NOF further explains that International Society for Clinical Densitometry (ISCD) classifies a normal Z-score as a value above -2.0. DXA results for body composition yield fat mass (g), lean mass (g) and total body fat percentage. The anterior posterior (AP) lumbar spine and non-dominant femoral hip bone density was obtained for BMD values, taking approximately 10 minutes combined for each participant. The total body scan to yield body composition values requires approximately eight minutes.

Radiation emitted from the DXA poses a risk to unborn fetuses. Prior to DXA screening, participants under the age of 55 completed a urine pregnancy test. If a pregnancy test was positive, the Script for Positive Pregnancy Test (Appendix F) was read and no further assessments were completed. After meeting inclusion criteria and passing a pre-screening pregnancy test, each participant then read and signed an informed consent document. Anthropometric measures were obtained with a Detecto scale, yielding height and weight, which are entered into the DXA software. After removing all metal clothing, DXA scans began.

First, a scan of the anterior-posterior (AP) spine was performed; this measures BMD of the lumbar spine (L1-L4) and femur (femoral neck, Ward's triangle, and trochanter); the scan time is approximately two minutes. Next a scan of the non-dominant femur was conducted. In order to determine non-dominance, the PI asked the participant which leg/foot she would use to kick a ball. This determination of dominance through dexterity preferences is an established practice in literature (Sone, Imai, Joo, Onodera & Fukunaga, 2006). This scan also takes approximately two minutes. Total body composition was also measured with a total body scan, yielding total fat mass (kg), lean mass (kg) and body fat percentage. This scan was completed in approximately six minutes.

Instruments

Risk factors and diet

To measure calcium consumption, the online Calcium Quiz developed by the Dairy Council of California assessed the total calcium that participants recalled consuming within the past day. Considering each individual's gender, age, and calcium supplementation, the quiz lists 34 calcium-rich food items. It identifies what a serving amount is and prompts the user to select how many servings he/she consumed in the last 24 hours. The free tool calculates the total

approximate mg of calcium one consumed. The results of the online Calcium Quiz have had significantly similar calcium estimates compared to a three-day diet record and a food frequency questionnaire, making it a valuable measurement of calcium intake (Hacker-Thompson, Robertson & Sellmeyer, 2009). Mean daily calcium intake, as determined by the Calcium Quiz, did not significantly differ from average calcium consumption as recoded by participants' three-day food records (2009). This is readily available questionnaire, previously used within an adolescent population. It is recommended for research and community settings and requires less than five minutes to complete (2009).

An osteoporosis questionnaire measuring several factors known to influence bone health also measured mothers' and daughters' behaviors affecting bone health. The Osteoporosis Risk Factor Assessment (ORFA) asks mothers and daughters about their engagement in preventative behaviors, such as engaging in physical activity, childhood consumption of milk, and other considerations. The ORFA also measured behaviors known to increase osteoporosis risk, such as smoking, amenorrhea, and family history of a hip fracture.

To explore mother-daughter health conversations, questions assessing each participant's engagement discussing certain health issues were assessed with a Health Communication Survey for each mother and daughter. This original questionnaire was developed for the NOF's *Generations of Strength* campaign seeking facts about mothers' and daughters' shared concerns about the disease (2012). The campaign also identified the average age osteoporosis conversations begin between mothers and daughters, although the results of the NOF's study were not paired with respective mothers and daughters. The health discussion questions also asked participants to identify their comfort level in having these conversations with their mother or daughter.

The Osteoporosis Knowledge Test (OKT) was utilized to measure osteoporosis knowledge for each mother and daughter. The OKT is a widely used 24-item instrument assessing osteoporosis knowledge with questions developed by Kim, Horan, Gendler and Patel (1991). Two subscales of the OKT measure calcium and exercise knowledge relating to the disease; total correct answers are summed. The internal consistency reliability coefficient for the OKT Exercise subscale is .69; OKT Calcium subscale validity has a reliability coefficient of .72 (1991). The validity of the OKT has been evaluated by factor analysis and discriminant function analysis (1996).

Statistical Analysis

The following independent variables were analyzed to explain the variance in spinal and femoral BMD: calcium intake, physical activity, smoking behavior, alcohol consumption, hormonal contraceptive use, and family history. The Statistical Package for Social Sciences (SPSS) Version 21 was used to analyze all data. Statistics are reported for each item in the Calcium Quiz, ORFA, and OKT.

To compare differences between the means of the two groups, paired and independent *t*-tests were used. Independent t-tests compared the outcome means among the group of mothers and also among the group of daughters. Independent t-tests also compared each mother-daughter couple's outcomes to determine if the difference in BMD was significantly different between races and if they differed significantly when compared to national standards for calcium intake and physical activity guidelines. Age, physical activity, calcium intake, oral contraceptive use, family history of osteoporosis, race, alcohol consumption, smoking behavior and family history of OP were independent variables used to explain the variance in spinal and femoral BMD.

Univariate analyses illustrated frequencies of responses between race and mother-daughter groups for survey responses.

This includes 13-18 year old adolescent African American and Caucasian females and their biological mothers. Independent variables include height, weight, fat and fat-free mass. Descriptive statistics are utilized to check assumptions of homoscedasticity and normality.

CHAPTER IV

RESULTS

Results

Description of the Sample

A total of 65 African American and Caucasian biological mothers (43.1%, n=28) and daughters (56.9%, n=28) from the Oxford, MS area participated in this study on the campus of The University of Mississippi. There were a total of 29 observed pairs of mothers and daughters; seven mothers participating included two daughters, allowing for 37 statistical pairs to be analyzed. The majority of participants included Caucasian mothers and daughters (76.9%, n=50), followed by African Americans (23.1%, n=15).

The mean age of African-American women was slightly younger than Caucasian mothers in this study. Overall, the mean age including both races of mothers was 45.48 years ($\pm$ 4.84). African American mothers had a mean age of 40.33 years ($\pm$ 3.62), and Caucasian's mean age was 46.83 years ($\pm$ 4.21). The adolescents' average age in this study was 15.31 years ($\pm$ 1.43). African American and Caucasian daughters had a similar mean age. The mean age of African American daughters was 15.44 years ($\pm$ 1.42), while Caucasian daughters had an average age of 15.26 years ($\pm$ 1.46).

Weight/BMI/Antrhopometric characteristics

The BMI cutoffs determined by the World Health Organization (WHO) stratifies individuals into categories based on weight and height include low or underweight (BMI $\leq$18.5 kg/m^2); normal weight (BMI between 18.5-24.9 kg/m^2); overweight (BMI $\geq$ 25 kg/m^2); and obese (BMI $\geq$ 30 kg/m^2). A majority (61.6%, 40) of the participants' BMI was classified as "normal"; a small number (6.2%, 4) were classified as being under weight. A smaller number of all participants had BMIs classifying them as overweight (16.9%, 11) or obese (15.4%, 10). African American participants were evenly split between both overweight and obese

classifications of BMI (40%, 6 each); a smaller number fell into the "normal" weight classification (20%, 3), and none were classified as being underweight. A high proportion of Caucasian participants were classified "normal" BMI (76%, 38). The remaining Caucasian participants were split into overweight (10%, 5), underweight (8%, 4) and obese (6%, 3) categories.

Exploring both race and mother/daughter status, African American mothers were most likely to be in the obese classification of BMI (66.6%, 4) while Caucasian women mostly comprised the "normal" weight category (81.8%, 18). African American daughters were most likely to be in the overweight category (55.5%, 5), with Caucasian daughters mostly being classified as "normal" (71.4%, 20).

The overall mean body fat percentage for every participant in this study averaged 28.73% ($\pm$7.53). The mean body fat percentage for all mothers was slightly higher than the average for daughters, with mothers' averaging 30.36% ($\pm$8.20) and daughters' 27.5% ($\pm$6.84). Among all African Americans in this study, the mean body fat percentage total was 35% ($\pm$6.90), compared to a lower body fat percent mean for Caucasians of 26.9% ($\pm$6.69).

Table 4-1

Mean and Standard Deviation (SD) of Characteristics of Mothers & Daughters by Race

Mother/Daughter	**Race**	**Mean body fat**	**Age (years)**	**Body Mass Index (BMI)**
Mother	African American (n=6)	40.3% (± 4.8)	40.3 (±3.6)	33.2 (±7.8)
	Caucasian (n=23)	27.7% (± 6.7)	46.7 (±4.3)	22.4 (±3.3)
Total	(n=29)	30.51% (±8.1)	45.5 (±4.8)	24.9 (±6.3)
Daughter	African American (n=9)	31.5% (± 5.8)	15.4 (±1.4)	28.3 (±6.4)
	Caucasian (n=28)	26.2% (± 6.7)	16.5 (±6.5)	21.9 (±3.7)
Total	(n=37)	27.3% (±5.8)	15.3 (±1.4)	23.3 (±5.1)
Totals:	African American (n=15)	35% (±6.9)	25.4 (±12.9)	30.3 (±7.1)
	Caucasian (n=50)	26.84 (±6.7)	29.8 (±16.2)	22.1 (±3.5)
Total	(n=65)	28.7% (±7.5)	28.8 (±15.5)	28.7 (±7.5)

Table 4-2

Distribution & Classifications of BMI of Mothers & Daughters by Race

Mother/Daughter	**Race**	**Underweight**	**Normal**	**Overweight**	**Obese**
Mother	African American (n=6)	0%	16.7%	16.7%	66.7%
	Caucasian (n=23)	4.5%	81.8%	9.1%	4.5%
Total	(n=29)	3.6%	67.9%	10.7%	17.8%
Daughter	African American (n=9)	0%	22.2%	55.6%	22.2%
	Caucasian (n=28)	10.7%	71.4%	10.7%	7.1%
Total	(n=36)	8.1%	59.5%	21.6%	10.8%
Totals:	African American (n=15)	0%	20%	40%	40%
	Caucasian (n=50)	8%	76%	10%	6%
Total	(n=65)	6.2%	63.1%	16.9%	13.8%

Spinal BMD values

As previously described, adults and adolescents should interpret their bone density results slightly differently since those who have not reached peak bone mass should not be compared to a reference group of healthy adults who have reached PBM with DXA measurements (Bachrach & Sills, 2011). Exploring mothers' t-scores for their spinal BMD, the average t-score was 1.04 (.124). Considering the NOF's classifications for t-scores, the majority of the mothers in this study could be categorized as having healthy spinal BMD. Overall, approximately 69% (n=20) of mothers of both races had healthy total spine t-scores; nearly 28% (n=8) had low spinal BMD or osteopenia; only 3% of the population of mothers in this study could be described as having osteoporotic spinal BMD (n=1).

Examining African American mothers' spinal BMD, 66% (n=4) fell into the healthy bone density category with their obtained t-scores; 33% (n=2) were classified with osteopenia. There were no African American mothers whose spinal t-scores categorized them with osteoporosis. With Caucasian mothers, approximately 70% (n=16) yielded healthy t-scores of the total spine; nearly 26% (n=6) had osteopenic spinal BMD scores. The only spinal BMD with osteoporosis was a Caucasian mother (n=1).

None of the daughters in this study provided z-scores that would label them as being low for their age (having a z-score greater than -2.0) as described in pediatric health literature on bone density (Bachrach & Sills, 2011). The mean z-score for daughters of both races was 0.403 ($\pm$ 0.8814), with the lowest obtained spinal z-score including -1.1 in this study. African American daughters had a mean spinal z-score of 0.611 ($\pm$ 1.045), where Caucasian daughters had a lower mean spinal BMD z-score of 0.333 ($\pm$0.831).

Table 4-3

Mean and SD of Spinal BMD by Race and Overall

Mother/Daughter	Race	BMD L-1 (g/cm^2)	BMD L-2 (g/cm^2)	BMD L-3 (g/cm^2)	BMD L-4 (g/cm^2)	Total BMD (g/cm^2)	Spinal t-score
Mother	African American (n=6)	0.984 (±0.18)	1.07 (±0.19)	1.07 (±0.18)	1.02 (±0.16)	1.03 (±0.18)	-1.02 (±1.16)
	Caucasian (n=23)	0.99 (±0.12)	1.05 (±0.12)	1.07 (±0.12)	1.01 (±0.13)	1.03 (±0.12)	-0.14 (±1.09)
							Spinal z-score
Daughter	African American (n=9)	1.01 (±0.13)	1.12 (±0.12)	1.14 (±0.12)	1.11 (±0.11)	1.09 (±0.11)	0.611 (±1.04)
	Caucasian (n=28)	0.92 (±0.99)	1.01 (±0.101)	1.03 (±0.11)	1.00 (±0.11)	0.99 (±0.09)	0.33 (±0.83)

Femoral BMD values

The mean t-score at the femoral neck for all mothers in this study was -0.586 (± 0.998). African American mothers did have a slightly higher average t-score for femoral BMD than Caucasian mothers, with -0.433 (±1.1201) and -0.626 (± 0.988), respectively. When considering the established guidelines for t-scores that similarly classify femoral BMD, the majority or nearly 69% (n=20) of mothers in this study could be classified as having healthy bone density. Approximately 28% (n=8) of mothers had t-scores classifying them as osteopenic; one mother had osteoporotic femoral BMD.

African American and Caucasian mothers in this study had similar results of femoral BMD as spinal BMD scores. Among African American mothers, were 66% (n=4) classified with healthy femoral BMD; 33% were considered osteopenic (n=2) and no African American mothers in this study had femoral BMD classified as osteoporotic. With Caucasian mothers,

nearly 70% (n=16) had healthy femoral BMD t-scores; approximately 26% (n=6) had osteopenic scores. The only femoral BMD with an osteoporosis t-score was a Caucasian mother (n=1).

The mean femoral z-scores for adolescents of both races in this study was lightly lower than spinal BMD. Overall, the mean z-score for all daughters was 0.244 (± 0.968). African American daughters did have a slightly lower mean z-score at the femoral hip compared to Caucasian daughters, with a mean of 0.067 (±1.12) compared to 0.304 (±0.928), respectively. None of the daughters had a z-score two standard deviations below their age-matched reference, however, one did have a score approaching the label of having low BMD with a z-score of -1.9.

Table 4-4

Mean and SD of Femoral BMD by Race and Overall

Mother/Daughter	**Race**	**BMD Femoral neck (g/cm^2)**	**Femoral T-score**	**BMD Total Hip (g/cm^2)**	**Total Hip t-score**
Mother	African American (n=6)	0.88 (±0.16)	-0.43 (±1.12)	0.97 (±0.14)	-0.37 (±0.89)
	Caucasian (n=23)	0.78 (±0.11)	-0.63 (±0.99)	0.99 (±0.11)	-0.39 (±0.86)
					Total Hip z-score
Daughter	African American (n=9)	0.95 (±0.15)	0.07 (±1.12)	1.03 (±0.14)	0.10 (±1.05)
	Caucasian (n=28)	0.88 (±0.11)	0.30 (±0.93)	0.96 (±0.94)	0.23 (±0.82)

Survey Responses

OKT Mothers' Responses

The Osteoporosis Knowledge Test (OKT) assessed responses to factors that prevent osteoporosis risk, developed by Kim, Horand, Gendler and Patel (1991). The first nine questions gauge an individual's perceived likelihood of having an increased or decreased chance of getting

osteoporosis based on several risk factors. Other questions ask about nutrition, exercise and sources of calcium. Half of African American mothers in this study did not know that eating a diet low in milk increases osteoporosis (OP) risk; here was also a low percentage of both African American and Caucasian mothers who identified that having big bones protects against OP likelihood, with 16.7% and 36.1%, respectively, correctly knowing risk was reduced. Surprisingly, only 33.3% of African American and 36.4% of Caucasian mothers were able to identify being a white woman with fair skin as increasing one's risk for OP. Just over a third of all mothers in this study correctly responded that having one's ovaries surgically removed does increase likelihood for developing OP.

All of the African American mothers in this study were able to correctly identify on the OKT that exercising on a regular basis decreases one's likelihood for developing OP. While only 50% of African American mothers were able to correctly identify walking as the best way to reduce OP risk from a list of exercise options compared to 70% of Caucasian mothers, all of the African American mothers were able to correctly identify the number of days needed to exercise to strengthen bones compared to 86.4% of Caucasian mothers. All of the African American mothers correctly identified jogging as the best exercise to reduce OP, compared to 81.8% of Caucasian mothers.

All of the African American mothers also correctly identified cheese as an ideal calcium source, compared to 95.5% of Caucasian mothers in this study. A smaller percentage of all mothers correctly identified canned sardines as the best source of calcium, with 33.3% of African American and 68.2% of Caucasian mothers. Additionally, 100% of African American mothers also accurately selected broccoli as a good source of calcium, versus a lower 68.2% of Caucasian mothers. Every mother in this study distinguished yogurt as a good source of calcium. Only

17.9% of mothers in this study correctly knew the recommended amount of daily calcium intake, with 50% knowing over two glasses of milk is needed to meet this requirement.

Table 4-5

Percentage of Mothers' Correct Responses on OKT by Race and Overall

Items:	**African American** (n=6)	**Caucasian** (n=23)	**Overall Total** (n=29)
1. Eating a diet low in milk products	50%	81%	74.1%
2. Being menopausal; "change of life"	66.7%	77.3%%	75%
3. Having big bones	16.7%	36.1%	32.1%
4. Eating a diet high in dark leafy vegetables	83.3%	72.7%	75%
5. Having a mother or grandmother with OP	66.7%	77.3%	75%
6. Being a white woman with fair skin	33.3%	36.4%	35.7%
7. Having ovaries surgically removed	16.7%	36.4%	32.1%
8. Taking cortisone (steroids, Prednisone) for a long time	33.3%	68.2%	60.7%
9. Exercising on a regular basis	100%	90.9%	93%
10. ...exercises is the best way to reduce a person's chance of getting OP?	50%	70%	65.4%
11. ...exercises is the best way to reduce a person's chance of getting OP?	66.7%	59.1%	60.7%
12. How many days a week do you think a person should exercise to strengthen the bones?	100%	86.4%	89.3%
13. What is the least amount of time a person should exercise on each occasion to strengthen the bones?	66.7%	86.4%	82.1%
14. Exercise makes bones strong, but it must be hard enough to make breathing:	33.3%	59.1%	53.6%
15. ...exercises is the best way to reduce a person's chance of getting OP?	100%	81.8%	85.7%
16. ...exercises is the best way to reduce a person's chance of getting OP?	83.3%	90.1%	89.3%
17. Which of these is a good source of calcium?	100%	95.5%	96.4%
18. Which of these is a good source of calcium?	33.3%	68.2%	60.7%
19. Which of these is a good source of calcium?	100%	68.2%	75%
20. Which of these is a good source of calcium?	100%	100%	100%
21. Which of these is a good source of calcium?	83.3%	90.9%	89.3%
22. Which of the following is the recommended amount of calcium intake for an adult?	16.7%	18.2%	17.9%
23. How much milk must an adult drink to meet the recommended amount of calcium?	50%	50%	50%
24. Which of the following is the best reason for taking a supplement?	83.3%	86.4%	85.7%

OKT Daughters' Responses

The same OKT given to mothers in this study was also given to daughters. Similar to responses from African American mothers, just 55.6% of daughters selected a diet low in milk as increasing likelihood of OP risk, compared to a higher 74.1% of Caucasians. While the majority or 88.6% of all daughters correctly identified an increased risk of OP with a mother or grandmother having a history of the disease, only 16.7% of daughters knew being a white woman with fair skin increased OP risk. Daughters also had a low percentage accurately identify an increased risk with having one's ovaries surgically removed, with 19.4% correctly responding.

While 100% of African American mothers identified a lower risk with regular exercise, only 55.5% of their daughters correctly associated a decreased risk of OP with activity. Caucasian daughters, however, had a higher 76.9% correctly associate a lower risk with exercise. A low percentage of 41.7% both African American and Caucasian daughters correctly knew walking was a good way to reduce OP risk. A higher percentage of African American daughters, however, correctly knew bicycling was a good exercise to reduce PA compared with Caucasian daughters (66.7% and 48.1%, respectively). While most or 77.8% of all daughters accurately identified three or more days of exercise as reducing OP risk, fewer knew the intensity needed. Just 33.3% of African American and 37% of Caucasian daughters in this study knew exercise should be hard enough to make breaking much faster, with walking possible. While 66.7% of African American daughters compared to 81.5% of Caucasian daughters knew jogging was an exercise option to reduce OP likelihood, 100% of African American daughters knew aerobic dance was also exercise that can reduce OP risk versus 66.7% of Caucasian daughters.

While most (80.6%) daughters correctly identified cheese as a good source of calcium, a much smaller percentage (22.2%) knew canned sardines also are a calcium-rich option. Similar to the responses from mothers, a higher percentage of African Americans knew broccoli was a good source of calcium, with 66.7% of African American daughters correctly responding compared to 26% of Caucasian daughters. While a high percentage or 88.5% of Caucasian daughters knew yogurt was a good source of calcium, 66.7% of African American daughters correctly selected this food option. Surprisingly, less than half or 47.2% of all daughters knew ice cream was a good source of calcium, with 44.4% of African American and 48.1% of Caucasian daughters correctly responding. There were no African American and only 11.1% of Caucasian daughters who knew the recommended calcium intake for adults exceeded 800 mg/day.

Table 4-6

Percentage of Daughters' Correct Responses on OKT by Race and Overall

Items:	**African American** (n=9)	**Caucasian** (n=27)	**Overall Total** (n=36)
1. Eating a diet low in milk products	55.6%	74.1%	69.4%
2. Being menopausal; "change of life"	37.5%	34.6%	35.3%
3. Having big bones	66.7%	33.3%	45.7%
4. Eating a diet high in dark leafy vegetables	87.5	59.3%	65.7%
5. Having a mother or grandmother with OP	77.8%	92.3%	88.6%
6. Being a white woman with fair skin	11.1%	18.5%	16.7%
7. Having ovaries surgically removed	11.1%	22.2%	19.4%
8. Taking cortisone (steroids, Prednisone) for a long time	22.2%	55.5%	47.2%
9. Exercising on a regular basis	55.5%	76.9%	71.4%
10. ...exercises is the best way to reduce a person's chance of getting OP?	44.4%	40.7%	41.7%
11. ...exercises is the best way to reduce a person's chance of getting OP?	66.7%	48.1%	52.8%
12. How many days a week do you think a person should exercise to strengthen the bones?	77.8%	77.8%	77.8%
13. What is the least amount of time a person should exercise on each occasion to strengthen the bones?	55.6%	77.8%	72.2%
14. Exercise makes bones strong, but it must be hard enough to make breathing:	33.3%	37%	36.1%
15. ...exercises is the best way to reduce a person's chance of getting OP?	66.7%	81.5%	77.8%
16. ...exercises is the best way to reduce a person's chance of getting OP?	100%	66.7%	75%
17. Which of these is a good source of calcium?	77.8%	81.5%	80.6%
18. Which of these is a good source of calcium?	11.1%	26%	22.2%
19. Which of these is a good source of calcium?	66.7%	26%	36.1%
20. Which of these is a good source of calcium?	66.7%	88.5%	82.9%
21. Which of these is a good source of calcium?	44.4%	48.1%	47.2%
22. Which of the following is the recommended amount of calcium intake for an adult?	0%	11.1%	8.3%
23. How much milk must an adult drink to meet the recommended amount of calcium?	33.3%	33.3%	33.3%
24. Which of the following is the best reason for taking a supplement?	66.7%	70.1%	69.4%

ORFA- Mothers' Responses

The Osteoporosis Risk Factor Assessment (ORFA) given to mothers included 36 items assessing current and previous behaviors known to influence bone health as well as family history. Self-reported information was obtained to determine if mothers in this study ever had a mother or grandmothers with a diagnosis of osteoporosis, with less than a third (27.9%) of all mothers indicating "yes." More Caucasian (30.4%) compared to African American (16.7%) mothers did have a family history of OP. Approximately a fifth (20.7%) of all mothers, however, indicated they were unsure of their family history of OP.

Specifically regarding a family history of a hip fracture, a higher percentage of Caucasian mothers indicated a past fracture, with just over 26% answering "yes"; a smaller 16.7% of their African American counterparts had a family history of a hip fracture. The same percentage (16.7%) of African American mothers who did have a family history of a hip fracture also unsure about past breaks.

A higher percentage of African American mothers reported being breastfed as a child by their mother than Caucasian mothers in this study (16.7% versus 13%, respectively). Caucasian mothers, however, reported a higher percentage of breastfeeding their own children, with 82.6% indicating breastfeeding compared to 40% of African American mothers.

There were no African American mothers in this study who reported ever consuming a high protein diet, while 26% of Caucasian mothers indicated they were at one time. Of the Caucasian mothers who did respond to eating a diet high in protein, most (83.3%) reported consuming this diet between one and three months.

Both African American and Caucasian mothers had none report being a current smoker. Of the mothers who had smoked in the past, only Caucasian mothers responded to being prior

smokers, the highest percentage (17.4%) reported smoking less than five years. Alcohol consumption was also measured by asking, "How many alcoholic beverages do you usually consume in a setting?" Just over a third (33.3%) of African American mothers indicated they do not consume any alcohol, with 17.5% of Caucasian mothers also answering zero beverages. Most African American and Caucasian mothers who consume alcohol responded to typically consuming two drinks at a time (50%, 52.9%, respectively).

Just over 20% of mothers of both races indicated being amenorreahic, or "having missed a menstrual cycle for any reason, other than pregnancy for longer than 3 months" as described by the ORFA. A slightly higher percentage of Caucasian mothers indicated being amenorreahic compared to African American mothers (21.7 versus 16.6%, respectively).

A higher percentage (50%) of African American mothers indicated having used estrogen or female hormones including "pills, vaginal cream, suppositories, injections or skin patches" on the ORFA than Caucasian mothers (21.7%) in this study. A slightly higher percentage (91.3%) of Caucasian mothers reported ever using oral contraceptives than African American mothers (80%).

The ORFA also measures physical activity habits of mothers growing up. While 43.5% of Caucasian mothers indicated having participated in recreational league sports before age 12, there were no African American mothers who answered "yes" to this item. More Caucasian mothers also indicated having participated in team sports at school before age 12, with 39.1% engaging compared to 20% of African American mothers. A higher percentage, however, were active in physical education (PE) classes prior to 12 years, with over 89% overall engaging in PE. Both races also reported a high percentage (85.7%) engaged in PE after age 12.

To gauge if mothers in this study engaged in physical activity and exercise types that promote bone health, questions on the ORFA asked for the number of times and minutes devoted to those types of caloric output known to increase bone density. Examples included walking, jogging/running, aerobics/aerobic dance, yard work/gardening, lifting weights, and other physically active sports and hobbies. The most recent recommendations in the 2008 Physical Activity Guidelines for Americans compiled by the US Department of Health and Human Services (USDHHS) states healthy adults should aim for 150 minutes per week of moderately intense activity. Mean number of minutes and standard deviations are reported below.

Table 4-7

ORFA - Mothers' Results

Items:	**African American** (n=6)	**Caucasian** (n=23)	**Overall Total** (n=29)
Has family history of OP	16.7%	30.4%	27.9%
Does not have a family history of OP	66.7%	47.8%	51.7%
Does not know if there is a family history of OP	16.7%	21.7%	20.7%
Has family history of hip fracture	16.7%	26.1%	24.1%
Does not have family history of hip fracture	66.7%	60.9%	62.1%
Does not know if there is a family history of hip fracture	16.7%	13%	13.8%
Was breastfed as a baby	16.7%	13%	13.8%
Was not breastfed as a baby	83.3%	78.3%	79.3%
Does not know if she was breastfed as a baby	0%	8.7%	6.9%
Breastfed her child(ren)	40%	82.6%	75%
Consumed a high protein diet (Atkins, South Beach, etc)	0%	26%	20.7%
Currently consumes carbonated beverages	83.3%	43.5%	51.7%
Smokes currently	0%	0%	0%
Has ever smoked	0%	43.5%	17.4%
Lives with a smoker	33.3%	0%	6.9%
Alcohol consumption: None	33.3%	17.4%	20.7%
One beverage	16.6%	17.4%	17.2%
Two beverages	50%	52.9%	51.7%
Three beverages	0%	13%	10.3%
Has had a period in the last 12 months	83.3%	69.6%	72.4%
Has ever been amenorreahic	16.6%	21.7%	20.7%
Estrogen or female hormone use	50%	21.7%	27.6%
Oral contraceptive use	80%	91.3%	89.3%
Physical Activity			
Meets USDHHS activity guidelines	16.7%	56.5%	48.3%
Recreation league sport participation (before age 12)	0%	43.5%	35.7%
School team sport participation (before age 12)	20%	39.1%	35.7%
Participation in PE classes (before age 12)	80%	91.3%	89.3%
Participation in PE classes (ages 13-19)	80%	87%	85.7%
Mean number of minutes of PA/week (SD)	50.4 (±92)	334 (±408.6)	406.5 (±612)

ORFA- Daughters' Responses

No African American daughters in this study reported having had a family member with osteoporosis, which contrasts with responses from their mothers, as indicated on the previous table. Additionally, while a third of Caucasian mothers responded to having family history of OP, only 3.7% of daughters indicated so. A high percentage, however, of Caucasian daughters answered that they were unaware of a family history of OP. Knowledge of family history was different for both races of mothers and daughters.

While no African American daughters had a family history of a hip fracture, 14.8% of Caucasian daughters did respond "yes" to this question; 50% of African American daughters were unaware of a history of fracture as were 29.6% of Caucasian daughters. While over 80% of Caucasian daughters indicated they were breastfed as an infant, 50% of African American daughters reported being breastfed with another 50% unsure. Additionally, 7.7% of Caucasian daughters were also unsure if they were breastfed.

There were no African American daughters who consumed a high protein diet, while 7.4% of Caucasian daughters had. Of those Caucasian daughters who did eat a high protein diet, the length of time reported was between one and three months. Overall, 64.7% of all daughters indicated they consume carbonated beverages; 85.7% of African American daughters and 59.3% of Caucasian daughters were regular consumers. Most daughters of both races, however, indicated typically consuming one per day.

Neither African American nor Caucasian daughters reported living with a smoker. No African American daughters reported having ever smoked, while 3.7% of Caucasian daughters did; the length of time a smoker this participant reported was "less than 1 year."

All of the African American and 96.3% of the Caucasian daughters indicated having had a menstrual period in the last 12 months. Of the Caucasian daughters, 7.4% responded to having ever been amenorreahic, but none of the African American daughters responded to having lost a menstrual cycle as described previously.

None of the African American daughters had ever used estrogen or female hormones; 14.3% have ever or currently use oral contraceptives. There was a 3.7% use of female hormones among Caucasian daughters and a 22.2% use of oral contraceptives in this study.

A higher percentage of daughters compared to their mothers reported being active through recreational activities and school sports or classes. Overall, 82.4% engaged in recreation sports before age 12, although there was a higher (88.9%) percentage of Caucasian than African American (57.1%) daughters. Regarding current participation in recreation leagues, no African American daughters indicated this activity, compared to just over a third (33.3%) of Caucasian daughters. Current school team sport participation indicated a 57.1% engagement by African American daughters and 63% by Caucasians. All African American daughters engaged in PE classes before age 12, as well as 92.6% of Caucasian daughters. When asked about current PE participation, 36.4% of all daughters answered to presently being in the class. There were a higher percentage of African American daughters taking PE now than Caucasians (66.7% versus 29.6%, respectively).

The USDHHS recommends children and adolescents engage in bone-building activities that may include both muscle-strengthening and aerobic activities (2008). Jumping rope, for example, is an example of all three types of activity one could utilize. They give a recommendation of engaging in 60 minutes of physical activity each day, or 180 minutes total per week (2008).

Table 4-8

ORFA- Daughters' Results

Items:	**African American** (n=9)	**Caucasian** (n=27)	**Overall Total** (n=36)
Has family history of OP	0%	3.7%	3%
Does not have a family history of OP	100%	37.1%	48.5%
Does not know if there is a family history of OP	0%	59.3%	48.5%
Has family history of hip fracture	0%	14.8%	12.1%
Does not have family history of hip fracture	50%	55.6%	54.5%
Does not know if there is a family history of hip fracture	50%	29.6%	33.3%
Was breastfed as a baby	50%	80.8%	75%
Was not breastfed as a baby	50%	11.5%	18.8%
Does not know if she was breastfed as a baby	0%	7.7%	6.3%
Consumed a high protein diet (Atkins, South Beach, etc)	0%	7.4%	5.9%
Currently consumes carbonated beverages	85.7%	59.3%	64.7%
Smokes currently	0%	0%	0%
Has ever smoked	0%	3.7%	2.9%
Lives with a smoker	0%	0%	0%
Has had a period in the last 12 months	100%	96.3%	97.1%
Has ever been amenorreahic	0%	7.4%	5.9%
Estrogen or female hormone use	0%	3.7%	2.9%
Oral contraceptive use	14.3%	22.2%	20.6%
Physical Activity			
Meets USDHHS activity guidelines	22.2%	66.7%	55.6%
Current school team sport participation	57.1%	63%	61.8%
Participation in PE classes (before age 12)	100%	92.6%	94.1%
Current participation in PE classes	66.7%	29.6%	36.4%
Mean number of minutes of PA/week (SD)	153.1 (±233.5)	631.8 (±808.3)	512.1 (±736.2)

Health Communication - Mothers' Responses

Mothers additionally completed a Health Communication Survey assessing factors regarding health discussions with their daughters. Questions measured topics mothers and daughters typically discuss as well as the comfort level mothers feel when having these conversations with their daughters. This survey also asked mothers the ages they initiated health discussions with their daughter(s); it further asks mothers when they felt family history impacted their own health and when women should start to consider bone health.

When asked, "How easy is it to have conversations with your daughter?" most mothers (75.9%) responded that it was extremely easy to do so, with 78.3% of Caucasian mothers and 66.7% of African American mothers indicating so. Just over 33% of African American mothers in this study found conversations with their daughter to be somewhat easy, as did 13% of Caucasian mothers. No African American mothers found discussions with daughters to be "not very easy" or "not easy at all," while 4.3% of Caucasians found conversations with some difficulty and another 4.3% finding discussions to be "not easy at all." Over 93% of all mothers had daily conversations with their daughters, while 6.9% engaged a few times during a week.

Both races of mothers all selected health as a topic they are likely to talk about with their daughter. More specifically, most topics (71.4%) of discussions with daughters were focused on "everyday health, such as taking vitamins or having an annual physical," with 81.5% of Caucasian mothers selecting this answer. A lower percentage of African Americans (33.3%) focused topics with daughters on daily health issues, but a higher percentage (66.7%) discussed "risk for serious diseases and conditions, such as osteoporosis or breast cancer." Caucasian mothers had a lower percentage indicating topics were generally on serious health issues

(13.6%). Among pressing health issues, 16.7% of African American and 22.7% of Caucasian mothers had ever discussed OP with their daughters.

Several questions also asked mothers appropriate ages for health discussions and considerations. When asked, "About how old was your daughter when you first talked to her about her health?" mothers of both races had similar mean ages of response. African American mothers typically initiated health discussions with daughters at 6.9 (±2.5) years, and Caucasians at 5.6 (±3.3) years. Another question asked mothers when they began "considering the impact your family health history may have on your own health," with both races also yielding similar mean ages. African American mothers began thinking about health history at 24 (±7.5) years and Caucasian women at 26.2 (±11.2) years. When asked, "About what age do women need to start thinking about their bone health?," there were very different mean ages between races. African American mothers reported a mean age of 43 (±15.7) years while Caucasian mothers on average indicated they believed bone health considerations should begin at 25.8 (±12.7) years.

Mothers were also asked which health conditions concerns them the most in regards to their health and responses included listed health conditions and issues including osteoporosis. There were no African American mothers who chose OP as the most concerning health issue but 21.7% of Caucasian mothers selected it as the most pressing topic listed. When asked which health condition they felt at risk for because of family history, no African American mothers felt at risk for OP: 30.4% of Caucasian mothers, however, did indicate it was a concern.

Another question asked mothers which of those same listed health conditions they felt at risk for "because of not knowing your family health history." No African American mother felt at risk for OP from not knowing family history but 13.6% of Caucasian mothers did. This survey also asked which health conditions mothers felt at risk for due to gender. Half of African

American and 82.6% of Caucasian mothers indicated OP was a health issue they felt at risk for because of gender.

The Health Communication Survey additionally asked which health condition most affects women with a list of female cancers as well as heart disease, infertility, stroke and osteoporosis. Among African American mothers, 16.7% selected OP while 39.1% of Caucasian mothers thought OP most affected women, and 34.5% of mothers overall.

A separate question asked mothers how confident they felt about their knowledge of osteoporosis prevention. Answer options included: very confident, somewhat confident, not very confident and not confident at all. No African American mothers selected "I am very confident" while 4.3% of Caucasian mothers felt very confident with OP prevention. Most or 62.1% of all mothers felt somewhat confident in OP prevention, with 66.7% of African American and 60.9% of Caucasian mothers selecting this response. Among those who selected being "not very confident,"16.7% were African American and 30.4% were Caucasian mothers. Mothers who felt not confident at all included 16.7% of African American and 4.3% of Caucasian mothers.

Table 4-9

Health Communication - Mothers' Results

Items:	African American (n=6)	Caucasian (n=23)	Overall Total (n=29)
Ease of conversations with your daughter:			
Extremely easy	66.7%	78.3%	75.9%
Somewhat easy	33.3%	13%	4.3%
Not very easy	0%	4.3%	3.4%
Not easy at all	0%	4.3%	3.4%
Frequency of conversation with your daughter:			
Daily	83.3%	95.7%	93.1%
Few times a week	16.7%	4.3%	6.9%
Likely to discuss health with daughter	100%	100%	100%
Has ever discussed OP with daughter	16.7%	22.7%	21.4%
Topic to most likely discuss with your daughter:			
Everyday health (vitamins, annual physical)	33.3%	81.8%	71.4%
Risk for serious conditions (OP or breast cancer)	66.7%	13.6%	25%
At about what age…:			
Did you talk to your daughter about her health	6.91 (±2.5) years	5.6 (±3.3)	5.9 (±3.15)
Consider impact of family history on own health	24 (±7.5)	26.2 (±11.2)	25.7 (±10.4)
Should women start thinking about bone health	43 (±15.7)	25.8 (±12.7)	29 (±14.6)

Health Communication - Daughters' Responses

The Health Communication Survey was also administered to daughters, asking similar questions about their frequency, ease and topics of health communication with their mothers as well as other questions about bone health that mothers answered. Questions regarding age of discussions and concern for OP were also included. Most African American daughters indicated

they found conversations with their mothers to be extremely or somewhat easy, with 44.4% in each of these categories of comfort.

Just over 73% of Caucasian daughters found discussions with their mother to be extremely easy and slightly more than 23% described discussions to be somewhat easy. A smaller percentage found discussions with their mother to be "not very easy." Just over 11% of African American daughters in this study selected "not very easy" compared to 3.8% of Caucasians. No daughters indicated conversations with their mother were "not easy at all."

All daughters described having daily conversations with their mothers and 85.7% overall indicated they were likely to discuss health with their mothers. A higher percentage of Caucasians, however, indicated they do discuss health with their mothers than African American daughters (92.3% versus 66.7%). In general, daughters of both races were discussed everyday health topics at a higher percentage with their mothers than they do serious health conditions. (85.7% versus 20%, respectively). While a small percentage (5.7%) of all daughters had ever discussed OP with their mother, the higher percentage (12.5%) of African American than Caucasian (3.8%) daughters indicated discussing OP.

Daughters were also asked when they first talked to their mother about their health. The majority (60%) selected the 10-14 years age range. Just over 25% began talking with their mother about health between 5-9 years. When asked, "what age did you start considering the impact your family health history may have on your own health?", the mean age overall was 12.8 ($\pm$1.6) years; each race had mean ages very similar mean age responses, with 12.6 ($\pm$1.2) years for Africa Americans and 12.9 ($\pm$11.2) for Caucasian daughters. African American daughters reported an average age of 28.8 ($\pm$11.9) years as when they believed women should start thinking about their bone health, while Caucasian daughters reported a mean age of 25.6 ($\pm$11.9) years.

Another question asked daughters to identify which health condition most concerned them. While only 3% of daughters overall selected osteoporosis as a primary health concern, a higher percentage of African American (12.5%) than Caucasian (0%) daughters chose OP to be a pressing health issue. Daughters were also asked which health conditions they felt at risk for because of their family history. No African American daughters selected OP as a risk due to their family's health history compared to 3.7% of Caucasian daughters in this study. When asked which health conditions they felt at risk for because of being unaware of their family history, 7.7% of Caucasian and no African American daughters indicated OP was a health condition of concern from not knowing family health history.

Daughters were also asked which health conditions they felt at risk for because of gender. A higher percentage of African American (25%) than Caucasian (11.5%) daughters felt at risk for OP due to being female. Another question asked daughters to select one health condition among a list of pressing health issues that most affects women. Among those who selected OP, 12.5% were African American and 3.8% were Caucasian daughters.

When asked about their knowledge about how to prevent osteoporosis, more Caucasian daughters felt less confident than their African American counterparts in this study. A small percentage (8.8%) of daughters felt "very confident" in their knowledge of how to prevent OP, with 12.5% of African American and 7.7% of Caucasian daughters selecting this answer option. Most African American daughters felt "somewhat confident," as did 19.2% of Caucasian daughters and 20.4% overall. Among daughters who felt "not very confident," 12.5% were African American and 38.5% were Caucasian. A higher percentage of Caucasian (34.6%) than African American (12.5%) daughters indicated they were "not confident at all" in OP prevention.

Table 4-10

Health Communication - Daughters' Results

Items:	**African American** (n=9)	**Caucasian** (n=26)*	**Overall Total** (n=35)
Ease of conversations with your mother:			
Extremely easy	44.4%	73.1%	65.7%
Somewhat easy	44.4%	23.1%	28.6%
Not very easy	11.1%	3.8%	5.7%
Not easy at all	0%	0%	0%
Frequency of conversation with your mother:			
Daily	100%	100%	100%
Few times a week	0%	0%	0%
Likely to discuss health with mother	66.7%	92.3%	85.7%
Has ever discussed OP with mother	12.5%	3.8%	5.7%
Topic to most likely discuss with your mother:			
Everyday health (vitamins, annual physical)	66.7%	92.3%	85.7%
Risk for serious conditions (OP or breast cancer)	33.3%	15.4%	20%
At about what age…:			
Did you talk to your mother about health:			
Under 5 years	11.1%	11.5%	11.4%
5-9 years	11.1%	30.8%	25.7%
10-14 years	77.8%	53.8%	60.0%
15-19 years	0%	3.8%	2.9%
Consider impact of family history on own health	12.6(±1.2)	12.9(±11.2)	12.8(±1.6)
Should women start thinking about bone health	28.8(±11.9)	25.6(±11.9)	26.1(±11.7)
*missing data from one daughter			

Nutrition

Table 4-11

Calcium Quiz Results and Percentage of participants who meet/fail to meet calcium RDA

Mother/Daughter	Race	Mean Ca (mg) intake	Meets RDA	Fails to Meet RDA
Mother	African American (n=6)	1601.17 (±1433.34)	66.7%	33.3%
	Caucasian (n=23)	1121.91 (±723.96)	47.8%	52.2%
Total	(n=29)	1221.07 (±904.29)	51.7%	48.3%
Daughter	African American (n=9)	943.11 (±904.29)	22.2%	77.8%
	Caucasian (n=27)	1434.48 (±987.84)	48.1%	51.9%
Total	(n=36)	1311.64 (±1055.18)	46.2%	53.8%
Totals:	African American (n=15)	1206.33 (±1303.82)	40%	60%
	Caucasian (n=50)	1290.70 (±881.98)	48%	52%
Total	(n=65)	1271.23 (±984.23)	46.2%	53.8%

Calcium intake results

As previously discussed, calcium is an important mineral in the formation and preservation of bones. The recommended daily allowance (RDA) for this micronutrient varies depending on age. The online assessment tool used to estimate participants' daily calcium intake yielded mothers' and daughters' approximate consumption of this nutrient critical for bone health while also considering each participant's age; it also asks if the individual uses supplemental calcium.

Overall, African American and Caucasian participants had generally similar mean calcium consumption outcomes (1206.33 and 1290.70 mg, respectively). Mothers and daughters also had similar mean intakes of calcium estimation. African American mothers, however, showed the highest consumption of calcium among all participants with 1601.17 mg. The lowest amount of average calcium consumption was among African American daughters, though, with 943.11 mg. Caucasian daughters consumed a higher amount of daily calcium as estimated by this validated instrument than African American daughters, at 1434.48 mg.

Statistical Findings

ANOVAs and independent *t*-tests were performed to examine the relationship between each outcome variable of interest and predictor variables. The alpha level was set at 0.05 a priori.

ANOVAs were performed to test if the mean body fat percentage and BMI differed according to race. The results showed that both body fat and BMI were both significantly different between African American and Caucasian participants in this study. The mean body fat for African Americans (35% $\pm$ 6.9) and Caucasians (26.8% $\pm$6.7) was statistically significant, $F(1, 63)$, $p<0.001$. Additionally, mean BMI between African American (30.3 $\pm$7.1) and Caucasian (22.1, $\pm$3.5) participants was significant as well, $F(1, 63)$, $p<0.001$.

Table 4-12

ANOVA Results for Comparison of Body Fat Percentage according to race

		Sum of Squares	**df**	**Mean Square**	**F**	***p***
Percent Body Fat	Between groups	772.947	1	772.947	17.031	$p<0.001$
	Within Groups	2859.171	63	45.384		
	Total	3632.118	64			
BMI	Between groups	764.259	1	764.259	36.776	$p<0.001$
	Within Groups	1309.236	63	20.782		
	Total	2073.495	64			

ANOVAs were also performed across all measures of physical activity known to influence bone health, as assessed by ORFA questions, to determine if minutes of activity per week differ between African American and Caucasian participants. Mean minutes of overall total physical activity was found to be statistically significant between African American (153.1$\pm$233.5) and Caucasian (631.8$\pm$808.3) participants, $F(1, 63)$, $p=0.033$. When comparing other types of physical activity such as jogging, aerobic dance, yard work, and weight-bearing exercise, there were no significant differences between African American and Caucasian participants.

Table 4-13

ANOVA Results for Comparison of total minutes of physical activity (PA) according to race

		Sum of Squares	**df**	**Mean Square**	**F**	***p***
Total PA	Between groups	1690562.59	1	1690562.59	4.781	$p = 0.033$
	Within Groups	22278875.5	63	353632.944		
	Total	23969438.1	64			

Independent t-tests were also conducted to test mean difference in body fat percentages and BMI between African American and Caucasians. Significant differences were found between participants of different races for both anthropometric measures, $t(63) = 4.12$, $p<0.001$. Independent samples t-test also yielded a significant differences between African American and Caucasian BMIs, $t(16) = 4.26$, $p<0.001$.

A chi-square test was performed to across BMI categories based off WHO classifications previously described and race. There was a significant relationship between African Americans and weight classification from BMI, X^2 (3, $N = 65$) = 22.705, $p<0.001$.

Independent t-tests were conducted to test mean differences in the overall t- and z-scores for both the lumbar spine and femoral neck of all mothers and daughters for each predictor with an alpha level of 0.05. The results for these tests for spinal BMD are shown below.

Table 4-14

Results of t-tests for Spinal BMD and differences according to Race, Oral Contraceptive use, RDA for Calcium, Physical Activity, Smoking, Alcohol Consumption, and Family History of OP for entire sample

Categorical Variable	n	Mean BMD	Mean Difference	95% Confidence Interval	t-test
Race			-0.15	-0.81, 0.50	-0.47, $p = 0.53$
African American	15	-0.04			
Caucasian	50	0.114			
Oral Contraceptive use			-0.50	-0.96, -0.05	-2.20, $p = 0.24$
Yes	32*	-0.163			
No	30	0.340			
Calcium RDA			-0.41	-0.96, 0.13	-1.52, $p = 0.85$
Meets	30	0.30			
Does not meet	35	-0.11			
School sports			0.30	-0.71, 0.50	-0.34, $p = 0.77$
Engage(d)	45*	0.01			
Does/did not engage	17	0.11			
Physical Activity					
Meets USDHHS guidelines	34	0.00	0.16	-0.39, 0.72	0.60, $p = 0.90$
Does not meets USDHHS guidelines	31	0.17			
Smoking behavior		NA	NA	NA	NA
Currently smokes	0*				
Does not smoke	63				
Alcohol consumption			0.29	-0.69, 1.27	0.60, $p = 0.16$
Consumes 2 or more drinks/setting	18*	-0.30			
Consumes less than 2 drinks/setting	11	-0.76			
Family History of OP		-1.12	-1.26	-2.04, -0.47	-3.25, $p = 0.054$
Has family history	9**	0.14			
Does not have family history	31				
*missing data; **some unaware of family history					

There were no statistically significant differences between mean spinal BMD for African American and Caucasian participants (p = 0.53). While there were no significant differences in mean spinal BMD (p>0.05) based on the other predictors (oral contraceptive use, meeting the RDA for calcium, engaging in high school sports, meeting the USDHHS recommended minutes of PA, smoking, consuming two or more alcoholic beverages per sitting or having a family

history of OP), having a family history of OP approached statistical significance (p=0.054). Some participants were unaware of knowing their family history of the disease.

The results of independent t-tests for femoral BMD are in the table below. There were no statistically significant differences between the mean femoral BMD for African American and Caucasian participants. None of the predictor variables yielded statistically significant differences in mean femoral BMD (p>0.05).

Table 4-15

Results of t-tests for Femoral BMD and differences according to Race, Oral Contraceptive use, RDA for Calcium, Physical Activity, High School Sports Participation, Smoking, Alcohol Consumption, and Family History of OP for entire sample

Categorical Variable	n	Mean BMD	Mean Difference	95% Confidence Interval	t-test
Race			-0.009	-0.64, -0.68	-0.03, p = 0.55
African American	15	-0.13			
Caucasian	50	-0.12			
Oral Contraceptive use			-0.48	-0.99, -0.99	-1.84, p = 0.47
Yes	32	-0.36			
No	30	0.11			
Calcium RDA			-0.24	-0.77, 0.29	-0.91, p = 0.58
Meets	35	-0.24			
Does not meet	30	0.003			
School sports			-0.05	-0.65, 0.55	-0.18, p = 0.36
Engage(d)	45*	-0.15			
Does/did not engage	17	-0.10			
Physical Activity					-0.48, p = 0.77
Meets USDHHS guidelines	34	-0.01	-0.11	-0.56, 0.34	
Does not meets USDHHS guidelines	31	-0.12			
Smoking behavior		NA	NA	NA	NA
Currently smokes	0*				
Does not smoke	63				
Alcohol consumption		-0.30	0.46	-0.32, 1.24	1.23, p = 0.72
Consumes 2 or more drinks/setting	11				
Consumes less than 2 drinks/setting	18	-0.76			
Family History of OP			-0.95	-1.69, -0.22	-2.63, p = 1.0
Has family history	9	-1.06			
Does not have family history	31**	-0.10			
*missing data; **some unaware of family history					

All mothers' and daughters' bone density measurements were paired together to determine if there were significant differences between their BMD, BMC and overall t-scores and z-scores for the hip, spine and each lumbar region. Mothers with more than one daughter were included as a separate observation with each biological daughter. There were several statistical significant differences comparing mothers and daughters at each bone site of interest.

There was a significant difference for mothers' and daughters' mean BMD at the femoral neck ($p = 0.003$) and overall t- and z-scores ($p = .0001$). While BMC at the hip was not significant, BMD of the total hip ($p = 0.002$) was significantly different between mothers and daughters as was their overall t- and z-score for hip bone density ($p = 0.004$). With the lumbar spine, the BMC ($p = 0.002$) and BMD ($p = 0.004$) at the L-1 were both significantly different between pairs of mothers and daughters. Surprisingly, regions L2 and L3 did not yield statistically significant differences in means across bone density or mineral content. At the L4, BMD was found to be significantly different between mother-daughter pairs (p,0.001). The t- and z-scores for total spine scores were significantly different between mothers and daughters in this study ($p = 0.01$). Mothers' and daughters' total hip BMD were positively but weakly correlated ($r = 0.389$, $p = 0.019$).

Table 4-16

Statistically Significant Paired Samples Test for BMD and BMC Measurements among Mother-Daughter Pairs

Bone Measurement	Mean BMD	SD	95% Confidence Interval	t-test (2-tailed)
Femoral Neck:				
BMD	-0.08	0.15	-0.13, -0.03	-3.15, (p =0.003)
t- and z-scores	-0.75	1.22	-1.16, -0.34	-3.77, (p = 0.001)
Total Hip:				
BMD	-0.51	0.13	-0.09, -0.008	-2.43, (p =0.02)
t- and z-scores	-0.53	1.03	-0.88, -0.18	-3.09, (p =0.004)
Lumbar Spine:				
BMC of L-1	1.65	2.92	0.66, 2.64	3.39, (p =0.002)
BMD of L-1	0.06	0.15	0.005, 0.10	2.24, (p =0.032)
BMD of L-4	-16.24	2.48	-17.07, -15.4	-39.3, (p<0.01)
t- and z-scores (total spine)	-0.61	1.36	-1.07, -.015	-2.70, (p =0.01)

Table 4-17

ANOVA Results for Comparison of Spinal and Femoral BMD by Race

Bone Measurement	F	*p*
Total hip t- and z-score	0.02	0.89
Total lumbar spine t- and z-score	0.22	0.64

Table 4-18

ANOVA Results for Comparison of Calcium Consumption by Race

Calcium consumption	F	*p*
Meeting/failing to meet RDA for Ca	.289	0.593

Summary of Results and Hypotheses

H_{01} stated that African American and Caucasian mothers' and daughters' bone mineral density would not be statistically significantly different. ANOVA results showed no significant difference in mean femoral hip and lumbar spine BMD when t- and z-scores of mothers and daughters were analyzed between races ($p = 0.89$ and $p = 0.64$, respectively). Because of these findings, H_{01} failed to be rejected. The second null hypothesis stated there would be no difference between calcium intake of African American and Caucasian mothers and daughters. Participants were dichotomized as meeting or failing to meet their age-appropriate RDA for calcium. ANOVA results showed that calcium consumption was not statistically significant between African American and Caucasian participants. H_{02} was rejected. The third null hypothesis stated there would be no significant differences in physical activity of African American and Caucasian mothers and daughters. ANOVA results showed a significant difference in total minutes of overall physical activity between races ($p = 0.033$), so H_{03} failed to be rejected.

CHAPTER V

DISCUSSION

Discussion

The primary purpose of this research was to explain the variance in BMD and associated risk factors for osteoporosis in African-American and Caucasian mother-daughter pairs. A secondary purpose was to evaluate the differences in knowledge and health communication between mothers and daughters of different races. A discussion of the results, additional findings, limitations, implications and recommendations for future research is included in this chapter.

While the mean age for all mothers in this study was 45.5 ($\pm$4.8) years, 28% of mothers participating had osteopenia and 3% osteoporosis. With African American mothers, 33% had osteopenia of the lumbar spine compared to 26% of Caucasian women. Often thought of a disease affecting more Caucasian women, there was a higher percentage of African American women with low bone density at the spine compared to Caucasian mothers. The bone density of the non-dominant hip for mothers in this study yielded a similar distribution, with 28% of Caucasian mothers having osteopenia compared to 33% of African American mothers. Surprisingly, 26% of African American mothers had osteoporotic bone density at the hip.

Daughters in this study had similar average bone densities, however, African American daughters had a lower mean z-scores for the hip compared to Caucasian daughters. This is similar to findings of McVeigh et al. (2007) as cited by Julian-Almarcegiu and colleagues (2015), reporting lower BMD among black African children compared to white children.

The mean body fat (40% of African American mothers' offers insight regarding the actual role of body fat in OP risk. Often thought as a protective factor, these mothers had lower overall spinal BMD compared to Caucasian mothers with lower mean body fat. Their daughters had a mean body fat just over 31%, which leads to more questions about the relationship

between bone health and anthropometrics. Additionally, over 85% of African American daughters reported consuming carbonated beverages. Some research (Wyshak, 2000) indicates an correlation between female adolescent consumption of sodas and increased risk for fractures. The NOF (2016) states there is a lack of certainty surrounding differences between soda consumption and colas, perhaps with caffeine and phosphorus impacting BMD.

Half of African American mothers were unaware that a diet low in milk increased one's risk of OP indicated by OKT responses. While all mothers were aware that exercise decreased OP risk, there was uncertainty regarding type, duration and intensity needed to prevent OP. All African American mothers in this study correctly identified jogging as a weight-bearing activity promoting bone health and were also able to correctly select the appropriate number of days weight-bearing activity was needed for bone health.

All African American and over 95% of Caucasian mothers knew cheese was an ideal source of calcium; 100% of mothers of both races also identified yogurt as a calcium rich food. However, fewer were able to identify non-dairy sources of calcium. Just over 68% of Caucasian mothers knew broccoli was rich in calcium, yet 100% of African American mothers correctly answered this question. Less than 17% of all mothers knew the RDA for calcium. Similar to results of Martin et al. (2004), adolescents may be unsure of non-dairy sources of calcium.

Since broccoli is healthy option other health programs may promote compared to less nutrient-dense options, health educators should consider promoting not only its low-calorie and high fiber content, but explain that being a source of calcium is another positive aspect of this vegetable. As previously discussed, being lactose intolerant is a particular concern among African Americans (NIH, 2012), so osteoporosis preventative programs should include a variety of nutritional options to meet the RDA for calcium.

While all African American adolescents in this study knew yogurt was a good source of calcium, only 66.7% of Caucasian daughters correctly responded to this item. Less than half of all daughters knew ice cream was rich in calcium. Gammage and Klentrou (2011) have noted that this specific age group of females may assume dairy-rich foods are high in fat and therefore unhealthy. Since fat is an essential macronutrient of one's diet, including some fat in one's diet that is also a source of calcium while encouraging moderation may be a goal of future health education programs.

Since adolescents may chose a fruit or vegetable to be an ideal source of calcium compared to another option such as sardines, health educators should consider dietary choices adolescent females may make and promote non-dairy sources of calcium that are both nutrient dense and familiar. Foods often encouraged by public health nutrition programs may be ideal choices for a balanced diet but are not necessarily rich in calcium.

There were low percentages of participants meeting the RDA for calcium. Mothers play a key role in influencing children's diet, particularly with calcium consumption (Winzenberg, Hansen & Jones, 2008). An activity and calcium-based intervention focused on the mother's ability to adopt and implement children's diet and exercise behaviors found that role modeling and support are key methods in preventative strategies (2008). Pairing both nutritional and activity-based programs that include mothers and daughters may be an effective preventative measure to address multiple factors known to affect bone health.

In this study, no African American daughters and only slightly more than 11% of Caucasian daughters knew the RDA for calcium. It may be difficult for one to visualize servings and appropriate amounts to consume to meet nutrient requirements. Utilizing food models and having visual representations of sources that provide calcium may assist in meeting guidelines.

Daughters were less aware of both family history of OP and examples of food that promote bone health. While most knew that a family history of the disease did increase one's own later risk, over 16% of daughters were unsure if their mother or grandmother ever had osteoporosis. Surprisingly, just 55.5% knew a diet low in milk increases risk for OP.

No African American mothers reported engaging in PA before age 12, while 100% of their daughters did. Mothers may be aware of the importance of PA on bones and encourage their daughters to be active. Prior research found mother-daughter interventions focusing on PA as an effective primary mode of OP prevention (Ulrich et al, 1996), yet a low percent of African American mothers met USDHHS recommendations for PA. Just over 55% of African American daughters knew that not engaging in exercise increased risk for OP compared to over 76% of Caucasian daughters in this study. All African American daughters correctly identified aerobic dance as an ideal way to promote bone health, yet 66.7% of Caucasian daughters correctly answered this question. These findings are similar to those of Martin et al. (2004), describing adolescents in their study as unsure about types of exercises that promote weight bearing activity when given a selection of choices; young women may understand exercise is beneficial to health in other areas yet not necessarily for osteoporosis prevention.

Caucasian mothers were more likely to report on the ORFA of having a family history of OP, but overall approximately a fifth were unsure of their family history of the disease. Mothers of both races reported similar comfort levels of discussions with their daughters. While all were likely to discuss health in general with their daughters, very few have ever discussed osteoporosis, specifically. This may explain the high percentage of participants who were unaware of their family history. African American mothers had a higher mean age of when bone

health consideration should begin compared to Caucasian mothers, although daughters of both races had similar mean ages to start bone health behaviors.

A tool that families could utilize to track and discuss their health histories freely available is the Surgeon General's Family Health Portrait (SGFHP) website. Here, personal information such as demographics are logged as well as a history of diseases including osteoporosis. Then, one is prompted to enter information on family member's health, creating a My Family Health Portrait one can later update. The SGFHP website also creates visuals and diagrams as a results of personal and family health histories one can share with his or her health care provider. While some diseases such as diabetes are part of a disease risk calculator on this tool, osteoporosis is not currently a disease one can determine risk for based off family history. This easily accessible website keeps information private and confidential. If mothers and daughters completed their My Family Health Portrait together, it may be an opportunity to discuss a variety of health conditions including osteoporosis and increase family history awareness.

None of the predictor variables were statistically significant in predicting spinal or lumbar bone density. There were, however, significant differences between African American and Caucasian body fat percentages as well as BMIs. Paired samples *t*-tests between mother-daughter pairs indicated several significant findings of bone density measurements. Mothers and daughters in this study had statistically significant differences of BMD at the femoral neck, t- and z-scores of the femoral neck; total hip BMD, t- and z-scores of the femoral neck; BMC of the L-1, BMD of L-1, BMD of L4 and t- and z-scores of the total spine. Other DXA measurements among the mother-daughter pairs were not significant.

Recommendations

A Health Belief Model-based study targeting adolescent high school girls discussed the possibility of educating young girls on sources of calcium other than dairy foods (Gammage & Klentrou, 2011). A barrier for calcium consumption identified in that study included dieting behaviors and low self-efficacy for consuming calcium. Calcium education strategies for this age group may consider these factors when tailoring future interventions to increase consumption. Health educators should also consider including non-dairy sources of calcium when developing OP preventative programs. Providing visual representations for foods that help meet daily calcium requirements may help in knowing and meeting RDAs for this nutrient.

Another potential opportunity for osteoporosis prevention may include school curriculums. A recent study of 11-14 year old male and female students provided lessons on calcium while also making food samples available for taste testing (Cheng, Monnat and Lohse, 2015). This study provided a variety of foods rich in calcium or calcium-fortified and found 60% of participating students enjoyed the diversity of both dairy and non-dairy calcium options (2015). Girls were more likely to positively respond to this bone health program and increase their food competency, which promotes the idea of sex specific nutrition education programs in schools (2015). School health programs may be an ideal osteoporosis preventative venue, particularly when students can engage in trying foods.

Prior research (Sharma et al., 2009) indicates middle-school girls may be more apt to engage in physical activity with peer and parental support. Being encouraged at home and school by these important influencers is a key factor in girls' likelihood to be physically active in team sports and outcome bone health (2009). Interventions aiming to increase the physical

activity of adolescent girls may target environmental factors, such as promoting a positive attitude towards physical activity at home, which may support girls' engagement (2009).

Limitations

The findings of this study may not be attributed to other age or racial groups. A limitation of this study is the disproportionate number of African American participants compared to Caucasian. The lack of minority participants and unbalanced design did not allow for some post-hoc tests among significant findings. Members of populations that have been marginalized in society historically may feel less inclined to participate in research within a community in which they may have felt excluded (Ofstedal & Weir, 2011).

Future Research

Positive and significant changes in knowledge of osteoporosis and preventative practices have been shown after a web-based education program for 13-17 year old male and female students (Schoenfeld at al., 2010). Tailored online strategies may be a cost-effective and useful tool to reach a large number of adolescents regarding OP education and prevention. Additionally, future interventions should emphasize that it is a misperception that only older adults are affected by bone loss and to stress the importance of bone building behaviors in earlier years as preventative measures (Gammage & Klentrou, 2011). Utilizing technology may be a helpful tool in not only educating adolescents on bone health strategies, but provide an opportunity for discussion of diseases and conditions that affect families; free online tools could promote discussions of family health histories and risks.

Since the specific age of PBM is uncertain, promoting health behaviors that increase bone mass should extend from adolescent years into adulthood to ensure optimal bone health (Gokce-Kustal, Arslan, & Atalay, 2005). Future studies should also consider inclusivity, as prior

interventions have not focused on minority youth (Janz, Thomas, Ford & Williams, 2015). Young African Americans are an ideal target population for future research and education-based programs (Geller & Derman, 2001). Older women from non-white populations have also been underrepresented in research among risk factors of OP (Castro et al., 2005).

Given that mothers have previously been identified as essential in affecting children's health behaviors coupled with the high level of comfort mothers and daughters felt in discussing health information from this study, targeting mothers and daughters for future interventions may be ideal. A time of many changes when mothers may begin discussing other health topics with their daughters, bone health conversations should be included with other importation health conversations, too.

LIST OF REFERENCES

REFERENCES

Bachrach, L & Sills, I. (2011). Clinical report-Bone densitometery in children and adolescents. *Pediatrics, 127*(1), 189-194.

Barbeau, P., Johnson, M., Howe, C., Allison, J., Davis, C., Gutin, B. & Lemmon, C. (2002). Ten months of exercise improves general and visceral adiposity, bone, and fitness in Black girls. *Obesity, 15*(8), 2077-2085.

Bohannon, A. (1999). Osteoporosis and African American women. *Journal of Women's Health & Gender-Based Medicine, 8*(5), 609-615.

Brandi, M. (2009). Microarchitecture, the key to bone quality. *Rheumatology, 48*, 3-8.

Burge, R., Dawson-Hughes, B., Solomon, D., Wong, J., 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.

Castro, J., Joseph, L., Shin, J., Arora, S., Nicasio, J., Shatzkes, J…McFarlane, S. (2005). Differential effect of obesity on bone mineral density in White, Hispanic and African American women: A cross sectional study. *Nutrition & Metabolism, 2*(9).

Cauley, J. (2011). Defining ethnic and racial differences in osteoporosis and fragility fractures. *Clinical Orthopaedics and Related Research, 469,* 1891-1899.

Chang, S., Yang, R., Chung, U., Chen, C., & Cheng, M. (2010). Perception of risk factors and DXA T score among at-risk females of osteoporosis. *Journal of Clinical Nursing, 19*, 1795-1802.

Cheng, F., Monnat, S. & Lohse, B. (2015). Middle school-aged child enjoyment of food tastings predicted interest in nutrition education on osteoporosis prevention. *Journal of School Health, 85*(7), 467-476.

Cheng, S.,Lyytikainen, A., Kröger, H. Lamberg-Allardt, C., Alén,M., Koistinen, A… Tylavsky, F. (2005). Effects of calcium, dairy product, and vitamin D supplementation on bone mass accrual and body composition in 10–12-y-old girls: A 2-y randomized trial. *American Journal of Clinical Nutrition, 82*, 1115-1126.

Cosman, F., de Beur, S.J., LeBoff, M.S., Lewiecki, E.M., Tanner, B., Ranall, S. & Lindsay, R. Clinician's guide to prevention and treatment of osteoporosis. *Osteoporosis International, 25,* 2359-2381.

Dishman, R. and Steinhardt, M. (1988). Reliability and concurrent validity for a 7- day recall of physical activity in college students. *Medicine and Science in Sports and Exercise*, 20(1), 14-25.

Eastell, R. Identification and management of osteoporosis in older adults. *Medicine in Older Adults, 41*(1), 47-52.

Fonseca, H., Moreira-Goncalves, D., Coriolano, H.J. & Duare, J. (2014). Bone Quality: The determinants of bone strength and fragility. *Sports Medicine, 44*, 37-53.

Fulgoni, V., Nicholls, J., Reed, A., Buckley, R., Kafer, K., Huth, P…Miller, G. (2007). Dairy consumption and related nutrient intake in African-American adults and children in the United States: Continuing Survey of Food Intakes by Individuals 1994-1996, 1998, and the National Health and Nutrition Examination Survey 1999-2000. *Journal of the American Dietetic Association, 107*(2), 256-264.

Furstenberg, A.L. & Mezey, M.D. (1987). Differences in outcome between black and white elderly hip fracture patients. *Journal of Chronic Diseases, 40*(10), 931-938.

Geller, S. & Derman, R. (2001). Knowledge, beliefs, and risk factors for osteoporosis among African-American and Hispanic women. *Journal of the National Medical Association, 93*, 13-21.

Gourlay, B., Callaham, L., Preisser, J. & Sloane, P. (2007). Osteoporosis preventive care in White and Black women in community family medicine settings. *Southern Medical Journal, 100*(9), 677-682.

Hamerman, D. (2005). Bone health across the generations: A primer for health providers concerned with osteoporosis prevention. *Maturitas,50,* 1-7.

Hamrick, I., Cao, Q., Agbafe-Mosley, D., & Cummings, D. (2012). Osteoporosis healthcare disparities in postmenopausal women. *Journal of Women's Health, 21*(12), 1232-1236.

Heaney, R. (2006). Low calcium intake among African Americans: Effects on bone and body weight. *The Journal of Nutrition*, 136, 1095-1098.

Kidambi, S., Partington, S., & Binkley, N. (2005). Low bone mass prevalence and osteoporosis risk factor assessment in African American Wisconsin women. *Wisconsin Medical Journal, 104*(8), 59-65.

Kim, K., Horan, M., Gendler, P., & Patel, M. (1991). Osteoporosis health belief, self-efficacy, and knowledge tests. Grand Valley State University, Allendale, MI.

Kim, K., Horan, M., Gendler, P., & Patel, M. (1996). Development and evaluation of the Osteoporosis Health Belief Scale. *Research in Nursing Health, 14*, 115-163.

KImm, S., Glynn, N., Kriska, A., Barton, B., Kronsberg, S., Daniels, S…Liu, K. (2002). Decline in physical activity in Black girls and White girls during adolescence. *The New England Journal of Medicine, 347*(10), 709-715.

Krall, E. & Dawson-Hughes, B. (1993). Heritable and life-style determinants of bone mineral density. *Journal of Bone and Mineral Research, 8*(1), 1-9.

Kuroda, T., Onoe, Y., Miyabara, Y., Yoshikata, R., Orito, S., Ishitani, K.,…Ohta, H. (2009). Influence of maternal genetic and lifestyle factors on bone mineral density in adolescent daughters: A cohort study in 387 Japanese daughter-mother pairs. *Journal of Bone Mineral Metabolism, 27*, 379-385.

Lonzer, M., Imrie, R., Rogers, D., Worley, D., Licata, A. & Secic, M. (1996). Effects of heredity, age, weight, puberty, activity and calcium intake on bone mineral density in children. *Clinical Pediatrics, 35*, 4, 185-189.

Lu-Yao, G., Baron, J., Barrett, J., & Fisher, E. (1994). Treatment and survival among elderly Americans with hip fractures: A population-based study. *American Journal of Public Health, 84*(8), 1287-1291.

Lutz, J. & Tesar, R. (1990). Mother-daughter pairs: Spinal and femoral densities and dietary intakes. *American Journal of Clinical Nutrition, 52*, 872-877

Martin, J., Coviak, C., Gendler, P., Kim, K., Cooper, K & Rodrigues-Fisher, L. (2004). Female adolescents' knowledge of bone health promotion behaviors and osteoporosis risk factors. *Orthopaedic Nursing, 23*(4), 235-244.

McVeigh, J.A., Norris, S.A. & Pittifor, J.M. (2007). Bone mass accretion rates in pre- and early-pubertal South African black and white children in relation to habitual physical activity and dietary calcium intakes. *Acta Paediatricia, 96*, 874-880.

Miller, R., Ashar, B., Cohen, J., Camp, M., Coombs, C., Johnson, E. & Schneyer, C. (2005). Disparities in osteoporosis screening between at-risk African American and White women. *Journal of General Internal Medicine, 20*, 847-851.

Mudano, A., Casebeer, L., Patino, F., Allison, J., Weissman, N., Kiefe, C…Saag, K. (2003). Racial disparities in a managed care population. *Southern Medical Journal, 96*(5), 445-451.

National Institutes of Health (2012). *Osteoporosis and African-American Women*. Retrieved February 24, 2014 from http://www.niams.nih.gov/Health_Info/Bone/Osteoporosis/Background/

National Institutes of Health (2012). *Osteoporosis Overview*. Retrieved October 29, 2014 from http://www.niams.nih.gov/Health_Info/Bone/Osteoporosis/overview.asp

National Institutes of Health (2013). Retrieved February 24, 2014 from http://ods.od.nih.gov/factsheets/Calcium-QuickFacts/

http://users.ipfw.edu/blumenth/Aging/AgingWebSite/NOFFactOsteoporosis.pdf

National Osteoporosis Foundation. (2011, September 26). *Mother-Daughter Health Dialogue Doesn't Cut Bone Deep: New Research Reveals Mothers and Daughters Talk about Family Health History, but leave Osteoporosis out of the Conversation.* [Press release]. Retrieved from http://www.prnewswire.com/news-releases/mother-daughter-health-dialogue-doesnt-cut-bone-deep-new-research-reveals-mothers-and-daughters-talk-about-family-health-history-but-leave-osteoporosis-out-of-the-conversation-130560893.html

National Osteoporosis Foundation (2013). *In the Face of Pain.* Retrieved February 24, 2014 from http://www.inthefaceofpain.com/content/uploads/2013/01/Osteoporosis_FactSheet.pdf

National Osteoporosis Foundation (2014). Having a Bone Density Test. Retrieved March 11th, 2014 from http://.org/articles/743

National Osteoporosis Foundation (2014). Clinician's guide to treatment and prevention of osteoporosis. Washington, D.C.

National Osteoporosis Foundation. (n.d.) *Debunking the Myths.* Retrieved February 24, 2014 from http://nof.org/articles/4

National Osteoporosis Foundation. (n.d.) *What Women Need to Know.* Retrieved September 16, 2013 from http://nof.org/articles/235

Neuner, J., Zhang, X., Sparapani, R., Laud, P. & Nattinger, A. (2007). Racial and ethnic disparities in bone density testing before and after hip fracture. *Journal of General Internal Medicine, 22,* 1239-1245.

Ofstedal, M. & Weir, D. (2011). Recruitment and retention of minority participants in the health and retirement study. *Gerontologist, 51* (suppl. 1): S8-S20.

Park, J.H., Song, Y.M., Sung, J., Lee, K., Kim, Y.S., & Park, Y.S. (2012). Genetic influence on bone mineral density in Korean twins and families: They healthy twin study. *Osteoporosis International, 23,* 1343-1349.

Pollard, K. (2013, June). The health and life expectancy of older Blacks and Hispanics in the United States. *Today's Research on Aging,* 28, 1-8.

Repovich, W., Hamdy, R., Hudgins, L. & Moore, S. (2014). Osteoporosis. *Magill's Medical Guide,* Online edition

Runyan, S., Stadler, D., Bainbridge, C., Miller, S. & Moyer-Mileur, L. (2003). Famililar resemblance of bone mineralization, calcium intake, and physical activity in early adolescent daughters, their mothers and maternal grandmothers. *Journal of the American Dietetic Association, 103(*10), 1320-1325.

Sharma, S., Hoelscher, D., Kelder, S., Day, R., & Hernroeder, A. (2009). Psychosocial, environmental and behavioral factors associated with bone health in middle-school girls. *Health Education Research, 24*(2), 173-184.

Shoepe, H.A. & Snow, C.M. (2005). Oral contraceptive use in young women is associated with lower bone mineral density than that of controls. *Osteoporosis International, 16,* 1538-1544.

Sone, T., Imai, Y., Joo, Y., Onodera, S., Tomomitsu, T., & Fukanaga, M. (2006). Side-to-side differences in cortical bone mineral density of tibiae in young male athletes. *Bone, 38*(5), 708-713.

Tidwell, D. & Valliant, M. (2011). Higher amounts of body fat are associated with inadequate intakes of calcium and vitamin D in African American women. *Nutrition Research, 31*, 527-536.

Thandrayen, K., Norris, S.A., Micklesfield, L.K., & Pettitfor, J.M. (2014). Fracture patterns and bone mass in South African adolescent-mother pairs: The birth to twenty cohort. *Osteoporosis International, 8*, 693-700.

Ulrich, C.M., Georgiou, C.C., Snow-Harter, C.M. & Gillis, D.E. (1996). Bone mineral density in mother-daughter pairs: Relations to lifetime exercise, lifetime milk consumption, and calcium supplements. *American Journal of Clinical Nutrition, 63*, 72-79.

Unson, C.G., Siccon, E., Gaztambide, J., Gaztambide, S., Trella, M. & Prestwood, K. (2003). Nonadherence and osteoporosis treatment preferences of older women: A qualitative study. *Journal of Women's Health, 12*(10), 1037-1045.

US Department of Health and Human Services (2008). 2008 physical activity guidelines for Americans. Retrieved July 22, 2016 from https://health.gov/paguidelines/pdf/paguide.pdf

Wallace, W., Ballard, J., Holiday, D. & Wells, H. (2005). Comparison between 60 matched pairs of postmenopausal black and white women: Analysis of risk factors related to bone mineral density. *Maturitas, 52*, 356-363.

Wanko S, Inouye L. (2003). Gender and ethnic disparities in osteoporosis risk factors and screening. [Abstract]. *Journal of General Internal Medicine*, (Suppl 1): 266.

Wei, S., Jones, G., Thomson, R., Dwyer, T & Venn, A. (2011). Oral contraceptive use and bone mass in women aged 26-36 years. *Osteoporosis International, 22*, 351-355.

Wilkins, C. & Goldfeder, J. (2004). Osteoporosis screening is unjustifiably low in older African-American women. *Journal of the National Medical Association, 96*(4), 461-467.

Winzenburg, T.M., Oldenburg, B., Frendin, S., DeWit, L., & Jones, G. (2006). A mother-based intervention trial for osteoporosis prevention in children. *Preventative Medicine, 42*, 21-26.

Winzenburg, T., Hansen, E. & Jones, G. (2008). How do women change osteoporosis-preventative behaviours in their children? *European Journal of Clinical Nutrition, 62*, 379-385.

Wyshak, G. (2000). Teenaged girls, carbonated beverage consumption, and bone fractures. *Archives of Pediatrics and Adolescent Medicine, 154*(6), 610-613.

Yoneyama, R., Shimzu, H. & Beppu, M. (2008). Correlation of bone status in mothers and daughters and the improvement of bone status. *Journal of Orthopaedic Science, 13*, 405-412.

Yoon, V., Maalouf, N.M. & Sakhaee, K. (2012). The effects of smoking on bone metabolism. *Osteoporosis International, 23*, 2081-2092.

APPENDICES

APPENDIX A

CHILD/ADOLESCENT ASSENT FORM

CHILD (age 13-18) ASSENT FORM

Assent to Participate in an Experimental Study

Title: Bone mineral density, preventative behaviors and risk factors in African American mother-daughter pairs.

Investigator
Mary Amanda Haskins
Department of Health, Exercise Science,
and Recreation Management
Turner Center
The University of Mississippi
(662) 915-1630

Co-Investigator
Allison Ford-Wade, Ph.D.
Department of Health, Exercise Science,
and Recreation Management
Turner Center
The University of Mississippi
(662) 915-6770

Dear (*Participant*):

I would like to invite you to help us with a project we are doing to investigate osteoporosis risk factor knowledge and awareness among African American mothers and daughters and their bone mineral density. This study also will also ask mothers and daughters if they talk about health issues and at what age that conversation occurs.

If you take part in this project you will come to the Bone Mineral Density and Body Composition Lab in the Turner Center at The University of Mississippi along with your parent. First, we will ask you to complete four surveys then we will measure your bone mass and how much muscle and fat you have in your body with a machine called DXA. After you finish the surveys and scan, you will be given a $10 Walmart gift card.

During the testing procedure, you will not feel any pain.

The only people who will see the results of your tests will be you, your parent, the members of the research team, and anyone you choose to share the information with.

You are free to quit this research at any time and I won't be upset with you. If you have any questions or concerns, please ask me now or call me at 662-915-1630. Thank you for your help.

What questions do you have about what you will do for me?

Will you do this?

I agree to help with this research project. ❑ YES ❑ NO

Signature of Adolescent Participant Date

Signature of Investigator Date

NOTE TO PARTICIPANTS: DO NOT SIGN THIS FORM IF THE IRB APPROVAL STAMP ON THE FIRST PAGE HAS EXPIRED.

APPENDIX B

PARENTAL CONSENT FOR CHILD PARTICIPATION

PARENTAL CONSENT FOR CHILD'S PARTICIPATION

Parental Consent for Child to Participate in an Experimental Study

Title: Bone mineral density, preventative behaviors and risk factors in African American mother-daughter pairs.

Investigator
Mary Amanda Haskins
Department of Health, Exercise Science,
and Recreation Management
Turner Center
The University of Mississippi
(662) 915-1630

Co-Investigator
Allison Ford-Wade, Ph.D.
Department of Health, Exercise Science,
and Recreation Management
Turner Center
The University of Mississippi
(662) 915-6770

Description
We are investigating the effects osteoporosis risks and preventative behaviors on bone mineral density in African American high school adolescents ages 13 to 18 year old and their biological mothers. In order to test our hypotheses, we are asking your daughter to take three short tests. It will take about 25 minutes to finish these three tests. We will then have you come to the Bone Mineral Density and Body Composition Lab in the Turner Center at The University of Mississippi where you will have your child's height and weights measured and receive a DXA scan (which uses low-dose radiation) to measure bone mineral density. We will explain the experiment to you and your child and you can ask any questions you have about the experiment.

DXA Scan:

1) Your child's height and weight, with her shoes removed, will be obtained using a standard doctor's scale.
2) She will be asked to lie on a padded table during the DXA scan.
3) A member of the research staff will position your child's body properly prior to the initiation of the scan.
4) She will be asked to lie still for approximately 6 minutes for body composition and 30 seconds for each scan of the hip and spine. During these scans you will be exposed to a small dose of radiation.

Risks and Benefits
The risks associated with participation in this study include exposing the participant and/or an unborn fetus to radiation. The amount of radiation you will receive is about 1/10 of a chest x-ray. To eliminate this risk, all participants will be asked to take a urine pregnancy test that we will provide. Participants will not be able to participate in this study unless a negative result is obtained.

Direct benefits include learning your daughter's bone mineral density and body composition results. Should the testing procedure indicate that your child's bone mineral density is low, you will be advised to make an appointment with your physician. We will provide the results of your scan to your physician at no cost.

Cost and Payments
The surveys will take about 25 minutes to complete. The DXA scan will also take approximately 20 minutes. There is no cost for participating in this study. You will not be paid for your participation in this project, but a $10 Walmart gift card will be given to each mother and each daughter.

Confidentiality
All contact information (i.e. names and email addresses) will be kept under lock and key in Ms. Haskins' office and the DXA laboratory (Turner 248A). Once all data has been collected, all names and identifying information will be destroyed.

Right to Withdraw
Your child does not have to take part in this study. If she starts the study and decides that she/he does not want to finish, all you have to do is tell Ms. Haskins.

The researchers may terminate your daughter's participation in the study without regard to your consent and for any reason, such as protecting your and your child's safety and protecting the integrity of the research data.

IRB Approval
This study has been reviewed by The University of Mississippi's Institutional Review Board (IRB). The IRB has determined that this study fulfills the human research subject protections obligations required by state and federal law and University policies. If you have any questions, concerns, or reports regarding your rights as a participant of research, please contact the IRB at (662) 915-7482.

Statement of Consent
I have read the above information. I have been given a copy of this form. I have had an opportunity to ask questions, and I have received answers. I consent to participate in the study.

Signature of Participant Date

Signature of Investigator Date

Statement of Consent to be Contacted for Future Studies

The staff of the DXA Laboratory may be interested in contacting you to participate in future studies. Signing below allows us to contact you with information on future studies.

Signature of Participant Date

Signature of Investigator Date

NOTE TO PARTICIPANTS: DO <u>NOT</u> SIGN THIS FORM IF THE IRB APPROVAL STAMP ON THE FIRST PAGE HAS EXPIRED.

APPENDIX C

PARENTAL CONSENT TO PARTICIPATE

PARENTAL CONSENT TO PARTICIPATE

Parental Consent to Participate in an Experimental Study

Title: Bone mineral density, preventative behaviors and risk factors in African American mother-daughter pairs.

Investigator
Mary Amanda Haskins
Department of Health, Exercise Science,
and Recreation Management
Turner Center
The University of Mississippi
(662) 915-1630

Co-Investigator
Allison Ford-Wade, Ph.D.
Department of Health, Exercise Science,
and Recreation Management
Turner Center
The University of Mississippi
(662) 915-6770

☐ *By checking this box I certify that I am 18 years of age or older.*

Description
We are investigating the effects osteoporosis risks and preventative behaviors on bone mineral density in African American high school adolescents ages 13 to 18 year old and their biological mothers. In order to test our hypotheses, we are asking you to take three short tests. It will take about 25 minutes to finish these three tests. We will then have you come to the Bone Mineral Density and Body Composition Lab in the Turner Center at The University of Mississippi where you will have your height and weights measured and receive a DXA scan (which uses low-dose radiation) to measure bone mineral density. We will explain the experiment to you and you can ask any questions you have about the experiment.

DXA Scan:

1) Your height and weight, with shoes removed, will be obtained using a standard doctor's scale.
2) You will be asked to lie on a padded table during the DXA scan.
3) A member of the research staff will position your body properly prior to the initiation of the scan.
4) You will be asked to lie still for approximately 6 minutes for body composition and 30 seconds for each scan of the hip and spine. During these scans you will be exposed to a small dose of radiation.

Risks and Benefits
The risks associated with participation in this study include exposing the participant and/or an unborn fetus to radiation. The amount of radiation you will receive is about 1/10 of a chest x-ray. To eliminate this risk, all participants will be asked to take a urine pregnancy test that we will provide. Participants will not be able to participate in this study unless a negative result is obtained.

Direct benefits include learning your bone mineral density and body composition results. Should the testing procedure indicate that your bone mineral density is low, you will be advised to make

an appointment with your physician. We will provide the results of your scan to your physician at no cost.

Cost and Payments
The surveys will take about 25 minutes to complete. The DXA scan will also take approximately 20 minutes. There is no cost for participating in this study. You will not be paid for your participation in this project, but a $10 Walmart gift card will be given to each mother and each daughter.

Confidentiality
All contact information (i.e. names and email addresses) will be kept under lock and key in Ms. Haskins' office and the DXA laboratory (Turner 248A). Once all data has been collected, all names and identifying information will be destroyed.

Right to Withdraw
You do not have to take part in this study. If you start the study and decides that you do not want to finish, all you have to do is tell Ms. Haskins.

The researchers may terminate your participation in the study without regard to your consent and for any reason, such as protecting your safety and protecting the integrity of the research data.

IRB Approval
This study has been reviewed by The University of Mississippi's Institutional Review Board (IRB). The IRB has determined that this study fulfills the human research subject protections obligations required by state and federal law and University policies. If you have any questions, concerns, or reports regarding your rights as a participant of research, please contact the IRB at (662) 915-7482.

Statement of Consent
I have read the above information. I have been given a copy of this form. I have had an opportunity to ask questions, and I have received answers. I consent to participate in the study.

Signature of Participant Date

Signature of Investigator Date

APPENDIX D

PARTICIPATION RECRUITMENT FLYER

African American Mothers & their Adolescent Biological Daughters (13-18 years old)

The Bone Mineral Density (BMD) & Body Composition Laboratory at the University of Mississippi is conducting a research study on osteoporosis risk factors and BMD

- **All participants will receive a $10 WalMart gift card &**

FREE:

*BMD scan with osteoporosis risk assessment
*body composition analysis
*calcium intake feedback

- Mothers and daughters will be asked to complete a survey and DXA scan on campus
- The session will last about 50 minutes total

Must be biological African American mothers & daughters
Must not have had a hysterectomy
Must not be pregnant

If interested, call **(662) 915-1630**
Ask for Mary Amanda Haskins, or email
mahaskin@go.olemiss.edu
218A Turner Center, University of Mississippi

mahaskin@go.olemiss.edu (662) 915-1630

APPENDIX E

PARTICIPATION RECRUITMENT ADVERTISEMENT

The Bone Mineral Density (BMD) & Body Composition Laboratory at the University of Mississippi is conducting a research study on osteoporosis risk factors and BMD

All participants will receive a $10 Walmart gift card &
FREE:

*BMD scan with osteoporosis risk assessment
*body composition analysis
*calcium intake feedback

-Mothers and daughters will be asked to complete a survey and DXA scan on campus
-The session will last about 50 minutes total

Must be biological African American mothers & daughters
Must not have had a hysterectomy
Must not be pregnant

If interested, call **(662) 915-1630**
Ask for Mary Amanda Haskins, or email mahaskin@go.olemiss.edu
218A Turner Center, University of Mississippi

APPENDIX F

LETTER TO PARENTS OF STUDENTS IN OXFORD/LAFAYETTE SCHOOLS

Dear Parents:

I would like to invite you to help us with a project we are doing to investigate osteoporosis risk factor knowledge and awareness among African American mothers and daughters and their bone mineral density. This study also will also ask mothers and daughters if they talk about health issues and at what age that conversation occurs.

If you take part in this project you will come to the Bone Mineral Density and Body Composition Lab in the Turner Center at The University of Mississippi along with your daughter. To participate, she must be between the ages of 13-18 years of age.

We will ask you and your daughter to complete 4 surveys then we will measure your bone mass and how much muscle and fat you have in your body with a machine called DXA. After you finish the surveys and scan, you will each be given a $10 Walmart gift card.

During the testing procedure, you will not feel any pain.

The only people who will see the results of your tests will be you, your parent, the members of the research team, and anyone you choose to share the information with.

You are free to quit this research at any time and I won't be upset with you. If you have any questions or concerns, please ask me now or call me at 662-915-1630. Thank you for your help.

I'm happy to answer or questions or address any concerns you may have.

Thank you,

Mary Amanda Haskins
Department of Health, Exercise Science,
and Recreation Management
Turner Center
The University of Mississippi
(662) 915-1630

APPENDIX G

PARTICIPANT SCREENING SCRIPT: INITIAL PHONE CONTACT WITH POTENTIAL PARTICPANT

INITIAL PHONE CONTACT WITH POTENTIAL SUBJECT

STUDY: **Bone mineral density, preventative behaviors and risk factors in African American mother-daughter pairs.**

INVESTIGATORS: **Mary Amanda Haskins, Allison Ford-Wade, Martha Bass, Melinda Valliant & Scott Owens**

Part 1:Subject Information *(Part of PI's confidential records – do not make hard copies of part 1)*

Name of investigator or study personnel:
_____

Date of phone call: _____/_____/_____ Time of phone call: _____:_____

How did the subject hear about the study (circle)?

1. Flyer
2. Email
3. Newspaper
4. Other – Please specify_____

Verbal Informed Consent Process

1. Verbal informed consent process completed (i.e. phone script on p. 2) (circle):
   YES - NO

2. Verbal consent obtained (circle): YES - NO Time: _____:_____

3. If answer to question 2 is NO, discontinue phone conversation with subject, otherwise proceed with question no. 4

4. If answer to question 2 is YES, then record following information from the subject:

   a. Parent's Name: _____
   b. Child's First Name _____
   c. Age: _____
   d. Weight: _____
   e. Height: _____
   f. BMI: _____
   g. Assign subject ID _____

Part 2:Phone Script

Thank you for calling to find out more about our research study. My name is *{staff name}*, and I am a researcher at the University of Mississippi. The purpose of this research study is to examine the effects osteoporosis risks and preventative behaviors on bone mineral density in African American high school adolescents aged 13 to 18 year old and their biological mothers. The following information will be destroyed if you choose not to participate. At any point during this conversation if you answer "NO" to a question and would like to discontinue, no more questions will be asked and you will be deemed ineligible to participate.

If you and your child decide to participate in the study, we will ask you to come in for one visit (~ 50 minutes). First, we will determine whether you and your daughter are eligible to participate in the study by asking you and your daughter to consent to a urine pregnancy test. Upon a negative result of the urine pregnancy test, you and your daughter will be asked to consent to a DXA scan which measures bone mineral density and body composition. We will also ask you and your daughter to complete four surveys relating to osteoporosis knowledge, risk and discussions. Do you think you might be interested in participating in that study?

{If answer is "NO", discontinue conversation}: Thank you very much for calling.

{If answer is "yes", proceed}: O.K.

Before enrolling people in this study, we need to determine if you and your daughter are eligible. And so what I would like to do now is ask you a few questions about you and your child's current medication intake and current health condition. Also, I would like to let you know that the information that I receive from you by phone and reveals you or your daughter's name or identity will be strictly confidential and will be kept securely. The purpose of these questions is only to determine whether you and your child are eligible for our study. Remember that your participation is voluntary.

Do I have your permission to ask you these questions and record your answers?

{If answer is "NO", discontinue conversation}: Thank you very much for calling.
{Record answer and time in part 1 / no.2}

{If answer is "YES", proceed}: O.K.
{Record answer and time in part 1 / no.2 and proceed with part 1 / no. 4 and part 3)

<u>Part 3:Eligibility Criteria / Phone screening</u> conducted if answer to question no. 2 in part 1 is YES

Date of phone screening: _____/_____/_____

- Ask the participant the following questions: (Answer to the following question must be YES, otherwise subject(s) is not eligible to participate in the study).

    - Are you an African American mother? YES - NO
    - Are you the biological mother of your daughter? YES - NO
    - Is your daughter 13-18 years old? YES - NO
    - Have you ever had a hysterectomy? YES - NO

- Ask potential participant the following question regarding current medication:

    - Do you or your child take any medications currently? YES - NO

- If YES, what are they and what for?

Medication(s)	Condition(s)
_____	_____
_____	_____
_____	_____
_____	_____

- Do you or your daughter have any outstanding medical problems? YES - NO
  (NOTE: Answer to previous question has to be NO for subject to be eligible)

  If a parent answers YES to any of the following questions, this will be noted as this may influence their children's BMD score.

- Have you or your child ever taken synthetic glucocorticoids-also called steroids including cortisone, prednisone? YES - NO

    - If yes-> have you taken these for longer Than 6 weeks YES - NO

- Have you/your child ever taken any of the following medications?
  Anti-convulsants YES - NO

  Thyroid hormone YES - NO

Cyclosporine A -- used in organ transplantation and for the treatment of some diseases of the immune system YES - NO

Heparin -- used to prevent blood clotting YES - NO

- Do you and/or your daughter have any questions for me? YES - NO
  If yes, summarize subject's concerns/questions:

  _____
  _____
  _____
  _____
  _____

- Subject's questions and concerns were answered (circle): YES - NO

- Based on phone screening, are participants eligible to participate in the study?
  YES - NO

- If YES, proceed with part 4. If NO, please destroy all subject information.

- As determined through this phone screening, you and your daughter are eligible to participate, would you and your child be interested in participating:
  YES - NO

- Now that we have determined you and your child are eligible to participate, I would like to record your contact information to contact you for testing purposes and scheduling:

Parent's Phone Number: _____
Alternate Phone Number: _____
Parent's Email Address: _____

Other Information provided to subject:

- For testing, you/your child should wear:
  - Pants
  - Comfortable clothing that does not contain metal objects such as buttons and zippers or under wire bras.
- You and your daughter will be asked to consent to a urine pregnancy test
- Directions to Turner if needed
- Schedule time or will be contacted to schedule a time

APPENDIX H

SCRIPT FOR POSITIVE PREGNANY TEST

SCRIPT FOR POSITIVE PREGNANCY TEST

The pregnancy test appears to be positive. We cannot do a bone density scan on you because of this positive reading. We recommend that you see your physician. If you find that our pregnancy test was incorrect and can provide a written statement from your physician that you are not pregnant and would like to receive a bone scan, you may contact Dr. Ford-Wade at 915-6770 or ford@olemiss.edu

APPENDIX I

PERMISSION TO USE CALCIUM ONLINE QUIZ FROM THE DAIRY COUNSEL OF CALIFORNIA

EMAIL PERMISSION FOR USE OF CALCIUM INTAKE INSTRUMENT

Mary Haskins <mahaskin@go.olemiss.edu> Apr 21

to mburkman, ford

Ms. Burkman,

I read an article published in the Journal of the American Dietetic Association written by Andrea Hacker-Thompson, Trina Robertson and Deborah Sellmeyer about the validation of food frequency questionnaires for calcium consumption. I am interested in using the questionnaire developed by the Dairy Council of California that allows users to check their calcium intake online at the provided link: http://www.healthyeating.org/Healthy-Eating/Healthy-Eating-Tools/Calcium-Quiz.aspx

My advisor, Dr. Allison Ford-Wade, and I believe the instrument will be a most helpful tool in measuring current calcium intake for African American mothers and their adolescent daughters in the community surrounding The University of Mississippi. Dr. Ford-Wade spoke on the phone with you earlier regarding sharing the instrument and I wanted to receive your permission before using the quiz as part of my dissertation. The Dairy Council will be identified as the developer of the instrument; I am happy to share the results of my study with you.

Thank you

Mary Amanda

cc: Dr. Allison Ford-Wade
Associate Professor of Health Promotion
Director, Bone Density Laboratory
Department of Health, Exercise Science and Recreation Management
The University of Mississippi

Mary Anne Burkman Jul 31

to ford, me

Sorry – this was buried in my inbox, and I just found it again.

We're fine with you using the tool as part of your research study. And we'd love to see the results of your study. Later in this fiscal year (probably May of 2015) we will be launching an updated and enhanced version of this tool. So, for the purpose of your study, I'd think you'd want to collect the intakes that mothers and their adolescent daughters record by that time. If your intakes are collected later than that, then you'd have two different tools that you would be using for assessments…or probably enough differences that it could impact your data collection.

Please confirm in an email as well: the approximate timeframe during which the tool will be used in your study; that there will be no editing of the tool on your part; approximate numbers you anticipate in your study.

Thanks, Mary Anne

Mary Anne Burkman, M.P.H., R.D.N.
Senior Director, Program Services

Dairy Council of California
Mary Haskins <mahaskin@go.olemiss.edu> Aug 1

to Mary, ford

Ms. Burkman,

Thank you for your response. The data collection period should begin and end this fall, so we will utilize the current Healthy Eating Tool-Online Calcium Quiz available. We will not edit or change the tool in any way. The estimate for participants is 70 pairs of mothers and daughters or 140 participants total. We look forward to sharing the results of the study, concluding the spring 2015.

Again, I appreciate your time and help.

Thank you,

Mary Amanda

Mary Anne Burkman Aug 1

to me

Sounds great. Best of luck with your efforts!

Mary Anne

Mary Anne Burkman, M.P.H., R.D.N.
Senior Director, Program Services
Dairy Council of California

From: Mary Haskins [mailto:mahaskin@go.olemiss.edu]
Sent: Friday, August 01, 2014 10:55 AM
To: Mary Anne Burkman
Cc: ford
Subject: Re: Healthy Eating: Online Calcium Quiz

APPENDIX J

INSTRUMENTATION: ONLINE CALCIUM QUIZ

Calcium Quiz Ca what's your calcium intake?

Name:

Gender: Male Female

Status: : Pregnant Nursing
(Check, if applicable.)

Age: *** Select Your Age Range ***

Are you taking a calcium supplement daily?
Yes No

Think about **what you ate yesterday** at breakfast, lunch, dinner, and snacks.
Click on each item that you ate in the List of Foods and enter the number of servings you had of that item.
Please enter servings in decimals, e.g., 1 serving or 2.5 servings.

High Calcium Foods	Serving Size	No. of Servings
Nonfat or low-fat yogurt	1 cup (8 oz)	
Milk (whole, low-fat or nonfat)	1 cup (8 oz)	
Milkshake (any flavor)	1 cup (8 oz)	
Chocolate milk or hot chocolate (made with whole, low-fat or nonfat)	1 cup (8 oz)	
Cheese (Cheddar/Monterey Jack types)	1-½ oz.	
Processed cheeses (sliced American, string cheese)	1 item	
Soft cheeses (feta, camembert, brie)	1-½ oz.	
Ricotta cheese	½ cup	
Blended coffee drinks (e.g. lattes, mochas, made with milk)	1 - ½ cup	
Lasagna	1 large piece	

Enchilada, cheese	1 large	
Tofu processed with calcium	½ cup (4 oz)	

Medium & Low Calcium Foods	Serving Size	No. of Servings
Custard or flan	½ cup (4 oz)	
Pudding	½ cup (4 oz)	
Frozen yogurt	½ cup (4 oz)	
Cottage cheese	1 cup (8 oz)	
Mustard greens, cooked	1 cup (8 oz)	
Bok choy, cooked	1 cup (8 oz)	
Canned fish with bones (salmon, mackerel)	2 oz.	
Parmesan cheese	2 Tbsp.	
Turnip greens, cooked	1 cup (8 oz)	
Kale	1 cup (8 oz)	
Ice milk (full fat, low-fat)	½ cup (4 oz)	
Ice cream	½ cup (4 oz)	
Almonds	¼ cup	
Hot chocolate (made with packet)	1 cup (8 oz)	
Broccoli	1 cup (8 oz)	
Beans, refried beans or peas	1 cup (8 oz)	
Corn tortillas	1 tortilla	
Cream soup	1 cup (8 oz)	
Sardines	1 3-inch sardine	
Cream cheese	1 tablespoon	

Spinach	1 cup (8 oz) fresh	
Macaroni & Cheese	1 cup (8 oz)	

Calcium Fortified Foods	Serving Size	No. of Servings
Calcium-fortified soy beverage	1 cup (8 oz)	
Calcium-fortified orange juice	1 cup (8 oz)	
Calcium-fortified frozen waffles	2 waffles	
Calcium-fortified cereal (100 mg calcium/serving)	1 cup (8 oz)	
Calcium-fortified energy bars	1 bar	

Check My Calcium Intake Reset

APPENDIX K

INSTRUMENTATION: OSTEOPOROSIS RISK FACTOR ASSESSMENT (MOTHERS' VERSION)

ORFA for Mothers

(Osteoporosis Risk Factor Assessment)

Please answer to the best of your knowledge.

1. Was your biological mother or grandmother ever told by a doctor they had osteoporosis, sometimes called thin or brittle bones?
    a. Yes
    b. No
    c. I don't know

2. Did your biological mother or grandmother ever fracture her hip?
    a. Yes
    b. No
    c. I don't know

3. When you were a baby, were you breastfed?
    a. Yes
    b. No
    c. I don't know

4. Have you ever been on a high protein diet (Atkins, South Beach, etc)?
    a. Yes
    b. No

5. How long have you been on this diet (or how long were you on this diet)?
    a. more than 1 year
    b. 8-12 months
    c. 6-8 months
    d. 3-6 months
    e. 1-3 months

6. During your childhood (prior to age 12), approximately how many servings of milk did you drink each day?
    a. None (0 servings)
    b. 1 serving each day
    c. 2 servings each day
    d. 3 servings each day
    e. 4 or more servings each day

7. During your teenage years (13-19 years) approximately how many servings of milk did you drink each day?
    a. None (0 servings)
    b. 1 serving each day
    c. 2 servings each day
    d. 3 servings each day
    e. 4 or more servings each day

8. During your childhood (prior to age 12), approximately how many servings of yogurt did you drink each day?
    a. None (0 servings)
    b. 1 serving each day
    c. 2 servings each day
    d. 3 servings each day
    e. 4 or more servings each day

9. During your teenage years (13-19 years) approximately how many servings of yogurt did you drink each day?
    a. None (0 servings)
    b. 1 serving each day
    c. 2 servings each day
    d. 3 servings each day
    e. 4 or more servings each day

The next questions ask you about your involvement in exercise.

10. In the past month, how often did you walk a mile or more at a time without stopping?
    Times per month _____

11. In the past month, how often did you jog or run?

    Times per month_____ Time spent per exercise_____

12. In the past month, how often did you ride a bicycle or and exercise bicycle?

    Times per month_____ Time spent per exercise_____

13. In the past month, how often did you swim?

    Times per month_____ Time spent per exercise_____

14. In the past month, how often did you do aerobics or aerobic dancing?

    Times per month_____ Time spent per exercise_____

15. In the past month, how often did you garden or do yard work (pulling up weeds, shoveling, digging, push mowing)?

    Times per month_____ Time spent per exercise_____

16. In the past month, how often did you lift weights?

    Times per month_____ Time spent per exercise_____

17. In the past month, how often did you do any other exercises, sports, or physically active hobbies not mentioned?

    Times per month_____ Time spent per exercise_____

18. Did you participate in recreation league sports such as OPC or similar recreation leagues (prior to age 12)?
    a. Yes
    b. No

19. Did you participate in a sports team in your school (prior to age 12)?
    a. Yes
    b. No

20. Did you participate in physical education classes on a regular basis during your childhood (prior to age 12)?
    a. Yes
    b. No

21. Did you participate in physical education classes on a regular basis during your teenage years (ages 13-19)?
    a. Yes
    b. No

22. In general, do you take the stairs or the elevator?
    a. Stairs
    b. Elevator

The next questions ask about your background.

23. What is your birthday? (MM/DD/YY) _____

24. Does anyone who lives with you smoke cigarettes in the home?
    a. Yes
    b. No

25. Total number of persons who smoke cigarettes in the home.
    a. 0
    b. 1
    c. 2
    d. 3
    e. 4+

26. Do you smoke?
    a. Yes
    b. No

27. If you have ever smoked cigarettes, how long did you smoke?
    a. I have never smoked cigarettes
    b. less than 1 year
    c. less than 3 years
    d. less than 5 years
    e. less than 10 years
    f. More than a year

28. How many alcoholic beverages do you generally consume in a setting?
    a. 0
    b. 1
    c. 2
    d. 3
    e. 4+

29. Have you had a period in the last 12 months?
    a. Yes
    b. No

30. Have you ever been amenorreahic (lost your menstrual cycle for any reason, other than pregnancy for longer than 3 months)?
    a. Yes
    b. No

31. How old were you when you had your hysterectomy?
    _____years

32. Have you ever taken or used estrogen or female hormones in any form? Include pills, vaginal cream, suppositories, injections or skin patches?
    a. Yes
    b. No

33. How old were you when you first took or used the estrogen or female hormones?

    _____years

34. Have you ever taken birth control pills for any reason?
    a. Yes
    b. No

35. How long altogether have you or did you take birth control pills? _____

36. Have you ever had the Depo-Provera shot?
    a. Yes
    b. No

37. If you are currently taking, how long have you been taking the Depo-Provera shot?
    _____

38. If you are currently not taking the Depo-Provera shot, but have in the past, how long did you consistently take it? _____

39. How many live births have you had?
    a. I have never had a live birth
    b. 1 live birth
    c. 2 live births
    d. 3 live births
    e. 4 live births
    f. 5 live births
    g. 6 live births
    h. More than 6 live births

40. If you have had a live birth, how many did you have before age 30 and after age 30?

_____ before age 30

_____after age 30

41. Approximately how much weight did you gain with each live birth pregnancy?

1st pregnancy _____lbs

2nd pregnancy _____lbs

3rd pregnancy _____lbs

4th pregnancy _____lbs

5th pregnancy _____lbs

6th pregnancy _____lbs

42. Did you breastfeed any of your children? Yes No

43. If yes, how many of your children have you breastfed? _____

Thank you for taking the time to participate in this survey!

APPENDIX L

INSTRUMENTATION: OSTEOPOROSIS RISK FACTOR ASSESSMENT (DAUGHTERS' VERSION)

ORFA for Daughters

(Osteoporosis Risk Factor Assessment)

Please answer to the best of your knowledge.

1. Was your biological mother or grandmother ever told by a doctor they had osteoporosis, sometimes called thin or brittle bones?
    a. Yes
    b. No
    c. I don't know

2. Did your biological mother or grandmother ever fracture her hip?
    a. Yes
    b. No
    c. I don't know

3. When you were a baby, were you breastfed?
    a. Yes
    b. No
    c. I don't know

4. Have you ever been on a high protein diet (Atkins, South Beach, etc)?
    a. Yes
    b. No

5. How long have you been on this diet (or how long were you on this diet)?
    a. more than 1 year
    b. 8-12 months
    c. 6-8 months
    d. 3-6 months
    e. 1-3 months

6. During your childhood (prior to age 12), approximately how many servings of milk did you drink each day?
    a. None (0 servings)
    b. 1 serving each day
    c. 2 servings each day
    d. 3 servings each day
    e. 4 or more servings each day

7. During your childhood (prior to age 12), approximately how many servings of yogurt did you drink each day?
    a. None (0 servings)
    b. 1 serving each day
    c. 2 servings each day
    d. 3 servings each day
    e. 4 or more servings each day

The next questions ask you about your involvement in exercise.

8. In the past month, how often did you walk a mile or more at a time without stopping?
Times per month _____

9. In the past month, how often did you jog or run?

Times per month_____ Time spent per exercise_____

10. In the past month, how often did you ride a bicycle or and exercise bicycle?

Times per month_____ Time spent per exercise_____

11. In the past month, how often did you swim?

Times per month_____ Time spent per exercise_____

12. In the past month, how often did you do aerobics or aerobic dancing?

Times per month_____ Time spent per exercise_____

13. In the past month, how often did you garden or do yard work (pulling up weeds, shoveling, digging, push mowing)?

Times per month_____ Time spent per exercise_____

14. In the past month, how often did you lift weights?

Times per month_____ Time spent per exercise_____

15. In the past month, how often did you do any other exercises, sports, or physically active hobbies not mentioned?

Times per month_____ Time spent per exercise_____

16. Did you participate in recreation league sports such as OPC or similar recreation leagues (prior to age 12)?
   c. Yes
   d. No

17. Do you currently participate in recreation league sports such as OPC or similar recreation leagues?
   a. Yes
   b. No

18. Did you participate in team sports in your school (prior to age 12)?
   a. Yes
   b. No

19. Do you currently participate in team sports in your school?
   a. Yes
   b. No

20. Did you participate in physical education classes on a regular basis during your childhood (prior to age 12)?
    a. Yes
    b. No

21. Do you currently participate in physical education classes on a regular basis?
    a. Yes
    b. No

22. In general, do you take the stairs or the elevator?
    a. Stairs
    b. Elevator

The next questions ask about your background.

23. What is your birthday? (MM/DD/YY) _____

24. Does anyone who lives with you smoke cigarettes in the home?
    a. Yes
    b. No

25. Total number of persons who smoke cigarettes in the home.
    a. 0
    b. 1
    c. 2
    d. 3
    e. 4+

26. Do you smoke?
    a. Yes
    b. No

27. If you have ever smoked cigarettes, how long did you smoke?
    a. I have never smoked cigarettes
    b. less than 1 year
    c. less than 3 years
    d. less than 5 years
    e. less than 10 years
    f. More than a year

28. Have you had a period in the last 12 months?
    a. Yes
    b. No

29. Have you ever been amenorreahic (lost your menstrual cycle for any reason, other than pregnancy for longer than 3 months)?
    a. Yes
    b. No

30. Have you ever taken or used estrogen or female hormones in any form? Include pills, vaginal cream, suppositories, injections or skin patches?
    a. Yes
    b. No

38. How old were you when you first took or used the estrogen or female hormones?
_____years

39. Have you ever taken birth control pills for any reason?
a. Yes
b. No

40. How long altogether have you or did you take birth control pills? _____

41. Have you ever had the Depo-Provera shot?
a. Yes
b. No

42. If you are currently taking, how long have you been taking the Depo-Provera shot?
_____

43. If you are currently not taking the Depo-Provera shot, but have in the past, how long did you consistently take it? _____

Thank you for taking the time to participate in this survey!

APPENDIX M

INSTRUMENTATION: OSTEOPOROSIS KNOWLEDGE ASSESSMENT

Osteoporosis Knowledge Test (OKT)

Q1 The following list contains things which may or may not affect a person's chance of getting osteoporosis. After reading each one, indicate if you think the person is MORE LIKELY TO GET OSTEOPOROSIS, LESS LIKELY TO GET OSTEOPOROSIS, or IT HAS NOTHING TO DO WITH GETTING OSTEOPOROSIS.

	More likely (1)	Less Likely (2)	Neutral (3)	Don't Know (4)
Eating a diet low in milk products. (1)	❍	❍	❍	❍
Being menopausal; "change of life" (2)	❍	❍	❍	❍
Having big bones (3)	❍	❍	❍	❍
Eating a diet high in dark leafy vegetables (4)	❍	❍	❍	❍
Having a mother or grandmother who has osteoporosis (5)	❍	❍	❍	❍
Being a white woman with fair skin (6)	❍	❍	❍	❍
Having ovaries surgically removed (7)	❍	❍	❍	❍
Taking cortisone (steroids, Prednisone) for long time (8)	❍	❍	❍	❍
Exercising on a regular basis (9)	❍	❍	❍	❍

Q10 Which of the following exercises is the best way to reduce a person's chance of getting osteoporosis?

- ❍ Swimming (1)
- ❍ Walking briskly (2)
- ❍ Doing kitchen chores, such as washing dishes or cooking (3)
- ❍ Don't know (4)

Q11 Which of the following exercises is the best way to reduce a person's chance of getting osteoporosis?

- ❍ Bicycling (1)
- ❍ Yoga (2)
- ❍ Housecleaning (3)
- ❍ Don't know (4)

Q12 How many days a week do you think a person should exercise to strengthen the bones?

- ❍ 1 day a week (1)
- ❍ 2 days a week (2)
- ❍ 3 or more days a week (3)
- ❍ Don't know (4)

Q13 What is the least amount of time a person should exercise on each occasion to strengthen the bones?

- ❍ Less than 15 minutes (1)
- ❍ 20 to 30 minutes (2)
- ❍ More than 45 minutes (3)
- ❍ Don't know (4)

Q14 Exercise makes bones strong, but it must be hard enough to make breathing:

- ❍ Just a little faster (1)
- ❍ So fast that talking is not possible (2)
- ❍ Much faster, but talking is possible (3)
- ❍ Don't know (4)

Q15 Which of the following exercises is the best way to reduce a person's chance of getting osteoporosis?

- ❍ Jogging or running for exercise (1)
- ❍ Golfing using golf cart (2)
- ❍ Gardening (3)
- ❍ Don't know (4)

Q16 Which of the following exercises is the best way to reduce a person's chance of getting osteoporosis?

- ❍ Bowling (1)
- ❍ Doing laundry (2)
- ❍ Aerobic dancing (3)
- ❍ Don't know (4)

Q17 Calcium is one of the nutrients our body needs to keep bones strong.Which of these is a good source of calcium?

- ❍ Apple (1)
- ❍ Cheese (2)
- ❍ Cucumber (3)
- ❍ Don't know (4)

Q18 Which of these is a good source of calcium?

- ❍ Watermelon (1)
- ❍ Corn (2)
- ❍ Canned sardines (3)
- ❍ Don't know (4)

Q19 Which of these is a good source of calcium?

- ❍ Chicken (1)
- ❍ Broccoli (2)
- ❍ Grapes (3)
- ❍ Don't know (4)

Q20 Which of these is a good source of calcium?

- ❍ Yogurt (1)
- ❍ Strawberries (2)
- ❍ Cabbage (3)
- ❍ Don't know (4)

Q21 Which of these is a good source of calcium?

- ❍ Ice cream (1)
- ❍ Grapefruit (2)
- ❍ Radishes (3)
- ❍ Don't know (4)

Q22 Which of the following is the recommended amount of calcium intake for an adult?

- ❍ 100 mg - 300 mg daily (1)
- ❍ 400 mg - 600 mg daily (2)
- ❍ 800 mg or more daily (3)
- ❍ Don't know (4)

Q23 How much milk must an adult drink to meet the recommended amount of calcium?

- ❍ 1/2 glass daily (1)
- ❍ 1 glass daily (2)
- ❍ 2 or more glasses daily (3)
- ❍ I don't know (4)

Q24 Which of the following is the best reason for taking a calcium supplement?

- ❍ If a person skips breakfast (1)
- ❍ If a person does not get enough calcium from diet (2)
- ❍ If a person is over 45 years old (3)
- ❍ Don't know (4)

APPENDIX N: HEALTH COMMUNICATION SURVEY (MOTHERS)

Mothers Survey

The purpose of this survey is to learn about mothers' discussions about family health histories with their biological daughters. This survey will take about 10 minutes to complete.

Q1. We are going to ask you some questions about your biological daughter. How easy is it to have conversations with your daughter?

- ❍ Extremely easy (1)
- ❍ Somewhat easy (2)
- ❍ Not very easy (3)
- ❍ Not easy at all (4)

Q2 How often do you speak with your daughter? Please think of anything ranging from phone calls, texts, Facebook messages, emails, etc...

- ❍ Daily (1)
- ❍ Few times a week (2)
- ❍ Once a week (3)
- ❍ Twice a month (4)
- ❍ Once a Month (5)
- ❍ Occasionally (6)
- ❍ Rarely (7)

Q3 Which of the following, if any, are you likely to talk about with your daughter? Please choose all that apply.

- ○ Family (1)
- ○ Health (2)
- ○ Relationships (3)
- ○ Finances (4)
- ○ Religion (5)
- ○ Fashion (6)
- ○ Body image (7)
- ○ Politics (8)
- ○ Pop culture (9)
- ○ Other (10)

Q4 About how old was your daughter when you first talked to her about health? (Age in years)

Q5 Which of the following are you more likely to talk to your daughter about?

- ❍ Everyday health, such as taking vitamins or having an annual physical (1)
- ❍ Risk for serious diseases and conditions, such as osteoporosis or breast cancer (2)

Q6 Which of the following health issues, if any, have you ever discussed with your daugher? Please choose all that apply.

- o Weight management (1)
- o Cancer (2)
- o Mental Health (3)
- o Heart-related diseases such as coronary heart disease (4)
- o Blood conditions, such as diabetes (5)
- o Stroke (6)
- o Osteoporosis (7)
- o Sexually transmitted diseases (8)
- o Infertility (9)
- o Other (10)
- o None (11)

Q7 Which of the following do you typically feel when talking to your daughter about health? Please choose all that apply.

- o Confident (1)
- o Protective (2)
- o Capable (3)
- o Nurturing (4)
- o Worried (5)
- o Stressed (6)
- o Smart (7)
- o Frustrated (8)
- o Nervous (9)
- o Tired (10)
- o Excited (11)
- o Lost (12)
- o Incapable (13)
- o Other (please specify) (14) _____

Q8 Which of the following health conditions concerns you the most in regards to your health?

- ❍ Weight Management (1)
- ❍ Cancer (2)
- ❍ Heart-related diseases such as coronary heart disease (3)
- ❍ Blood conditions, such as diabetes (4)
- ❍ Infertility (5)
- ❍ Osteoporosis (6)
- ❍ Stroke (7)
- ❍ Addiction (8)
- ❍ Other (please specify) (9) _____

Q9 Which of the following health conditions, if any, are you at risk for because of your family history? Please choose all that apply.

- ○ Cancer (1)
- ○ Heart-related diseases, such as coronary heart disease (2)
- ○ Blood conditions, such as diabetes (3)
- ○ Weight management (4)
- ○ Stroke (5)
- ○ Addiction (6)
- ○ Osteoporosis (7)
- ○ Infertility (8)
- ○ Other (9)
- ○ None (10)
- ○ I don't know anything about my family health history (11)

Q10 Which family members have you ever talked to about health conditions in your family history? Please choose all that apply.

- ○ Mother (1)
- ○ Sibling (2)
- ○ Father (3)
- ○ Grandparent (4)
- ○ Aunt (5)
- ○ Cousin (6)
- ○ Daughter (7)
- ○ Uncle (8)
- ○ Other (9)
- ○ I have never talked to a family member about my health conditions in my family's history (10)

Q11 Which of the following health conditions, if any, have you ever thought about being at-risk for because of not knowing your family health history? Please choose all that apply.

- Cancer (1)
- Osteoporosis (2)
- Heart-related diseases, such as coronary heart disease (3)
- Blood conditions, such as diabetes (4)
- Weight management (5)
- Stroke (6)
- Addiction (7)
- Infertility (8)
- Other (9)

Q12 Which of the following health conditions, if any, would you be at risk for because of your gender? Please choose all that apply.

- Cancer (1)
- Osteoporosis (2)
- Weight management (3)
- Heart-related diseases, such as coronary heart disease (4)
- Infertility (5)
- Blood conditions, such as diabetes (6)
- Stroke (7)
- Addiciton (8)
- Other (9)
- None (10)

Q13 About what age did you start considering the impact your family health history may have on your own health? _____ (Years)

Q14 If you know your family health history and were to ever change your behavior, such as what you eat or how often you exercise, to help reduce your risk of developing a family health-related condition, what would you do? Please choose all that apply.

- o Exercise regularly (1)
- o Eat healthy, nutritious foods (2)
- o Go on a diet (3)
- o Go to the doctor for annual physicals (4)
- o Go to the doctor for preventative care on a regular basis (5)
- o Get tested regularly for health conditions regarding my family history (6)
- o Avoid certain foods, such as fast food or junk food (7)
- o Monitor my portions (8)
- o Other (9)
- o I wouldn't change my behavior to help reduce my risk of developing a family health-related condition (10)
- o I don't know my family health history (11)

Q15 Who would you be most likely to talk to about concerns regarding your health?

- ❍ Doctor (1)
- ❍ Mother (2)
- ❍ Significant other (3)

Q16 If you had to select one, which of the following health conditions affects women the most?

- ❍ Osteoporosis (1)
- ❍ Heart-related diseases, such as coronary heart disease (2)
- ❍ Infertility (3)
- ❍ Uterine cancer (4)
- ❍ Breast cancer (5)
- ❍ Ovarian cancer (6)
- ❍ Stroke (7)

Q17 The next few questions are related to bone health. Which of the following best describes how you feel about your knowledge of how to prevent osteoporosis?

- ❍ I am very cofident (1)
- ❍ I am somewhat confident (2)
- ❍ I am not very confident (3)
- ❍ I am not confident at all (4)

Q18 If a family member has ever experienced a broken bone or fracture after age 50, was it because of osteoporosis?

- ❍ Yes (1)
- ❍ No (2)
- ❍ I don't know (3)
- ❍ A family member has never experienced a broken bone or fracture after age 50 (4)

Q19 About what age do women need to start thinking about their bone health? Your best guess is fine.

_____ (years)

Q20 Osteoporosis is caused by ____. Please choose all that apply.

- Lack of exercise (1)
- Aging (2)
- Being a woman (3)
- A calcium deficency (4)
- Low bone mineral density (5)
- Smoking (6)
- Lack of vitamin D (7)
- Certain medical conditions (8)
- Certain medications (9)
- A poor diet (10)
- Family history (11)
- Being thin and small (12)
- None of these (13)

Q21 Which of the following are possible consequences of having osteoporosis? Please choose all that apply.

- Bone fracture (1)
- Broken bone (2)
- Lack of mobility (3)
- Lack of independence (4)
- Depression (5)
- Low self-esteem (6)
- Weight gain (7)
- Insomnia (8)
- None of these (9)

Q22 Which of the following are ways that women can prevent osteoporosis? Please choose all that apply.

- Getting a bone density test (1)
- Muscle strengthening and weight bearing exercises (2)
- Talking to a doctor about osteoporosis (3)
- Monitoring calcium intake from food (4)
- Taking calcium supplements to reach the recommended daily amount (5)
- Monitoring vitamin D intake (6)
- Taking vitamin D supplements to reach the recommended daily amount (7)
- Other (8)
- None (9)

APPENDIX O: HEALTH COMMUNICATION SURVEY (DAUGHTERS)

Daughters Survey

The purpose of this survey is to learn about mothers' discussions about family health histories with their biological daughters. This survey will take about 10 minutes to complete.

Q1 We are going to ask you some questions about your biological mother. How easy is it to have conversations with your mother?

- ❍ Extremely easy (1)
- ❍ Somewhat easy (2)
- ❍ Not very easy (3)
- ❍ Not easy at all (4)

Q2 How often do you speak with your mother? Please think of anything ranging from phone calls, texts, Facebook messages, emails, etc...

- ❍ Daily (1)
- ❍ Few times a week (2)
- ❍ Once a week (3)
- ❍ Twice a month (4)
- ❍ Once a Month (5)
- ❍ Occasionally (6)
- ❍ Rarely (7)

Q3 Which of the following, if any, are you likely to talk about with your mother? Please choose all that apply.

- ○ Family (1)
- ○ Health (2)
- ○ Relationships (3)
- ○ Finances (4)
- ○ Religion (5)
- ○ Fashion (6)
- ○ Body image (7)
- ○ Politics (8)
- ○ Pop culture (9)
- ○ Other (10)

Q4 About how old were you when you first talked to your mother about your health?

- ❍ Under 5 years old (1)
- ❍ 5-9 years old (2)
- ❍ 10-14 years old (3)
- ❍ 15-19 years old (4)
- ❍ 20-29 years old (5)
- ❍ I've never talked to my mother about my health (6)

Q5 Which of the following are you more likely to talk to your mother about?

- ❍ Everyday health, such as taking vitamins or having an annual physical (1)
- ❍ Risk for serious diseases and conditions, such as osteoporosis or breast cancer (2)

Q6 Which of the following health issues, if any, have you ever discussed with your mother? Please choose all that apply.

- ○ Weight management (1)
- ○ Cancer (2)
- ○ Mental Health (3)
- ○ Heart-related diseases such as coronary heart disease (4)
- ○ Blood conditions, such as diabetes (5)
- ○ Stroke (6)
- ○ Osteoporosis (7)
- ○ Sexually transmitted diseases (8)
- ○ Infertility (9)
- ○ Other (10)
- ○ None (11)

Q7 Which of the following do you typically feel when talking to your mother about health? Please choose all that apply.

- Confident (1)
- Protective (2)
- Capable (3)
- Nurturing (4)
- Worried (5)
- Stressed (6)
- Smart (7)
- Frustrated (8)
- Nervous (9)
- Tired (10)
- Excited (11)
- Lost (12)
- Incapable (13)
- Other (14)

Q8 Which of the following health conditions concerns you the most in regards to your health?

- Weight Management (1)
- Cancer (2)
- Heart-related diseases such as coronary heart disease (3)
- Blood conditions, such as diabetes (4)
- Infertility (5)
- Osteoporosis (6)
- Stroke (7)
- Addiction (8)
- Other (please specify) (9) _____

Q9 Which of the following health conditions, if any, are you at risk for because of your family history? Please choose all that apply.

- Cancer (1)
- Heart-related diseases, such as coronary heart disease (2)
- Blood conditions, such as diabetes (3)
- Weight management (4)
- Stroke (5)
- Addiction (6)
- Osteoporosis (7)
- Infertility (8)
- Other (9)
- None (10)
- I don't know anything about my family health history (11)

Q10 Which family members have you ever talked to about health conditions in your family history? Please choose all that apply.

- Mother (1)
- Sibling (2)
- Father (3)
- Grandparent (4)
- Aunt (5)
- Cousin (6)
- Daughter (7)
- Uncle (8)
- Other (9)
- I have never talked to a family member about my health conditions in my family's history (10)

Q11 Which of the following health conditions, if any, have you ever thought about being at-risk for because of not knowing your family health history? Please choose all that apply.

- Cancer (1)
- Osteoporosis (2)
- Heart-related diseases, such as coronary heart disease (3)
- Blood conditions, such as diabetes (4)
- Weight management (5)
- Stroke (6)
- Addiction (7)
- Infertility (8)
- Other (9)

Q12 Which of the following health conditions, if any, would you be at risk for because of your gender? Please choose all that apply.

- Cancer (1)
- Osteoporosis (2)
- Weight management (3)
- Heart-related diseases, such as coronary heart disease (4)
- Infertility (5)
- Blood conditions, such as diabetes (6)
- Stroke (7)
- Addiciton (8)
- Other (9)
- None (10)

Q13 About what age did you start considering the impact your family health history may have on your own health? _____ (YEARS)

Q14 If you know your family health history and were to ever change your behavior, such as what you eat or how often you exercise, to help reduce your risk of developing a family health-related condition, what would you do? Please choose all that apply.

- Exercise regularly (1)
- Eat healthy, nutritious foods (2)
- Go on a diet (3)
- Go to the doctor for annual physicals (4)
- Go to the doctor for preventative care on a regular basis (5)
- Get tested regularly for health conditions regarding my family history (6)
- Avoid certain foods, such as fast food or junk food (7)
- Monitor my portions (8)
- Other (9)
- I wouldn't change my behavior to help reduce my risk of developing a family health-related condition (10)
- I don't know my family health history (11)

Q15 Who would you be most likely to talk to about concerns regarding your health?

- ❍ Doctor (1)
- ❍ Mother (2)
- ❍ Other (3)

Q16 If you had to select one, which of the following health conditions affects women the most?

- ❍ Osteoporosis (1)
- ❍ Heart-related diseases, such as coronary heart disease (2)
- ❍ Infertility (3)
- ❍ Uterine cancer (4)
- ❍ Breast cancer (5)
- ❍ Ovarian cancer (6)
- ❍ Stroke (7)

Q17 The next few questions are related to bone health. Which of the following best describes how you feel about your knowledge of how to prevent osteoporosis?

- ❍ I am very cofident (1)
- ❍ I am somewhat confident (2)
- ❍ I am not very confident (3)
- ❍ I am not confident at all (4)

Q18 If a family member has ever experienced a broken bone or fracture after age 50, was it because of osteoporosis?

- ❍ Yes (1)
- ❍ No (2)
- ❍ I don't know (3)
- ❍ A family member has never experienced a broken bone or fracture after age 50 (4)

Q19 About what age do women need to start thinking about their bone health? Your best guess is fine.

_____(YEARS)

Q20 Osteoporosis is caused by ____. Please choose all that apply.

- Lack of exercise (1)
- Aging (2)
- Being a woman (3)
- A calcium deficency (4)
- Low bone mineral density (5)
- Smoking (6)
- Lack of vitamin D (7)
- Certain medical conditions (8)
- Certain medications (9)
- A poor diet (10)
- Family history (11)
- Being thin and small (12)
- None of these (13)

Q21 Which of the following are possible consequences of having osteoporosis? Please choose all that apply.

- Bone fracture (1)
- Broken bone (2)
- Lack of mobility (3)
- Lack of independence (4)
- Depression (5)
- Low self-esteem (6)
- Weight gain (7)
- Insomnia (8)
- None of these (9)

Q22 Which of the following are ways that women can prevent osteoporosis? Please choose all that apply.

- Getting a bone density test (1)
- Muscle strengthening and weight bearing exercises (2)
- Talking to a doctor about osteoporosis (3)
- Monitoring calcium intake from food (4)
- Taking calcium supplements to reach the recommended daily amount (5)
- Monitoring vitamin D intake (6)
- Taking vitamin D supplements to reach the recommended daily amount (7)
- Other (8)
- None (9)

ATTACHMENT P: SCRIPT FOR LOW BONE MINERAL DENSTIY

DXA Test Results Report Form

Name of Subject_____ Date of DXA scan_____

Based on guidelines established by the World Health Organization, the results of your DXA scan indicate that you have a lower than desired bone mineral density. I recommend you make an appointment with your physician at your earliest convenience to discuss the results of this test. If you desire, we will fax a copy of these results to your physician.

Recommendation of:

Eric Dahl, D.O.
Supervising Physician
Bone Density & Body Compostion Laboratory
The University of Mississippi

By signing my name below I acknowledge that I have been advised that the results of my DXA scan indicate that I have a lower than desired bone mineral density. My signature also acknowledges that I have indicated whether I request a copy of these test results be faxed to my physician.

____Yes, I request a copy of my test results be faxed to my physician.

____No, I do not request a copy of my test results be faxed to my physician.

My physician's name _____

Office location _____

fax number _____ phone number_____

_____Date _____
Signature of Participant

_____Date_____
Signature of PI

VITA

CURRICULUM VITAE

Mary Amanda Haskins, M.S., Ph.D (C), CHES
Health, Exercise Science & Recreation Management
School of Health Sciences
Stephens College
227 Pillsbury Science Center
Columbia, MO 65215
(573) 441-5166
mhaskins@stephens.edu

Academic

December 2016 **Doctor of Philosophy** **The University of Mississippi,** University, MS
(degree requirements completed)
Department of Health, Exercise Science and Recreation Management
Major area: Health and Kinesiology
Concentration: Health Behavior and Promotion
Area of support: Nutrition

Dissertation: *Bone mineral density, preventative behaviors and risk factors in African American and Caucasian mother-daughter pairs*

2009 Master of Science **Mississippi University for Women,** Columbus, MS
Department of Health and Kinesiology
Major area: Health Education

2007 Bachelor of Science **Mississippi University for Women**, Columbus, MS
Department of Business and Legal Studies
Major area: Paralegal Studies

Professional

2012-2014 **Adjunct course instructor,** Behavioral Aspects of Weight Management
Department of Health, Exercise Science and Recreation Management
The University of Mississippi, University, MS

2009-2014 **Project Coordinator,** New Beginnings Weight Loss Program
Student Health Services
The University of Mississippi, University, MS

- Facilitator of individual weight-management consultations for referred students, faculty and staff utilizing motivational interviewing
- Project planner of educational seminars and events
- Compiled bi-annual evaluations of health and program outcomes

2010 **Adjunct course instructor,** Personal and Community Health
Department of Health, Exercise Science and Recreation Management
The University of Mississippi, University, MS

2009 **Adjunct course instructor,** Personal and Community Health
Department of Health and Kinesiology
Mississippi University for Women, Columbus, MS

2008-2009 **Graduate Assistant**
Department of Health and Kinesiology
Mississippi University for Women, Columbus, MS

- Coordinated community-wide Women's Health Awareness week, which invites the general public to participate in free luncheons that feature speakers highlighting key aspects of women's health
- Planned and publicized for annual MUW Community Health Fair
- Speaker at Mississippi Alliance for School Health (MASH)

Research

2008-2009 **Manager,** Cancer-Beat It! Grant Phase II
Department of Health and Kinesiology
Mississippi University for Women, Columbus, MS

- Implemented and evaluated grant activities including focus groups and survey research
- Collected data regarding attitudes and perceptions towards cancer and caner types
- Determined the effectiveness of local cancer awareness PSAs via focus groups and survey evaluations

2007-2008 **Manager,** Cancer-Beat It! Grant Phase I
Department of Health and Kinesiology
Mississippi University for Women, Columbus, MS

- Staffed Internet research resource center at Baptist Memorial Hospital-Golden Triangle Cancer Center (BMH-GTCC)
- Established cancer-awareness programs in local elementary schools by recruiting and facilitating R.A.T. programs
- Determined the effectiveness of programs by sending take-home sheets to parents to assess the child's response and any shared information
- Provided and attended Cancer Lunch and Learn at BMH-GTCC. Created and facilitated on-campus displays at student centers focusing on tobacco prevention, lung, skin and cervical cancers

2007 **Research Assistant,** Webster County Roundtable Rally
Department of Health and Kinesiology
Mississippi University for Women, Columbus, MS

- Planned luncheons that engaged important community stakeholders to determine leaders' insights on cancer prevalence within the Appalachian region and to address potential environmental risk factors

Research Funding

Spring 2015 The University of Mississippi Graduate School
Dissertation Fellowship
Funding: $6,500

Fall 2015 The University of Mississippi
Department of Health, Exercise Science and Recreation Management
Internal departmental dissertation funding
Funding: $1,000

Publications:

Ford, M. A., **Haskins, M. A.,** & Nahar, V. K. Does Adherence to a Motivational Counseling Program Impact Weight Loss. *International Journal of Health Sciences.* (In press).

Nahar, V. K., Ford, M. A., **Haskins, M. A.,** Bass, M., Johnson, A. K. Biviji-Sharma, R. Osteoporosis Risk Factors and Bone Mineral Density among Asian Indian Population in North Mississippi. *Journal of Research in Health Sciences* (In press).

Nahar, V. K., Ford, M. A., Brodell, R. T., Boyas, J.F., Jacks, S. K., Biviji-Sharma, R. **Haskins, M. A.,** & Bass, M. A. (2016). Compliance with Sun Protection and Screening Practices among Melanoma Survivors: A Systematic Review. *Journal of Cancer Research and Clinical Oncology, 142*(6): 1273-1283.

Ford, M.A., **Haskins, M.A**., & Wade, C. (2014). Weight Management through motivational counseling in the workplace. *The Journal of Safety, Health and Environmental Research*, 10 (2), 178-183.

Nahar, V.K., Nelson, K., Ford, M.A., Sharma, M., Bass, M., **Haskins, M.A**., Garner, J.Predictors of Bone Mineral Density among Asian Indians in Northern Mississippi: A Pilot Study. (Under review).

Presentations:

Morris, C.E., Garner, J.C., Owens, S.G., Valliant, M.W., **Haskins, M.A.,** & Loftin, M. (2015, May). *Comparing Distance-based vs. Time-based Exercise Prescriptions of Walking and Running for Improvement of Body Composition*. ACSM Annual Meeting, San Diego, CA.

Haskins, M. A., Ford, M. A., Morgan, R.G., & Nahar, V.K**.** (2015, April). Adherence to On-campus Motivational Counseling Program Impacts Students' Weight Loss. Society for Public Health Education, Annual Meeting, Portland, OR.

Morris, C.E., Garner, J.C., Owens, S.G., Valliant, M.W., **Haskins, M.A.,** & Loftin, M. (2015, February). *Comparing Distance-based vs. Time-based Exercise Prescriptions of Walking and Running for Improvement of Body Composition.* SEACSM Annual Meeting, Jacksonville, FL.

Haskins, M.A., Ford-Wade, M., Bass, M., & Johnson, A. (2011, March). *Bone mineral density and related risk factors: A follow-up study*. Poster session presented at the American Academy of Health Behavior, Hilton Head, NC.

Pintado, I., Yates. J., **Haskins, M.A**., & Li, M. (2009, February). *Cancer-Beat It! A cancer prevention media campaign in northeast Mississippi*. Poster session presented at the 20th National Conference on Chronic Disease Prevention and Control, National Harbor, MD.

Certifications:

Mississippi Society of Radiologic Technologists
Hologic X-ray Bone Densitometer Operator

National Cancer Institute
Certified *Body and Soul* program assistant

National Institute of Health Science
Certified in *Cultural Competency in Nursing Setting*

Office of Research on Women's Health, National Institute of Health
Certified in *The Science of Sex and Gender in Human Health*

Awards:

2015 ***Kevser Ermin Professional Development Award***, The University of Mississippi

2015 ***Graduate Student Travel Grant Award,*** The University of Mississippi

Community Service:

2015 Memory Makers Respite Day Services of Oxford, Inc.: Nutrition education and food preparation demonstrations for individuals with Alzheimer's and dementia

2015 Volunteer: Rebel Man Triathlon, Oxford, MS

2013 Provision of Osteoporosis Educational Information: Building Bones for Mothers and Daughters: A Community Event, Oxford, MS

2009-2014 Residential Living Educational Sessions: Applying Nutrition Basics while Living On-Campus, Oxford, MS