REDUCTION IN MODIFIABLE OSTEOPOROSIS-RELATED RISK FACTORS IN OLDER ADULTS IN ELDERLY NUTRITION PROGRAMS

By

JENNIFER MEI-KUIN CHEONG

(Under the direction of Dr. MARY ANN JOHNSON)

ABSTRACT

The purpose was to reduce modifiable osteoporosis-related risk factors (MORR) in older adults receiving Title III nutrition services. A convenience sample in northeast Georgia (n = 71) completed heel bone mineral density (BMD) tests (Hologic, Bedford, MA) at Time 1 and osteoporosis risk assessment questionnaires at Time 1 and Time 2 (n = 59). An osteoporosis education intervention focusing on MORR was implemented. At Time 1, 60% had either osteoporosis or osteopenia (T-score $\leq$ -1.0). African American women had more MORR than Caucasian women (5 or 6 MORR: 62% versus 30%, respectively, $p = 0.004$). At Time 2, participants reported they talked to their doctor about heel BMD results (42%) or osteoporosis (41%); calcium supplement use was more than doubled ($p < 0.05$); and MORR was decreased by 1.3. In conclusion, this osteoporosis intervention reduced MORR in older adults. The curriculum is available for other educators at www.arches.uga.edu/~noahnet.

INDEX WORDS: Osteoporosis, Risk factors, Elderly nutrition program, Nutrition education

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DEDICATION

This endeavor is dedicated to my beloved parents. Thank you for your sacrificial and unconditional love.

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CHAPTER 1

INTRODUCTION

Up to 44 million Americans have either low bone mass or osteoporosis (National Osteoporosis Foundation, 2002). Osteoporosis results in height loss, muscle weakness, loss of physical function and independent living, social isolation, increased length of hospitalization, chronic pain, and fractures (McClung, 1999; Sartori, 1998). A 50-year old Caucasian American woman's lifetime risk of hip, vertebral, and distal forearm fracture is approximately 17.5%, 15.6%, and 16%, respectively (Melton et al., 1992). The corresponding values for Caucasian men are 6%, 5%, and 2.5%, respectively (Melton et al., 1992). Consequences of fractures are severe, especially for the elderly, as they may not be able to walk without assistance, may face permanent disability or die. Among hip fracture patients aged 50 and older, 24% die within a year after the fracture while 25% need long-term care (NOF, 2002). Other implications of hip fracture include difficulty in rehabilitation, chronic nursing home care, and high medical treatment cost (Sakata et al., 1997). More than 250,000 hip fractures occur each year (Looker & Wasnich, 1996), with an expected 50-fold increase for women between 50 and 90 years old (Norris, 1992).

In older adults, increasing calcium and vitamin D has been shown to increase bone mineral density (BMD) and decrease risk of fractures (Reid et al., 1995; Prince et al., 1995; Recker et al., 1996; Looker et al., 1993; Chapuy et al., 1992, 1993; Dawson-Hughes et al., 2000), while decreasing the risk of falls may also reduce the risk of fractures (Cumming & Klineberg, 1994). Therefore, osteoporosis risk reduction might be particularly beneficial in elderly populations with low calcium and vitamin D intakes. One such population is the Elderly Nutrition Program participants whereby 11% and 25% of participants had vitamin D deficiency and marginal vitamin D status, respectively

(Brackett, 1999). None of the participants met the Recommended Dietary Allowance for vitamin D of 600 IU (National Academy of Sciences, 1997).

Nutrition education intervention can change knowledge and beliefs about osteoporosis (Blalock et al., 2000) and nutrition (McCamey et al., 2002), and calcium and vitamin D intake (Rolnick et al., 2001). To our knowledge, no studies have been published concerning osteoporosis-related behavior modification among Elderly Nutrition Program participants. Therefore, the objectives of this present study were to determine the: (1) prevalence of low BMD as estimated by heel BMD test, (2) prevalence of MORR (modifiable osteoporosis-related risk factors such as falling, low physical activity, or poor diet), and (3) effectiveness of a Nutrition and Bone Health Education Program that is tailored for low-income, low-literacy older adults. The four primary hypotheses were: (1) the prevalence of low BMD in Elderly Nutrition Program participants will be higher than a representative sample of older adults from NHANES III, (2) more than 90% of Elderly Nutrition Program participants will have at least one MORR, (3) at least 80% of the participants will reduce at least one MORR after the osteoporosis nutrition intervention, and (4) at least 50% of the participants who did not consume calcium-fortified foods or calcium supplements at Time 1 (pre-intervention) will start to do so at Time 2 (post-intervention). For the purposes of this study, MORR was defined very broadly to include potentially modifiable behaviors directly or indirectly related to osteoporosis, low bone mass, and/or risk of falling.

CHAPTER 2

LITERATURE REVIEW

Elderly Nutrition Programs

The Title III Elderly Nutrition Program (ENP) of the Older Americans Act includes congregate and home-delivered meal programs. The Elderly Nutrition Program is available to any individual who is at least 60 years old. However, State and Area Agencies on Aging have, over time, been required by amendments to the Older Americans Act (OAA) to target such programs at economically and socially deprived individuals, especially those who are minority and low-income (Administration on Aging, 2002). The Elderly Nutrition Program participants are generally older and have relatively less income than the overall elderly population aged 60 and older. The average Title III congregate meal program and home-delivered meal program participant is 76 years old and 78 years old, respectively. Non-Hispanic African Americans constitute 12% and 18% of congregate and home-delivered meal program, compared to 8% in the overall US elderly population. The percentage of congregate and home-delivered meal program participants who are below 100% of the DHHS (U.S. Department of Health and Human Services) poverty guidelines are 35% and 48%, compared to 15% in the overall US elderly population (Administration on Aging, 1996).

Prevalence of osteoporosis

Up to 44 million Americans have either low bone mass or osteoporosis (National Osteoporosis Foundation, 2002). In the second phase of the third National Health and Nutrition Examination Survey (NHANES III), approximately 37% to 50% (13 to 17 million) and 13% to 18% (4 to 6 million) older women have osteopenia and osteoporosis, respectively (Looker et al., 1997).

Healthcare cost of osteoporosis and osteoporosis-related fractures

Osteoporosis-related cost is expected to rise as the population 65 years and older increases in the future since it afflicts mainly the older population. It is estimated that there will be between 530,000 to 840,000 hip fractures per year by 2040 (Melton, 1996). In 1986, the direct medical costs (hospitalization, nursing home care and outpatient services) of osteoporosis in women 45 years and older was $5.2 billion (Norris, 1992). Estimated total annual medical care treatment costs for osteoporosis among a sample of women 45 years and older was $12.9 billion in 1997 (7% of the total medical treatment cost) (Hoerger et al., 1999). According to the NOF, the national direct expenditure in hospitals and nursing homes on osteoporosis and osteoporosis-related fractures was $13.8 billion in 1995 (NOF, 2002). According to Ray et al. (1997), hospital admissions (63%) and institutionalization (28%) constitute the largest portion of osteoporosis-related health care cost.

Calcium and dairy food intake, and lactose intolerance in older adults

Diets high in calcium promote bone health (Heaney, 2000). However, high calcium consumption from dairy foods may not be feasible in older adults due to factors such as milk consumption pattern during youth and lactose intolerance (Elbon et al., 1998). Milk consumption during late adulthood is positively related to milk consumption in youth (Elbon et al., 1998). Approximately 21%, 51%, 75%, 79% and 80% of Caucasians, Hispanics, African Americans, Native Americans and Asian Americans in the US suffer from lactose intolerance (Miller et al., 1995).

Nutrition education for low-literacy older adults

Development of the proposed nutrition and health program will rely on the principles of working with low literacy and low income populations. Nutrition education for low-literacy populations should be presented in a fashion that will help them understand how and what to change in their dietary habits (Albright et al., 1997). Materials should be easy to read and understand (should aim for a 6th grade reading level or less) (Brunt & Schafer, 1997), culturally relevant, and address the issue of cost of food (Albright et al., 1997). Brochures on learning how to read nutrition food labels were developed with reading levels 6.3 to 8.7 (based on Flesch Grade Level Index and the Gunning Fog Index) (Brunt & Schafer, 1997). Both brochures improved low-literacy participants' skill at using the Nutrition Facts food label. In a focus group involving low-income Vietnamese mothers, the desired method of nutrition education was videotapes and print materials with pictures of foods (Reed et al., 1998).

In the PRECEDE-PROCEED theoretical model for health education that was adapted for Reed's study, predisposing factors (such as knowledge, attitudes, and motivations pertaining to dietary calcium consumption), reinforcing factors (such as perceived benefits as a result of behavior change), and enabling factors (skills and resources such as videotapes, recipes, and brochures that will result in behavior change) need to be identified before calcium intake is increased and risk of osteoporosis is reduced (Reed et al., 1998). Reed et al. (1998) also suggested that nutrition education on calcium should be targeted at both the lay people and physicians because few physicians seem to be advising their patients to increase consumption of dairy products.

There is a need for innovative, creative and well-implemented nutrition education programs for low-income, high-risk populations (Glanz, 1994; Woodruff et al., 1996; Albright et al., 1997). According to Israel & Rounds (1987), interventions that include social networks (such as family and friends) might give better results. In addition, Emmons et al. (1999) found that (1) social support for healthy eating had a positive influence on desired dietary changes among the low-income populations, and (2) Nutrition Home Parties was an effective means to disseminate nutrition information to women who are economically disadvantaged. In a Nutrition Home Party, participants were given monetary incentive for hosting a party whereby they invited their friends and relatives. The researchers supplied all the foods and nutrition education was conducted during the parties.

Albright et al. (1997) succeeded in facilitating dietary changes in their participants with low literacy skills by employing the following behavior change strategies: self-assessment, role modeling, skill building (that involves label reading, recipe modification, and meal planning), incentives such as manufacturer's coupons, goal setting, and formulation of strategies to solve problems. In addition, they also employed the following strategies that were used for teaching low-literate adults: using an active voice, wording statements positively in a conversational style, avoiding figures of speech, using specific foods (such as cheese) instead of food categories (such as dairy foods), using the same terms throughout the curriculum, repeating important points numerous times by using different examples, using upper and lower case letters, avoiding words printed only with upper case letters, printing horizontally instead of vertically, using font that is large and of consistent style, and having ample "white space" on printed material.

In addition, Ralston & Cohen (1999) employed the following six strategic principles when delivering nutrition education to African American elders: (1) understand that the elderly African American population is heterogeneous and that there is a need to address subgroup characteristics in planning programs, (2) understand why African American elders adopt certain food habits and dietary patterns, (3) identify cultural traditions that can help to improve and reinforce appropriate and desirable dietary behaviors, (4) identify and overcome hurdles that might prevent the adoption of appropriate and desirable behaviors, (5) involve both formal and informal forms of support for nutrition education delivery to African American elders, and (6) ensure that the techniques for educating and strategies for evaluating are suitable for the targeted African American elders.

The content and style of Food News (a low-literacy newsletter for limited-resource individuals in Alabama) were based on the following seven guidelines (Struempler & Marshall, 1999): (1) emphasized a specific topic and repeated information so as to facilitate learning, (2) included how-to information; one side of the newsletter contained nutrition information while the other side presented a self-administered test to reinforce the nutrition information, (3) included both expert and peer input, (4) included traditional southern recipes, (5) used specific and concise terms, (6) used direct and positive statements, and (7) used active instead of passive voice (e.g. use canola oil instead of canola oil was used.)

When we developed the curriculum, we incorporated the above concepts and principles in educating older adults with low-literacy in the following ways. We repeated key concepts so as to enhance learning, had experts review the curriculum before we

implemented it, incorporated skill building (such as label reading of calcium supplements), used active voice, used specific examples (such as calcium-fortified orange juice as a good source of calcium), avoided using only upper case letters in the handouts, printed horizontally and not vertically, used large font size that is of consistent style, had ample "white space" on the handouts, and emphasized how and what dietary changes to make.

Effect of nutrition interventions on reducing modifiable osteoporosis risk factors and osteoporosis-related fractures

To our knowledge, there has been no systematic evaluation of osteoporosis risk in Elderly Nutrition Program participants, beyond dietary assessment. It has been documented that nutrition education intervention results in changes in knowledge and belief about osteoporosis (Blalock et. al, 2000) and nutrition (McCamey et al., 2002) as well as calcium and vitamin D intake (Rolnick et al., 2001). In another study, there was a significant increase over a 2-year period in dietary calcium intake among the elderly (60 years of age and older) who had a nutrition education intervention (Constans et al., 1994). Increase of calcium intake was due to an increase in milk but not other dairy products. Since this study was conducted, there has been an increase in the number of foods fortified with calcium such as Tropicana calcium-fortified orange juice in 1995 (The Institute of Food Technologists, 2002), and calcium and vitamin D supplements (Colorado State University Cooperative Extension, 2002).

Supplementation of calcium in the diet does not completely eliminate postmenopausal bone loss. However, it does slow the rate of decline (Reid et al., 1995; Prince et al., 1995; Recker et al., 1996). Higher calcium intakes in the elderly reduce the

risk for hip and spine fractures (Looker et al., 1993; Recker et al., 1996; Reid et al., 1995). In a French study, supplementing the diet of older institutionalized women with vitamin D_3 (800 IU) and calcium (1200 mg) for 18 months resulted in a significant increase in femoral neck and proximal femur BMD (Chapuy et al., 1992). Hip fracture rate and nonvertebral fracture rate in the treatment group decreased 43% and 32%, respectively (Chapuy et al., 1992). After 36 months of vitamin D_3 (800 IU) and calcium (1200 mg) supplementation daily, the supplemented group experienced a lower risk of hip and all non-vertebral fractures (Chapuy et al., 1994). In another study, community-dwelling adults aged 65 and older were given either 500 mg of calcium plus 700 IU vitamin D_3 (cholecalciferol) or a placebo. Calcium and vitamin D supplementation moderately reduced bone loss and reduced the incidence of nonvertebral fractures (Dawson-Hughes et al., 1997). However, calcium and vitamin D supplementation needs to be continued. Otherwise, increase in BMD that was achieved with supplementation may be lost (Dawson-Hughes et al., 2000). So the curriculum that was implemented in this study emphasized dairy foods, calcium-fortified foods, and supplements. In order to sustain intakes of such foods, participants were shown examples of calcium-rich and calcium-fortified foods, as well as given calcium-fortified orange juice to taste. In addition, since the conclusion of the study, the lesson on calcium and vitamin D has been expanded from one to three lessons.

Fractures, fall prevention, exercise, and medication

Falls increase as one ages, especially in Caucasian women (Sartori, 1998). Approximately 33% of community dwellers aged 65 and older will fall each year (Rubenstein et al., 1988). There is a strong relationship between the number of falls in the

past and risk of hip fracture (Cumming & Klineberg, 1994). Even though only 10% of falls result in hip fractures, fractures alone constitute 30-40% (Sattin et al., 1990) to 75% (Nordell et al., 2000) of fall injuries among the elderly. Hip fracture constituted about 30% of fall injuries at home that resulted in hospital admission (Sattin et al., 1990). Hip fractures can be prevented by external hip protectors (Lauritzen et al., 1993). Studies have found that exercise has a protective effect on the risk of falling (Buchner et al., 1997). In the position statement of the Australian and New Zealand Bone and Mineral Society, falls can be prevented and fracture risk can be lowered by improved fitness and muscle strength (Forwood & Larsen, 2000). Side effects of certain medications is a risk factor of falls (Nordell et al., 2000). Psychotropic medications may cause a 2-fold increased risk of falls and fractures. Antidepressants are associated with falls. It is still not known if nonsteroidal anti-inflammatory drugs is associated with falls (Cumming, 1998).

Given the information that we have about the benefits of exercise on bone mass, we then decided to incorporate exercise in the curriculum. Specifically, we taught the participants balance exercises from The National Osteoporosis Foundation (NIH, 2000). Participants were given handouts on the exercises to take home with them so that they can practice the exercises at home. We also included information about the benefits of certain medications on bone health and highlighted the increased risk of falls as a potential side effect of certain medications.

Heel BMD in predicting osteoporosis and fractures

Bone mineral density (BMD) testing is used to determine indirectly the amount of mineral in bones, is related to bone strength and provides a good prediction of fracture

risks (Kanis et al., 1994). There are numerous types of BMD tests such as dual-energy X-ray absorptiometry (DXA), considered as the "gold standard" of bone densitometry, and ultrasound. Ultrasound measures broadband ultrasound attenuation (BUA) and speed of sound (SOS) in the calcaneus, tibia, and patella and is significantly correlated ($r = 0.992$) to trabecular bone volume (Agren et al., 1991). Advantages of ultrasound technique over DXA include: (1) it is less expensive, (2) it does not utilize ionizing radiation, (3) it is relatively simple to use, (4) the device is portable, and (5) it contains information such as bone structure and bone strength that is not found in DXA (Graafmans et al., 1996; Ross et al., 1995; Turner et al., 1995). BUA and SOS are indicative of structural component of bones, regardless of BMD that was measured by DXA (Gluer et al., 1994; Nicholson et al., 1994) and may help to diagnose bone fragility and osteoporosis (Nicholson et al., 1994; Turner & Eich, 1991). Ultrasound technique differentiates between osteopenic/osteoporotic and non-osteopenic/non-osteoporotic individuals (Agren et al., 1991; Graafmans et al., 1996; Agren et al., 1991; Baran et al., 1988; Yamazaki et al., 1994; Lees & Stevenson, 1992; Herd et al., 1993) as well as between fracture and non-fracture individuals (Turner et al., 1995). Different short-term precision values of ultrasound measurements have been reported, ranging from 0.1% to 1.6% for SOS and 1% to 4% for BUA (Nicholson et al., 1994; Graafmans et al., 1996; Lees & Stevenson, 1992; Schott et al., 1995). Heel ultrasound measurements correlate well to heel BMD (Graafmans et al., 1996). Correlation coefficient between ultrasound parameters and BMD range from 0.3 to 0.8 (Graafmans et al., 1996) and 0.54 to 0.67 (Lees & Stevenson, 1992). Variability could be due to day-to-day variation in measurement method such as the positioning of the heel. Vogel (Vogel et al., 1994) found a correlation between

calcaneus BMD and BUA of 0.681. The correlation is not stronger possibly because BMD and BUA measure different aspects of bone strength and fracture risk (Vogel et al., 1994). It has been shown that ultrasound densitometry predicts spine and hip fracture risk (Schott et al., 1995; Sakata et al., 1997; Bauer et al., 1995; Heaney et al., 1995; Pfeifer et al., 1994; Pfeifer et. al, 1995; Vogel et al., 1994). Bauer (Bauer et al., 1995) found that a reduction of one standard deviation in BUA corresponds to a relative risk of vertebral fracture of 1.8 after adjustment for age, weight, and bone density at several different sites while Pfeifer (Pfeifer et al., 1994) found that relative risk of at least one vertebral fracture increases when BUA and SOS are below 130 db/MHZ and 1550 m/s, respectively. Ultrasound of the os calcis and femoral BMD are comparable in terms of predicting hip fracture risk. In fact, in several studies, ultrasound of the os calcis was a better indicator of hip fracture risk than DXA (Stewart et al., 1994; Schott et al., 1995). In Stewart's study, fifty women with fractured neck of the femur and fifty age-matched control subjects were recruited. Subjects were not significantly different in terms of age, height, age at menopause, and years post-menopause. Controls, however, were significantly heavier than participants with a fracture ($p = 0.0012$). Spine and hip were scanned with DXA and os calcis with broadband ultrasound attenuation (BUA). There were significant differences in DXA and BUA measurements between the two groups, with the largest percentage difference in BUA measurement. It was concluded that BUA, when compared to DXA, is a better discriminator of hip fracture. Schott et al. (Schott et al., 1995) conducted a similar study whereby forty-three women with recent hip fractures and eighty-six age-matched controls had their heels scanned by an ultrasound device, and their femur, neck, Ward's triangle, and trochanteric regions scanned by DXA. It was

reported that BUA, SOS, and stiffness were significantly lower in fractured patients and that these measurements predicted hip fracture independently of BMD. Results also indicated that ultrasound had a stronger correlation to the type of fracture than DXA. Controls and subjects with hip fracture differed significantly in terms of height ($p = 0.05$), weight ($p = 0.01$), BMI ($p < 0.001$) but not age and age at menopause. Results from these two studies (Stewart et al., 1994; Schott et al., 1995) added more significance and importance to the heel BMD measurement that was conducted in our study because ultrasound measurements of os calcis can predict hip fracture risk. It has been postulated that there is a high correlation between ultrasound of the os calcis and the strength of the femur (Bouxsein et al., 1995). Overall, ultrasound measurements of the heel can be used as an alternative method for predicting future fracture risk (Bauer et al. 1995; Sakata et al., 1997; Schott et al., 1995; Heaney et al., 1995). However, heel BMD is only a screening and not diagnostic tool for low bone mass.

Rationale, Specific Aims, and Hypotheses

Osteoporosis, a common disorder, affects approximately 10 million people in the United States (Institute of Medicine, 2000). Twenty-five to 30% of Caucasian women 65 years and over suffer from osteoporosis. According to the National Osteoporosis Foundation, there are approximately 1.5 million fractures due to osteoporosis per year (300,000 hip fractures; 700,000 spine fractures; 250,000 wrist fractures; 300,000 at other sites) (NOF, 2002).

Osteoporosis will affect more people in the future as the population in the United States ages. The proportion of the population who are 65 years and older is predicted to

increase from the current 12% to 20% in 2030 (U.S. Bureau of Census, 2002). Therefore, there is an urgent need to address osteoporosis prevention and management.

Osteoporosis-related problems such as hip fractures are costly. In 1995, the estimated cost of hip fractures in people over 45 years old was $8.7 billion in the United States (Ray et al., 1997). In women with hip fractures, one in every four to five will die within a year; one in every four will be admitted to a long-term care setting. Also, they will have less than a 50 percent chance of regaining baseline functional status (National Osteoporosis Foundation, 1999). It is also estimated that osteoporosis-related costs could double within the next 30 years (Cummings et al. 1990).

Low calcium and vitamin D intake are modifiable risk factors for osteoporosis (Chapuy et al., 1992). The Elderly Nutrition Program population has low intakes of calcium and vitamin D and a high prevalence of self-reported osteoporosis (Brackett, 1999). Other modifiable risk factors include physical inactivity and medication use. By implementing the Nutrition and Bone Health Program, this study aims to increase calcium and vitamin D intake and lower the prevalence of modifiable osteoporosis-related risk factors of this population.

The specific aims of this study were:

(1) To determine the prevalence of low BMD as estimated by heel BMD test.

(2) To determine the prevalence of modifiable osteoporosis-related risk factors such as falling, low physical activity, or poor diet.

(3) To determine the effectiveness of a Nutrition and Bone Health Education Program that is tailored for a low-income, low-literacy elderly population.

It was hypothesized that: (1) the prevalence of low BMD in Elderly Nutrition Program participants will be higher than a representative sample of older adults from NHANES III (Looker et al. 1997), (2) more than 90% of ENP participants will have at least one modifiable risk factor for osteoporosis or fracture such as low intake of calcium-rich foods, non-use of calcium supplements, non-use of vitamin D supplements, lack of minimal exercise, high risk of falling in their home, and current use of cigarettes, pipes, cigars or tobacco, (3) at least 80% of the seniors will reduce at least one of their modifiable osteoporosis-related risk factors after attending the Nutrition and Bone Health Education Program, and (4) at least 50% of the participants who did not consume calcium-fortified foods or calcium supplements at Time 1 will start to do so after the Nutrition and Bone Health Education Program.

CHAPTER 3

REDUCTION IN MODIFIABLE OSTEOPOROSIS-RELATED RISK FACTORS IN OLDER ADULTS IN ELDERLY NUTRITION PROGRAMS[1]

[1]Cheong, J.M.K., Johnson, M.A., Lewis, R.D., Fischer, J.G., & Johnson, T. Submitted to Family Economics and Nutrition Review, 4/1/02.

Abstract

The purpose was to reduce modifiable osteoporosis-related risk factors (MORR) in older adults receiving Title III nutrition services. A convenience sample in northeast Georgia (n = 71, 66% Caucasian, 34% African American, 90% women), completed heel bone mineral density (BMD) tests (Hologic, Bedford, MA) at Time 1 (pre-intervention) and osteoporosis (OP) risk assessment questionnaires at Time 1 and Time 2 (post-intervention, n = 59). An OP education intervention focusing on MORR was implemented. At Time 1, 60% had either OP or osteopenia (T-score $\leq$ -1.0). African American women had more MORR than Caucasian women (5 or 6 MORR: 62% versus 30%, respectively, $p = 0.004$). At Time 2, participants reported they talked to their doctor about heel BMD results (42%) or OP (41%); ate more calcium-rich (31%) or calcium-fortified foods (20%); started taking a calcium (23%) or vitamin D supplement (11%); and practiced balance exercises at home (56% of participants). At Time 2, calcium supplement use was more than doubled ($p < 0.05$) and MORR was decreased by 1.3 (from 4.2 to 3.0, $p < 0.0001$). Ninety-eight percent of participants rated the program as good or excellent. In conclusion, this OP intervention reduced MORR in older adults. The curriculum is available for other educators at www.arches.uga.edu/~noahnet.

Introduction

According to the National Osteoporosis Foundation (National Osteoporosis Foundation, 2002), up to 44 million Americans have osteoporosis or low bone mass. More than 1.5 million fractures per year are caused by osteoporosis. There are many consequences of osteoporosis. These include body deformity such as height loss, muscle weakness, loss of physical function and independent living, social isolation, increased

length of hospitalization, and chronic pain (McClung, 1999; Sartori, 1998). Perhaps the most debilitating consequence of osteoporosis is fractures. Fractures of the proximal humerus, pelvis and tibia are related to osteoporosis. By the time a Caucasian American woman reaches the age of 50, her lifetime risk of hip, vertebral, and distal forearm fracture is approximately 17.5%, 15.6%, and 16%, respectively (Melton et al., 1992). The corresponding values for Caucasian men are 6%, 5%, and 2.5%, respectively (Melton et al., 1992). Elderly patients with fracture may not be able to walk without assistance, may face permanent disability or die. The increase in fracture-related mortality occurs within 6 to 12 months after the fracture, decreases with time after fracture, and is higher in male and older patients (especially those aged 80 and over) (McClung, 1999; Poor et al., 1994; Sexson & Lehner, 1988; White et al., 1987). Twenty-four percent of hip fracture patients aged 50 years old and above die within a year following their fracture while 25% of the patients needed long-term care (NOF, 2002). Hip fracture is also associated with difficulty in rehabilitation, chronic nursing home care, and high medical treatment cost (Sakata et al., 1997). Annually, there are approximately 300,000 hip fractures; 700,000 vertebral fractures; 250,000 wrist fractures; and 300,000 fractures at other sites (NOF, 2002). There is a 50-fold increase of hip fractures between 50 and 90 year-old women (Norris, 1992).

In older adults, increasing calcium and vitamin D, and reducing risks of falls have been shown to decrease both the rate of total body BMD loss and the risk of bone fractures (Chapuy et al., 1992, 1994; Looker et al., 1993; Prince et al., 1995; Recker et al., 1996; Reid et al., 1995; Reid, 1996). Thus, osteoporosis risk reduction might be particularly beneficial in elderly populations with low calcium and vitamin D intake. One

such population includes older adults who participate in Elderly Nutrition Program (ENP). Brackett found that Elderly Nutrition Program participants have low intakes of calcium and vitamin D (Brackett, 1999). Eleven percent and 25% had vitamin D deficiency and marginal vitamin D status, respectively. No participants met the Recommended Dietary Allowance for vitamin D of 600 IU (National Academy of Sciences, 1997).

To our knowledge, there has been no systematic evaluation of osteoporosis risk in Elderly Nutrition Program participants beyond dietary assessment. It has been documented that nutrition education intervention results in changes in knowledge and belief about osteoporosis (Blalock et al., 2000) and nutrition (McCamey et al., 2002) as well as calcium and vitamin D intake (Rolnick et al., 2001). Thus, the focus of this study is to reduce the risk of osteoporosis in Elderly Nutrition Program participants through a Nutrition and Bone Health Education intervention. The objectives of this study were to determine the: (1) prevalence of low BMD as estimated by heel BMD test, (2) prevalence of MORR (modifiable osteoporosis-related risk factors such as falling, low activity, or poor diet), and (3) effectiveness of a Nutrition and Bone Health Education Program that is tailored for a low-income, low-literacy elderly population. It was hypothesized that: (1) the prevalence of low BMD in Elderly Nutrition Program participants will be higher than a representative sample of older adults from NHANES III, (2) more than 90% of ENP participants will have at least one modifiable risk factor for osteoporosis or fracture such as low intake of calcium-rich foods, non-use of calcium supplements, non-use of vitamin D supplements, lack of minimal exercise, high risk of falling in their home, and current use of cigarettes, pipes, cigars or tobacco, (3) at least 80% of the seniors will reduce at

least one of their modifiable osteoporosis-related risk factors after attending the Nutrition and Bone Health Education Program, and (4) at least 50% of the participants who did not consume calcium-fortified foods or calcium supplements at Time 1 will start to do so after attending the Nutrition and Bone Health Education Program. For the purposes of this study, MORR was defined very broadly to include potentially modifiable behaviors directly or indirectly related to osteoporosis, low bone mass, and/or risk of falling such as not consuming at least 3 servings of calcium-rich and/or calcium-fortified foods daily, not taking calcium and/or vitamin D supplements, low physical activity, high risk of falling at home, and use of tobacco products.

Methods

Recruitment of the sample

This was a convenience sample. There were no exclusion criteria because one condition of the contract with our Area Agency on Aging was to make the heel BMD testing and nutrition education program available to all Senior Center participants. This evaluation was conducted in Georgia in Walton, Madison, Oconee, and Greene counties because of their interest in the project and availability of their center at the time. Participants were recruited through the Senior Center directors who helped to distribute flyers and sign up sheets**.** Approval for the study was obtained from the Institutional Review Boards of the Georgia Department of Human Resources and The University of Georgia for all procedures. Before the protocol began, the consent form was read aloud to the participants and written informed consent was obtained individually from each participant. By signing the consent form, they agreed to have their heel BMD tested,

listen to nutrition education classes, perform physical activities, and to answer questions about their nutrition and health status.

At Time 1, heel BMD, weight, and height was assessed, and participants answered nutrition and health questions (not in any particular order). Heel BMD and T-scores (a value that is derived by comparing participants' BMD with the optimal and peak bone density of a 30-year old healthy adult) were determined with an ultrasound bone densitometer (Hologic Sahara Clinical Bone Sonometer, Bedford, MA). Precision of estimated heel BMD with the Sahara clinical bone sonometer is 0.014 g/cm^2 (absolute unit), and 3.0% (coefficient of variation) (Hologic, 1998). Each participant received a copy of their BMD results, an explanation of their heel BMD results (low risk, moderate risk, or high risk for osteoporosis), and was strongly encouraged to take the results to their healthcare provider.

After completing the nutrition and health questionnaire and heel BMD test at Time 1, the Nutrition and Bone Health Education Program was implemented. The curriculum included three lessons: (1) What is osteoporosis, (2) Calcium and vitamin D, and (3) Fall prevention and medications. Each lesson had a lesson plan, handouts, post-tests, and a personal plan. Balance exercises from the National Osteoporosis Foundation were performed at each lesson (NOF, 2000). Lesson-specific post-test questions that comprised four questions were administered after each lesson. Each topic constituted one lesson. One lesson was taught per month. After conducting the entire curriculum, a post-test was administered to assess behavior modification so as to reduce their risk of osteoporosis, falls, and osteoporosis-related fracture. This post-test was administered approximately 1 month after the third lesson so as to allow participants time to make

behavioral changes. Participants completed the client satisfaction survey and provided information on the quality and their level of satisfaction with the program.

Questionnaire

Questions were selected based on past nutrition questionnaires that were developed for this population of Elderly Nutrition Program participants and key issues that need to be addressed for osteoporosis (such as calcium, vitamin D, and fall prevention) (Brackett, 1999; Accettura, 2000). Nutrition experts (three faculty members and one research coordinator in The University of Georgia's Food and Nutrition department) reviewed the curriculum. Experts reviewed the questions to increase face validity of the questionnaire. To help determine the reliability of the questionnaire for this population, the questionnaire was administered twice with the same participants at Time 2. Test-retest reliability data indicated that on the average, participants gave the same response 79% of the time. The questionnaire included medication history, family history of osteoporosis and fractures, medical conditions / medications, diet, physical activity, lifestyle (smoking and tobacco chewing), fall prevention, osteoporosis-related knowledge questions, menstruation history, medications and illnesses, and orientation-memory-concentration (for cognition) test. The cognition measure is a validated 6-item tool that discriminates cognitive function as being normal or minimally impaired (score of 8 or less), moderately impaired (score of 9 to 19) or severely impaired (score of 20 or more) (Katzman, 1983). Participants were required to perform tasks such as counting backwards from 20 to 1, naming the months of the year in reverse order, naming the current month and year, and repeating a phrase that was read to them at the beginning of the testing session. Trained staff from the Department of Foods and Nutrition administered the

questionnaire. The interviewer read the questions to the participants and recorded their responses. During the interview, food models were used to help the participants determine portion sizes.

MORR score

The following six categories were considered as MORR (yes/no for each category) at Time 1 and Time 2: (1) Low intake of calcium rich foods (quantified as eating less than 3 servings of calcium-rich and/or calcium-fortified foods per day; calcium-rich foods included milk as a beverage or with cereal, yogurt, cheese, mustard, turnip, or collard greens, and canned salmon; calcium-fortified foods included calcium-fortified orange juice and calcium-fortified cereals).

(2) Non-use of calcium supplements (defined as not taking a supplement with calcium. For the purposes of this study, a multivitamin supplement was not considered as calcium supplement.)

(3) Non-use of vitamin D containing supplements (defined as not taking either a multivitamin supplement or any capsule or tablet that contains vitamin D).

(4) Lack of exercise (defined as exercising for less than a total of 150 minutes per week, regardless of duration of exercise sessions and number of exercise sessions per week). According to the American Heart Association, older adults can benefit from moderate amount of physical activity, preferably everyday (http://www.americanheart.org/presenter.jhtml?identifier=4557). Older adults should accumulate at least 30 minutes of moderate physical activity on most days of the week (http://www.health.state.mn.us/divs/fh/chp/npa/seniors.html).

(5) High risk of falling at home (defined as any one of the following: not anchoring throw rugs, not having grab bars in bathroom, not having non-skid tape or non-skid mat in tub or shower area, or not turning on the light or using a night light when getting out of bed at night).

(6) Current use of cigarettes, pipes, cigars or tobacco (chewing).

Statistical analysis

Data were entered twice to ensure accuracy. The Statistical Analysis System was used for all analyses (SAS, Version 8.2, Cary, NC). Descriptive statistics such as frequencies, means and standard deviations were calculated. Data at Time 1 and Time 2 were compared to determine the percentage of participants who improved at least one of these six categories of MORR, the total number of MORR reduced from Time 1 to Time 2, as well as change in our variables of interest. Data at Time 1 and Time 2 were compared by using Chi-square and paired T-tests to determine the statistical significance of changes ($p<0.05$). Comparisons also were made between or by gender and ethnicity.

Results

Participant characteristics at Time 1 are listed in Table 1 (n = 71). Of the 71 participants who were enrolled at Time 1, 59 completed the study. Twelve participants did not complete the study because they were out of town for an extended period of time (n = 5), passed away (n = 1), refused to complete the questionnaire at Time 2 (n = 1), not a regular Senior Center participants (n = 1), or stopped going to the Senior Center (n = 4). All of them participated in ENP programs at four Senior Centers in Georgia (Walton, Madison, Oconee, and Greene counties). The sample was predominantly female (90%) and Caucasian (66%). Mean age of the sample was 75.9 years old, with women being

significantly older than men ($p = 0.04$). Caucasian women and African American women were not statistically different in terms of age ($p = 0.62$). Other comparisons between men ($n = 7$) and women ($n = 64$) indicated that somewhat more women had bone pain (59% versus 33%, $p = 0.23$), had a fall within the past 1 year (33% versus 0%, $p = 0.07$), and had a fracture or broken bone after age 50 (34% versus 14%, $p = 0.28$). Sixty percent (60%) of participants had either osteopenia or osteoporosis (Table 1). Seventeen percent had moderate risk while 23% had low risk for a future fracture. Heel BMD and T-score (mean $\pm$ SD) were 0.47 ± 0.2 gm/cm^2 and -1.03 ± 1.5, respectively, indicating high risk for a future fracture. There was a significant difference between T-score for African American and Caucasian women, which indicated moderate risk for future fracture, and Caucasian women, which indicated high risk for a future fracture. African American women had significantly higher mean body mass index (31.3 kg/m^2 which indicated obesity grade I) than Caucasian women (28.2 kg/m^2 which indicated overweight) ($p = 0.05$).

At Time 1, 100% of participants had at least 1 MORR (Table 2). Every participant ate less than 3 servings of calcium-rich and/or calcium-fortified foods per day. Other results related to milk consumption were: the majority of participants drank milk as a child (93%) and are still currently drinking milk (89%), with 2% milk being the most popular type of milk consumed. One out of every four participants experienced stomachache, gas, or diarrhea after drinking milk, occurring significantly more often in African American women than Caucasian women ($p = 0.006$). Generally, there was no statistically significant difference in consumption patterns of calcium-rich and calcium-fortified foods between men and women, or between Caucasian women and African

American women (Table 2). Among the calcium-rich foods examined, the only statistically significant difference was a higher consumption of mustard, turnip, or collard greens in African American women versus Caucasian women ($p < 0.0001$). Seventy-seven percent of participants had calcium supplement risk, defined as not taking a calcium supplement. When compared to Caucasian women, significantly more African American women did not take a calcium supplement ($p = 0.01$). Sixty-four percent of participants did not take a vitamin D supplement or supplement containing vitamin D. Eighty-two percent of participants exercised less than 150 minutes per week, with African American women exercising significantly less than Caucasian women ($p = 0.01$). Seventy-five percent of participants were at risk of falling at home. Results of the four parameters that were used to assess their risk of falls at home are as follows: 30% of the total sample did not have throw rugs anchored and smooth, 54% did not have grab bars in bathroom, 28% did not have non-skid tape or non-skid mat in tub or shower area, and 10% did not turn on light or use night light when getting out of bed at night. There were no significant differences in any of these four parameters between men and women, or between Caucasian women and African American women. Seventeen percent of the total sample had smoking/tobacco risk, defined as current users of cigarettes, pipes, cigars, or tobacco. Somewhat more African American than Caucasian women used tobacco ($p = 0.08$).

Although African American women had higher heel BMD, they had more osteoporosis-related risk factors than Caucasian women. Compared to Caucasian women, African American women consumed less milk and cheese, and were more likely to not take calcium or multivitamin supplements, not use hormone replacement therapy, never

have been told by their doctor that they had osteoporosis, have signs of lactose intolerance, and smoke or use tobacco products (Table 3). In addition, somewhat more African American than Caucasian women did not know that calcium needs increase after age 50 (23% versus 6%, $p = 0.08$), both men and women get osteoporosis (54% versus 26%, $p = 0.08$), normal fruit juice does not have as much calcium as milk (60% versus 27%, $p = 0.03$), dairy foods are not the only foods that are high in calcium (67% versus 25%, $p = 0.005$), and sunlight helps our bodies make vitamin D (11% versus 6%, $p = 0.54$). Mean number of MORR for both men and women at Time 1 ($n = 67$) was 4.2 (Table 4), with African American women having significantly more MORR than Caucasian women ($p = 0.004$).

About 68%, 64%, and 58% of the participants attended lessons 1, 2, and 3, respectively. About 12% of the participants did not attend any of the lessons. In the subset of participants who completed both Time 1 and Time 2 ($n = 54$), mean number of MORR at Time 1 was the same as in the total sample ($n = 71$) and the significant difference between African American women and Caucasian women persisted ($p = 0.003$). At Time 2, the mean number of MORR was significantly reduced from 4.2 to 3.0 ($p<0.0001$) (Table 4). African American women still had somewhat more risk factors than Caucasian women (3.4 versus 2.8, $p = 0.06$) but the difference was smaller than at Time 1.

After the nutrition education intervention, 74.6% of participants reduced at least one of their MORR. Figure 1 shows the prevalence of the 6 categories of MORR. Although the risk from low intake of calcium-rich foods remained at 100% at Time 2, consumption of some, but not all, calcium-rich foods was significantly increased by a

small amount as follows: milk as a beverage (from 5.5 ± 4.3 to 7.1 ± 4.7 glasses per week, p = 0.006), milk with cereal (from 2.4 ± 3.0 to 3.2 ± 3.3 glasses per week, p = 0.05), yogurt (from 2.4 ± 4.2 to 2.9 ± 3.7 cups per week, p = 0.59), cheese (from 1.9 ± 2.0 to 2.2 ± 2.3 servings per week, p = 0.56), and calcium-fortified orange juice (from 1.5 ± 3.6 to 3.5 ± 5.5 cups per week, p = 0.02). Mustard, turnip, or collard greens, and canned salmon consumption remained about the same at Time 2. The percentage of participants who did not take a calcium supplement decreased significantly from 83% to 51% (p = 0.0003). When participants who did not consume calcium-fortified foods or calcium supplements at Time 1 were analyzed collectively, 42.1% of them started to do so at Time 2. There were no significant changes in the percentage of participants who exercised at least 150 minutes per week (from 17% to 20%, p = 0.64), smoked or used tobacco (from 18% to 13%, p = 0.43), and were at risk of falling at home (from 78 to 88%, p = 0.40). There were several items that showed trends for changes including the percentage of participants whose doctor told them that they had osteoporosis (increased from 14 to 29%, p = 0.07), percentage of participants who take a vitamin/mineral supplement (increased from 51 to 66%, p = 0.09), and the mean number of times participants exercised per week (increased from 4.5 to 5.5 times per week, p = 0.01).

In a series of multivariate stepwise regression models, the dependent variables were change in MORR or number of self-reported changes and the independent variables were (1) age, gender, ethnicity, cognition, and attendance, or (2) all of the above plus whether the participants had been told by their doctor that they had osteoporosis. Change in MORR was not significantly associated with age, gender, ethnicity, attendance, cognition, or whether the participants have been told by their doctor that they had

osteoporosis. However, in the first regression model a greater number of self-reported changes after the intervention was weakly associated with more attendance ($F = 2.26$, $p = 0.14$), ethnicity ($F = 3.66$, $p = 0.06$, Caucasian greater than African American), and younger age ($F = 3.11$, $p = 0.08$). When whether participants were told by their doctors that they had osteoporosis was included in the second model, a greater number of self-reported changes was significantly associated with being told by their doctor that they had osteoporosis ($F = 5.2$, $p = 0.03$) and younger age ($F = 5.17$, $p = 0.03$).

Discussion

Senior Centers and other organizations that support ENPs are believed to be ideal places to deliver health promotion programs (Millen et al., 2002). However, a search of MEDLINE identified very little information about health promotion programs in ENPs, and no programs that focused on nutrition and bone health. Thus, this study has important implications for health promotion activities in ENPs. There was strong support for three of the four hypothesized outcomes. We expected at least 90% of participants would have at least one MORR, and 100% did. It was hypothesized that 80% of the participants would reduce at least one of their MORR after attending the Nutrition and Bone Health Program, and 75% achieved this goal. We expected 50% of the participants who did not consume calcium-fortified foods or calcium supplements at Time 1 would start to do so at Time 2, and 42% of the participants initiated at least one of these behaviors. The other major findings were that after the intervention, between 11% and 56% of the participants reported changing their behavior to reduce their risk of osteoporosis and falls by practicing balance exercises at home, talking to their doctor about osteoporosis-related issues, increasing their physical activity, changing their diet or supplement use patterns,

and/or reducing their risk of falls at home; participants significantly decreased their MORR factor score by more than 1 point (out of 6); and there was a highly significant increase in the use of calcium supplements from 17% to 49% ($p = 0.0003$).

Heel BMD was conducted only at Time 1 because it takes 2 to 3 years for improvements in heel BMD to be reflected by the ultrasound bone densitometer (Hologic, 2002). We expected a high percentage of participants to have osteopenia or osteoporosis, but the prevalence was similar and not higher than NHANES III (Looker et al. 1997). This could be in part due to the higher body mass index in the sample since body weight is associated with higher BMD and lower bone loss (Tremollieres et al., 1993, Versluis et al., 2001). A high percentage (60%) of participants had osteopenia or osteoporosis based on their heel BMD results. However, the sample is still at high risk because of their advanced age, a high percentage of women, a high percentage of Caucasians, poor dietary patterns, and lack of physical activity.

Of all the self-reported behavior modifications, the largest positive change was in the percentage of participants who reported practicing balance exercises at home. This could be due to the distribution of handouts with a pictorial illustration of the balance exercises, and the inclusion of the balance exercises at the end of every session. It has been shown that a successful physical activity promotion program can increase older adults' level of physical activity (Stewart et al., 2001). Between 25% to 42% of participants talked to their physician about some aspect of bone health such as heel BMD, osteoporosis, exercises for bone health, and/or medications for osteoporosis.

There was significant reduction in one of the six categories of MORR, namely calcium supplementation risk. Participants may have significantly increased their use of

calcium supplements for several reasons. Participants were shown examples of calcium supplements and were given information on selecting calcium supplements. Also, the importance of an adequate intake of calcium was emphasized and repeated throughout the entire curriculum. Including a calcium supplement in the diet will help the participants meet their calcium requirement, especially when their intake of calcium-rich and calcium-fortified foods is low. Also, calcium supplementation will reduce their risk of future fractures (Recker et al., 1996, Looker et al., 1993, Chapuy et al., 1992).

There was a lack of changes in other diet-related domains, as seen from a lack of increase in the number of participants who consumed three or more servings of calcium-rich and/or calcium-fortified foods after the intervention. Thus, after this evaluation was completed, the calcium and vitamin D section of the curriculum was expanded from one to three lessons in order to help increase calcium-rich and calcium-fortified food consumption among this population. These three lessons focus on calcium and vitamin D from food sources such as dairy foods and certain vegetables, calcium-fortified foods, and calcium and vitamin D supplements.

Although women are at higher risk than men for osteoporosis, the men in this study had poor knowledge about some aspects of osteoporosis and/or diet. Among the few men in this study, about half (40%) did not know that calcium needs increase after age 50, and none knew that sunlight helps the body make vitamin D.

There is a heightened awareness that African American women are at risk for osteoporosis. Five percent of African American women aged 50 and older have osteoporosis while 35% have low bone mass (NOF, 2002). Although in the present study, BMD was similar in Caucasian women and African American women, the African

American women may be at somewhat higher future risk for osteoporosis because they were significantly less likely to be physically active, take a calcium supplement, or be on hormone replacement therapy, and were more likely to have signs of lactose intolerance and had poor knowledge of osteoporosis- and diet-related information.

There might be concern that this sample of older adults with low literacy and lack of finances (Millen et al., 2002) might not be able to make behavioral changes. However, changes in MORR were not significantly related to age, gender, ethnicity, attendance, or cognition (forward stepwise logistic regression analyses). In regression analyses, those with higher age ($p = 0.08$), who were African American versus Caucasian ($p = 0.06$), or who had poor attendance ($p = 0.14$) were somewhat less likely to report a change in their behavior; however the number of self-reported changes was not related to gender or cognition. When being "told by their doctor that they had osteoporosis" was added to the model, this factor as well as younger age were the only two variables associated with a self-reported behavior change. Thus, this sample appears capable of reducing their risk for osteoporosis. However, further analysis of the test-retest reliability of questions that determined the number of self-reported changes indicated that 3 questions had the same answer in less than 70% of the participants. These 3 questions asked if participants increased their physical activity (reliability of 73%), adopted at least one of the ways to prevent falls that was mentioned in the curriculum (reliability of 32%), and if they made any other changes (reliability of 73%). When the question with the lowest reliability or when all three questions were deleted from the analysis, the total number of self-reported changes was not associated with age, gender, ethnicity, attendance, cognition, or being

told by their doctor that they had osteoporosis (forward stepwise logistic regression analyses).

Sample characteristics between participants who completed only Time 1 but not Time 2 (n = 12) was compared to participants who completed both Time 1 and Time 2 (n = 59) (Table 11). Both groups did not differ except for the following variables. More women remained in the study (75% versus 93%, p = 0.05), and mean weight of the sample was significantly lower at Time 2 (86.2 $\pm$ 18.7 kg versus 72.2 $\pm$ 14.0 kg, p = 0.004). The lower mean weight was probably due to the men who dropped out of the study. There was a trend for participants who remained in the study to have fallen within the past one year (8% versus 31%, p = 0.08). Also, significantly more participants who completed the study did not consume calcium (83% versus 45%, p = 0.007) and vitamin D supplements (95% versus 73%, p = 0.02), and had more modifiable osteoporosis-related risk factors (4.3 $\pm$ 1.0 versus 3.5 $\pm$ 1.4, p = 0.02) at Time 1. It is possible that these significant differences motivated some participants to remain in the study. However, six of the participants who completed the nutrition and health questionnaire at Time 1 and Time 2 did not attend any of the lessons. When these six participants were removed from the analysis, non-use of calcium (45% versus 88%, p = 0.001) and vitamin D (73% versus 94%, p = 0.03) supplementation, and the number of modifiable osteoporosis-related risk factors (3.5 $\pm$ 1.4 versus 4.4 $\pm$ 1.0, p = 0.01) was still significantly higher among those who completed the study. There was still a trend for participants who completed the study to have fallen within the past 1 year (8% versus 32%, p = 0.10).

In the future it would be preferable to administer the questionnaire on two separate occasions (at least one week apart) at Time 1 before the intervention began. Of the 105 questions that were asked twice, 40%, 16%, 16%, and 28% of the questions had the same answers in ≥ 90%, ≥ 80% to 89.9%, ≥ 70% to 79.9%, and < 70% of participants. When questions that had answers with multiple categories (such as yogurt consumption that ranged from less than once per week to 2 or more times per day) were removed from the 105 questions, 47%, 18%, 13%, and 22% of the questions had the same answers in ≥ 90%, ≥ 80% to 89.9%, ≥ 70% to 79.9%, and < 70% of participants. This implied that questions with answers that had multiple categorical answers reduced test-retest reliability data. Of the 15 questions that had multiple categorical answers, 1, 5, and 9 questions had the same answer in ≥ 80% to 89.9%, ≥ 70% to 79.9%, and < 70% of participants. There were a total of 22 questions that were used to derive the number of modifiable osteoporosis-related risk factors that participants had. Of the 22 questions, 6, 5, 3, and 8 questions had the same answer in ≥ 90%, ≥ 80% to 89.9%, ≥ 70% to 79.9%, and < 70% of participants, respectively. Further analysis indicated that test-retest reliability of the 12 questions that were used to calculate the percentage of participants who consumed at least 3 servings of calcium-rich and calcium-fortified foods was fairly poor. The majority of questions had the same answers in less than 70% of the participants. No question had the same answer in at least 90% of the participants. This could be due to the nature of the questions. Most of them addressed frequency of food consumption and it may be difficult to give exactly the same response the second time. On the contrary, questions that required participants to answer either “yes” or “no” had good test-retest reliability. Between 80% to 89.9% of the participants gave the same

response to questions regarding calcium and vitamin D supplement intake (yes/no answers) while at least 90% of the participants gave the same response (yes/no answers) for questions related to falling at home and smoking and tobacco use. Only 69% to 78% of the participants were able to give the same response when asked about their physical activity frequency and duration. Perhaps future studies that address calcium intake from foods as well as physical activity may need to have additional questions with answers such as "yes or no" or answers that are given as a range. When test-retest reliability of the fourteen questions that determined the number of self-reported changes was analyzed, 9, 2,2, and 1 question had the same answer in $\geq$ 90%, $\geq$ 80% to 89.9%, $\geq$ 70% to 79.9%, and < 70% of participants, respectively.

There are limitations in this study. The curriculum may not accommodate varied levels of competence among the participants. In order to address this issue, educators reviewed the curriculum before it was implemented at the Senior Centers. A question and answer session was included at the end of every session to allow participants to address issues that were not covered in the lessons. Also, not everyone attended all the sessions. In order to minimize the impact of absenteeism on behavior modification, participants were given handouts that repeated important concepts and emphasized self-empowerment. Finally, objective biological indicators of nutrition and bone health were not measured. Such measurements were outside the scope of this study. However, this would be an important area to study in the future.

There are at least three other outcomes of this study in addition to the reduction of MORR and positive behavioral changes made by the participants. One, results from this study demonstrated the effectiveness of using a combination of handouts, product

demonstrations, and taste-testing to promote use of a food or supplement. For example, the increase in calcium-fortified orange juice consumption may have been the result of bringing in several brands of this orange juice to taste. Thus, it is important to include product demonstrations and taste tests in nutrition education programs for this population in the future. Two, since the conclusion of this study, we have implemented the curriculum at other Senior Centers in Georgia. Three, given the success of this curriculum in reducing MORR, the lesson plans are now available on a web site called Nutrition for Older Adults' Health (www.arches.uga.edu/~noahnet). The lesson plans include text and script for the lessons, handouts, materials for overhead transparencies, pre- and post-tests, as well as references for additional reading about nutrition and bone health. These lesson plans can be downloaded by educators from the internet without any charge. This will increase the number of ENP clients, as well as other older adults, who can benefit from the curriculum by reducing their modifiable osteoporosis-related risk factors for osteoporosis.

In conclusion, the nutrition and bone health curriculum that was designed for low-literacy, low-income older adults in this study reduced the number of MORR.

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Table 1. Participants characteristics at Time 1 (n = 71)

Variable	Total sample (n = 71)	Men (n = 7)	Women (n = 64)	p-value	Caucasian women (n = 42)	African American women (n = 22)	p-value
County, % Walton	20	0	22		29	9	
Madison	31	43	30		45	0	
Oconee	14	43	11		12	9	
Greene	35	14	38		14	82	
Age, mean ± SD	75.9 ± 7.7	70.3 ± 5.8	76.5 ± 7.7	0.04	76.8 ± 7.5	75.8 ± 8.3	0.62
n	70	7	63		41	22	
Missing, n	1	0	1		1	0	
Gender, % Men	10				0	0	
Women	90				66	34	
Ethnicity, % Caucasian	66	71	66				
African American	34	29	34				
Have you had a heel bone mass density test done before? (not including the one which we did for you) No, %	90	86	91	0.66	94	86	0.29
Yes, %	10	14	9		6	14	
n	62	7	55		34	21	
Missing, n	9	0	9		8	1	
Heel BMD, mean ± SD	0.47 ± 0.2	0.51 ± 0.12	0.46 ± 0.17	0.51	0.45 ± 0.15	0.49 ± 0.20	0.36
T-score, mean ± SD	-1.03 ± 1.5	0.67 ± 1.10	-1.07 ± 1.52	0.50	-1.20 ± 1.36	-0.83 ± 1.81	0.04
T-score >0 (low risk), %	23	29	22		17	33	
≤ 0 and >-1.0 (moderate risk), %	17	29	16		17	14	
≤ -1.0 (high risk), %	60	42	62		67	52	
Missing, n	1	0	1		0	1	
BMI, mean ± SD	29.2 ± 5.8	28.9 ± 4.3	29.2 ± 5.9	0.88	28.2 ± 5.0	31.3 ± 7.1	0.05
n	71	7	64		42	22	
Missing, n	0	0	0		0	0	

$p < 0.05$ is considered statistically significant.

Table 2. Prevalence of modifiable osteoporosis-related risk factors among the total sample and by gender and ethnicity at Time1 (n = 71)

Type of modifiable risk for osteoporosis or fracture	Total sample	Men	Women	p-value	Caucasian women	African American women	p-value
Calcium food risk: Eats less than 3 servings of calcium-rich and calcium-fortified foods/day, %	100	100	100	1.0	100	100	1.0
n	71	7	64		42	22	
Missing, n	0	0	0		0	0	
Calcium supplement risk: Does not take a calcium supplement, %	77	86	76	0.56	66	95	0.01
n	69	7	62		41	21	
Missing, n	2	0	2		1	1	
Vitamin D risk: Does not take a vitamin D supplement, %	64	86	61	0.58	49	86	0.10
n	69	7	62		41	21	
Missing, n	2	0	2		1	1	
Exercise risk: Exercise less than 150 minutes per week, %	82	57	84	0.08	76	100	0.01
n	71	7	64		42	22	
Missing, n	0	0	0		0	0	
Risk of falling at home, %	75	57	77	0.26	83	64	0.08
n	71	7	64		42	22	
Missing, n	0	0	0		0	0	
Smoking/tobacco risk: Smokes cigarettes, pipes or cigars or chews tobacco, %	17	33	16	0.28	12	23	0.28
n	69	6	63		41	22	
Missing, n	2	1	1		1	0	

$p < 0.05$ is considered statistically significant.

Table 3. Osteoporosis-related behavior of Caucasian women and African American women at Time 1

Variable	Caucasian women (n = 37-42)	African American women (n = 19-22)	p-value
Exercise (minutes per week)	136	73	0.01
Milk as beverage (cups per week), mean ± SD	5.3 ± 4.7	4.7 ± 2.4	0.55
Milk with cereal (cups per week), mean ± SD	2.6 ± 3.0	1.7 ± 2.2	0.24
Cheese (servings per week), mean ± SD	2.3 ± 2.4	1.5 ± 1.3	0.11
Does not take calcium supplement, %	66	95	0.01
Does not take a multivitamin supplement, %	29	76	0.0003
Smokes or uses tobacco products, %	12	23	0.28
Non use of hormone replacement therapy, %	85	100	0.06
Never been told by doctor that they had osteoporosis, %	74	100	0.01
Possible lactose intolerance, %	15	48	0.006

$p < 0.05$ is considered statistically significant.

Table 4. Number of modifiable osteoporosis-related risk factors at Time 1 and Time 2

No. of MORR	Time 1 (n = 67)	Time 1 Matched-pair (n = 54)	Time 1 Matched-pair (n = 54)	Time 2 Matched-pair (n = 54)	Time 2 Matched-pair (n = 54)	Time 1 minus Time 2	p-value
	% partici-pants	% partici-pants	Number of partici-pants	% partici-pants	Number of partici-pants		
0	0	0	0	0	0		
1	1	2	1	9	5		
2	7	4	2	26	14		
3	16	13	7	22	12		
4	33	37	20	39	21		
5	31	35	19	4	2		
6	10	9	5	0	0		
mean $\pm$ SD	4.2 $\pm$ 1.1	4.2 $\pm$ 1.1		3.0 $\pm$ 1.1		1.3 $\pm$ 1.1	<0.0001

$p < 0.05$ is considered statistically significant.

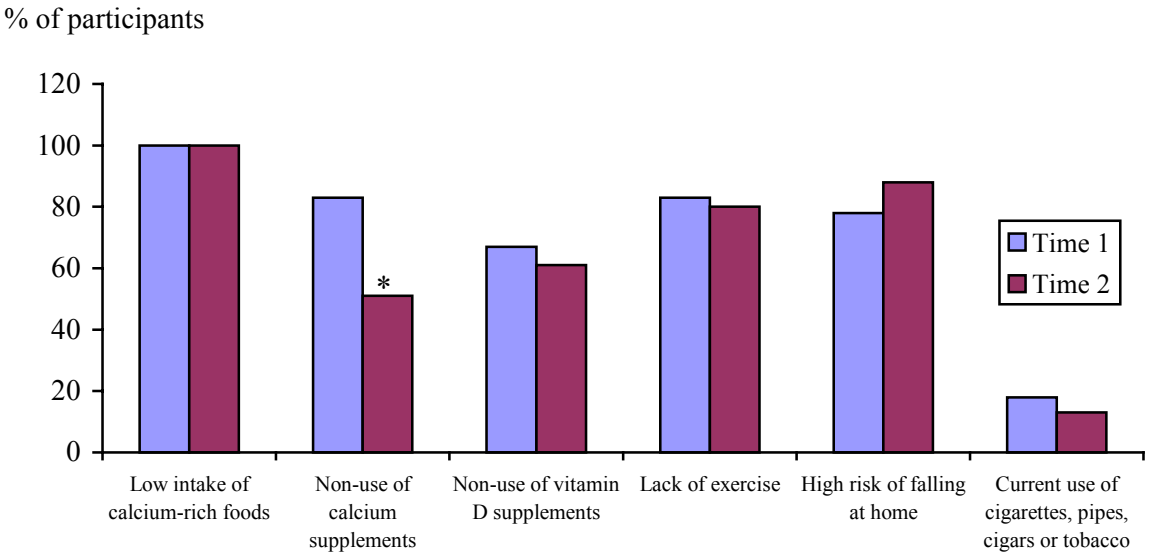

Figure 1. Change in percentage of participants who had the six categories of modifiable osteoporosis-related risk factors. Significant difference as compared to Time 1 is indicated by *, $p = 0.0003$.

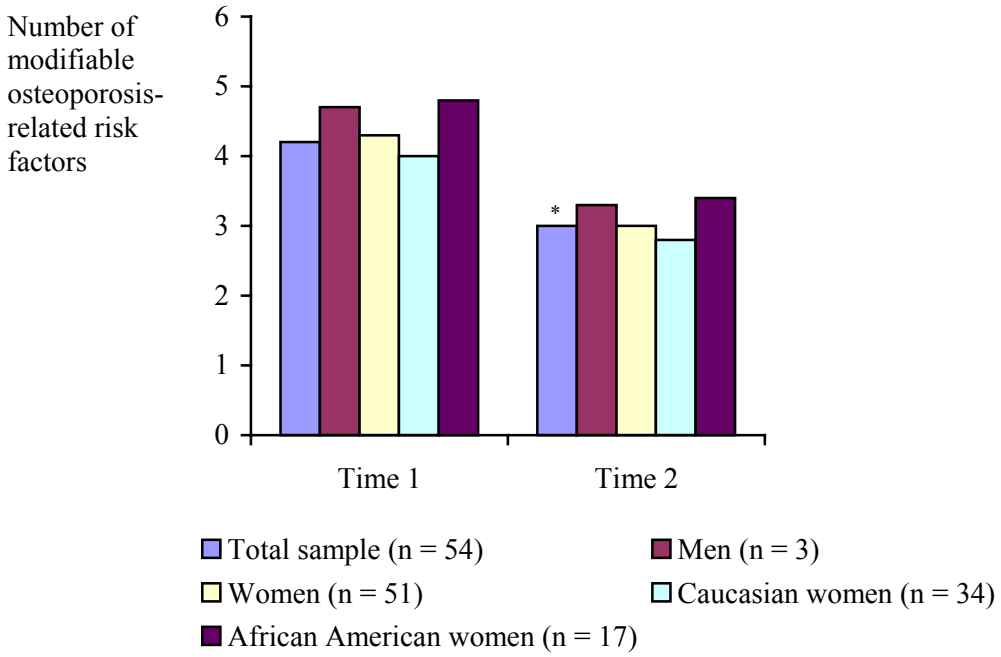

Figure 2. Number of modifiable osteoporosis-related risk factors (MORR) at Time 1 and Time 2. Significant difference as compared to Time 1 is indicated by *, $p < 0.0001$.

CHAPTER 4

SUMMARY AND CONCLUSIONS

The overall goal of this study was to document the impact and determine the outcomes of a nutrition and bone health promotion intervention for a specific group of older adults at high risk for osteoporosis. This osteoporosis curriculum was developed for Elderly Nutrition Program participants and was effective in reducing the number of modifiable osteoporosis-related risk factors. However, there are areas that could be improved such as expanding the number of men and minorities, improving questionnaires, adding biological markers of bone health, utilizing focus groups, and monitoring long term impacts of the program.

In terms of sample characteristics, future studies could include more men and African American women so as to add more power to detect possible differences seen between men and women, and between Caucasian women and African American women. Non-participant characteristics could have been gathered with a short questionnaire for them to fill out. This will shed more light on non-participation and perhaps help in designing future studies that addresses reasons for not wanting to participate in the studies. For example, if non-participation data indicate that ENP participants refused to participate in the studies because they were afraid that the heel BMD measurement will result in adverse events, then the researchers can assure them of the safety of Sahara clinical bone sonometer.

Questions relating to calcium and vitamin D supplement could have been more specific. For example, participants could have been asked about the duration of supplementation, the brand of supplements, the amount of calcium and vitamin D in the supplements, and the frequency of taking supplements in the past week. Such information would have given quantitative information on calcium and vitamin D consumption. This

data was not collected in the present study because of burden on the participants, difficulty in getting them to bring their supplements to the center, and their hesitancy in providing information over the telephone.

Future studies could also include biological markers such as BMD, parathyroid hormone, n-telopeptide, osteocalcin and other indicators that are related to bone health. Inclusion of biological markers would help provide objective data and possibly add more strength to the study. Such information was not collected in the present study because of limited resources and no data initially on the effectiveness of the intervention on behavioral change. In addition, anthropometric measurements (such as height and weight) for future studies could have been measured more accurately with a Health O' meter school scale. Heel BMD measurements could have been done two to three times, with the average value given to the participants. This will help to reduce any potential human error in measuring heel BMD due to factors such as placement of foot in the Sahara clinical bone sonometer.

Although we contacted the Senior Center directors and older adult participants to solicit feedback about our programs, we could conduct formal focus groups before and after implementing the program. This will help to fine tune the program as well as ensure that topics of interest to the target group are addressed. Focus groups also could be conducted upon completion of the study to assess the effectiveness and future directions of the program.

It will be useful to conduct a follow-up study to assess the permanency of behavior change in reducing modifiable osteoporosis-related risk factors. Once such data is gathered, analysis can be conducted to determine factors that influenced initiation and

maintenance of behavior change. This may then help in defining the target audience for future nutrition education intervention studies. For example, if it has been found that changes are more permanent among women, then nutrition and health intervention strategies that are targeted to men may need to be incorporated in future nutrition education programs.

In summary, there are many ways to improve studies such as this that measure the outcomes of educational interventions. It is hoped that when these suggestions are incorporated in future studies, it will generate additional ideas and directions for effective nutrition and health promotion interventions for older adults at high risk of chronic diseases.

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APPENDIX

Table 5. Additional participant characteristics at Time 1

Variable name	Description of variable	Total (N=71)	Men	Women	p-value	Caucasian women	African American women	p-value
A10	Has anyone in your family ever had a fracture or broken bone after age 50? No, %	87	50	90	0.006	90	90	0.95
	Yes, %	13	50	10		10	10	
	n	67	6	61		40	21	
	Missing, n	4	1	3		2	1	
A11	If yes, who in your family had a fracture or broken bone after age 50?							
A11a	Mother, %*	40	33	43	0.78	40	50	0.81
	n	4	1	3		2	1	
A11b	Father, %*	0	0	0	-	0	0	-
	n	0	0	0		0	0	
A11c	Sister, %*	10	0	0	0.49	20	0	0.49
	n	1	0	0		1	0	
A11d	Brother, %*	20	33	14	0.49	20	0	0.49
	n	2	1	1		1	0	
A11e	None of the above, %*	30	33	29	0.88	20	50	0.43
	n	3	1	2		1	1	
A12	Do you have bone pain? No, %	43	67	41	0.23	43	38	0.74
	Yes, %	57	33	59		58	62	
	n	67	6	61		40	21	
	Missing, n	4	1	3		2	1	

Variable name	Description of variable	Total (N=71)	Men	Women	p-value	Caucasian women	African American women	p-value
A13	Has your doctor ever told you that you had osteoporosis? No, %	84	100	83	0.23	74	100	0.01
	Yes, %	16	0	17		26	0	
	n	70	7	63		42	21	
	Missing, n	1	0	1		0	1	
A14	Have you had a fall within the past 1 year? No, %	70	100	67	0.07	69	64	0.66
	Yes, %	30	0	33		31	36	
	n	71	7	64		42	22	
	Missing, n	0	0	0		0	0	
A15	Have you had a fracture or broken bone after age 50? No, %	68	86	66	0.28	62	73	0.39
	Yes, %	32	14	34		38	27	
	n	71	7	64		42	22	
	Missing, n	0	0	0		0	0	
A16	If yes, at what age? mean $\pm$ SD	65 $\pm$ 9.7	55	65.5 $\pm$ 9.7	0.30	64.6 $\pm$ 10.9	68 $\pm$ 5.3	0.52
	n	20	1	19		14	5	

Variable name	Description of variable	Total (N=71)	Men	Women	p-value	Caucasian women	African American women	p-value
	If yes, where?							
A17w	Hip, %**	9	0	9	0.75	6	17	0.45
	n	2	0	2		1	1	
A17x	Wrist, %**	22	0	23	0.59	25	17	0.68
	n	5	0	5		4	1	
A17y	Spine, %**	0	0	0	-	0	0	-
	n	0	0	0		0	0	
A17z	Others, %**	78	100	77	0.59	81	67	0.47
	n	18	1	17		13	4	
A17a	Have you been taking excessive thyroid medication or high or prolonged doses of cortisone-like drugs for asthma, arthritis or cancer?							
	No, %	78	71	79	0.66	83	71	0.32
	Yes, %	22	29	21		18	29	
	n	68	7	61		40	21	
	Missing, n	3	0	3		2	1	
A17b	Are you taking hormone replacement therapy such as Raloxifene, Draloxifene, Premarin, Prempo?							
	No, %	90		90		85	100	0.06
	Yes, %	10		10		15	0	
	n	59		59		39	20	
	Missing, n	5		5		3	2	

Variable name	Description of variable	Total (N=71)	Men	Women	p-value	Caucasian women	African American women	p-value
A18	Did you drink milk as a child? No, %	7	0	8	0.44	7	10	0.74
	Yes, %	93	100	92		93	90	
	n	70	7	63		42	21	
	Missing, n	1	0	1		0	1	
A19	Do you currently drink milk? No, %	11	0	13	0.32	12	14	0.84
	Yes, %	89	100	88		88	86	
	n	71	7	64		42	22	
	Missing, n	0	0	0		0	0	
A21	What type of milk do you usually drink? Skim, %	8	14	8	0.49	9	6	0.40
	1%, %	10	0	11		6	22	
	2%, %	45	43	45		46	44	
	Whole, %	25	14	27		31	17	
	Buttermilk, %	12	29	9		9	11	
	n	60	7	53		35	18	
	Missing, n	11	0	11		7	4	
A22	If you used to drink milk as a child but have stopped doing so, at what age did you stop drinking milk? mean $\pm$ SD	57.8 $\pm$ 25.9		57.8 $\pm$ 25.9		68.3 $\pm$ 15.9	42.0 $\pm$ 36.8	0.33
	n	5		5		3	2	

Variable name	Description of variable	Total (N=71)	Men	Women	p-value	Caucasian women	African American women	p-value
	What type of breakfast cereal do you usually eat?							
A23a	Oatmeal, %	39	14	42	0.15	40	45	0.70
A23b	Grits, %	32	29	33	0.82	29	41	0.32
A23c	Ready-to-eat cereal, %	7	14	6	0.43	10	0	0.13
	n	71	7	64		42	22	
	Missing, n	0	0	0		0	0	
A24	How often do you eat breakfast cereal?							
	Less than 1 time per week, %	4	0	5	0.63	8	0	0.46
	1 time per week, %	4	17	3		5	0	
	2 time per week, %	19	17	19		18	23	
	3 time per week, %	19	0	21		18	27	
	4 time per week, %	4	0	5		5	5	
	5 time per week, %	7	17	6		10	0	
	6 time per week, %	4	0	5		8	0	
	at least 1 time per day, %	37	50	35		30	45	
	2 or more times per day, %	0	0	0		0	0	
	mean $\pm$ SD	4.4 $\pm$ 2.4	4.8 $\pm$ 2.7	4.3 $\pm$ 2.3		4.2 $\pm$ 2.4	4.6 $\pm$ 2.3	
	n	68	6	62		40	22	
	Missing, n	3	1	2		2	0	
A26	What type of milk do you eat with your cereal?							
	Skim, %	14	20	13	0.84	15	11	0.06
	1%, %	12	0	13		6	26	
	2%, %	53	60	53		50	58	
	Whole, %	21	20	21		29	5	
	Buttermilk, %	0	0	0		0	0	
	n	58	5	53		34	19	
	Missing, n	13	2	11		8	3	

Variable name	Description of variable	Total (N=71)	Men	Women	p-value	Caucasian women	African American women	p-value
A27	Do you get stomachache, gas, or diarrhea after drinking milk? No, %	75	86	74	0.49	85	52	0.006
	Yes, %	25	14	26		15	48	
	n	68	7	61		40	21	
	Missing, n	3	0	3		2	1	
A34	Do you eat calcium-fortified foods (such as calcium-fortified orange juice, calcium-fortified cereals - Total, Kellogg's K)? No, %	61	50	62	0.56	55	75	0.14
	Yes, %	39	50	38		45	25	
	n	59	6	53		33	20	
	Missing, n	12	1	11		9	2	
A36	Do you take a vitamin/mineral supplement? No, %	47	71	44	0.17	29	76	0.0003
	Yes, %	53	29	56		71	24	
	n	70	7	63		42	21	
	Missing, n	1	0	1		0	1	
A38	Do you drink caffeinated beverages such as coffee, tea and cola? No, %	15	29	14	0.31	17	9	0.41
	Yes, %	85	71	86		83	91	
	n	71	7	64		42	22	
	Missing, n	0	0	0		0	0	

Variable name	Description of variable	Total (N=71)	Men	Women	p-value	Caucasian women	African American women	p-value
A40	Do you exercise? No, %	7	0	8	0.44	12	0	0.09
	Yes, %	93	100	92		88	100	
	n	71	7	64		42	22	
	Missing, n	0	0	0		0	0	
A43a	What type of exercises do you usually do? Swimming, %	0	0	0		0	0	
A43b	Walking, %	43	57	41	0.43	53	23	0.02
A43c	Gardening, %	14	14	14	0.97	22	0	0.02
A43d	Leg exercises taught at the senior center, %	60	43	62	0.33	53	77	0.06
A43e	Others, %	28	29	28	0.96	31	23	0.52
A43a-e	n Missing, n	65 6	7 0	58 6		36 6	22 0	
	KNOWLEDGE							
A54	Calcium needs increase after age 50. No, %	13	40	10	0.06	6	23	0.08
	Yes, % (correct answer)	87	60	90		94	77	
	n	53	5	48		35	13	
	Missing, n	18	2	16		7	9	
A55	Only women, but not men get the bone disease called osteoporosis where bones become weaker and break more easily. No, % (correct answer)	66	67	66	0.97	74	46	0.08
	Yes, %	34	33	34		26	54	
	n	53	6	47		34	13	

Variable name	Description of variable	Total (N=71)	Men	Women	p-value	Caucasian women	African American women	p-value
	Missing, n	18	1	17		8	9	
A56	Normal fruit juice has as much calcium as milk. No, % (correct answer)	63	67	62	0.83	73	40	0.03
	Yes, %	37	33	38		27	60	
	n	51	6	45		30	15	
	Missing, %	20	1	19		12	7	
A57	Our bodies need vitamin D in order to absorb calcium. No, %	16	60	11	0.005	16	0	0.11
	Yes, % (correct answer)	84	40	89		84	100	
	n	50	5	45		31	14	
	Missing, n	21	2	19		11	8	
A58a	Which of the following exercises are good for my bones? Swimming No, % (correct answer)	45	17	47	0.15	41	60	0.17
	Yes, %	55	83	53		59	40	
A58b	Walking No, %	5	17	3	0.14	5	0	0.30
	Yes, % (correct answer)	95	83	97		95	100	
A58c	Gardening No, % (correct answer)	45	33	46	0.56	41	55	0.31
	Yes, %	55	67	54		59	45	
A58d	Golf No, %	52	17	56	0.07	49	70	0.12
	Yes, % (correct answer)	48	83	44		51	30	
A58a-d	n	65	6	59		39	20	
A58a-d	Missing, n	6	1	5		3	2	

Variable name	Description of variable	Total (N=71)	Men	Women	p-value	Caucasian women	African American women	p-value
A59	Dairy foods are the only foods high in calcium. No, % (correct answer)	64	80	63	0.44	75	33	0.005
	Yes, %	36	20	37		25	67	
	n	56	5	51		36	15	
	Missing, n	15	2	13		6	7	
A60	Sunlight helps our bodies make vitamin D. No, %	7	100	8	0.47	6	11	0.54
	Yes, % (correct answer)	93	0	92		94	89	
	n	56	6	50		32	18	
	Missing, n	15	1	14		10	4	
A61	How old were you when you had your first menstrual period? mean $\pm$ SD	13.1 $\pm$ 2.1				13.2 $\pm$ 2.2	12.9 $\pm$ 1.9	0.58
	n	61				40	21	
A62	How old were you when you had your last menstrual period? mean $\pm$ SD	47.4 $\pm$ 7.8				48.1 $\pm$ 8.2	45.9 $\pm$ 6.7	0.29
	n	59				39	20	
ACFr1	**Calcium food risk (eats less than 3 servings of calcium-rich and calcium-fortified foods/day), %**	100	100	100	1.0	100	100	1.0
	n	71	7	64		42	22	
	Missing, n	0	0	0		0	0	

Variable name	Description of variable	Total (N=71)	Men	Women	p-value	Caucasian women	African American women	p-value
A20	**Milk as beverage** Glasses/week, mean ± SD	5.4 ± 4.1	7.4 ± 4.8	5.1 ± 4.0	0.16	5.3 ± 4.7	4.7 ± 2.4	0.55
	<1 glass/week, %	10	0	11		14	0	
	1 glass/week, %	8	0	9		10	5	
	2 glass/week, %	13	14	13		7	18	
	3 glass/week, %	11	0	13		10	14	
	4 glass/week, %	6	14	5		5	5	
	5 glass/week, %	5	14	4		2	5	
	6 glass/week, %	2	14	0		0	0	
	At least 1 glass/day, %	33	14	36		26	41	
	2 or more glasses/day, %	13	29	11		14	0	
	n	63	7	56		37	19	
	Missing, n	8	0	8		5	3	
A25	**Milk with cereal** Glasses/week, mean ± SD	2.3 ± 2.8	2.5 ± 3.5	2.3 ± 2.8	0.86	2.6 ± 3.0	1.7 ± 2.2	0.24
	<1 glass/week, %	37	50	36		26	45	
	1 glass/week, %	15	17	15		17	9	
	2 glass/week, %	14	0	15		14	14	
	3 glass/week, %	6	0	7		5	9	
	4 glass/week, %	9	0	10		10	9	
	5 glass/week, %	3	0	3		5	0	
	6 glass/week, %	2	0	2		2	0	
	At least 1 glass/day, %	12	33	10		10	9	
	2 or more glasses/day, %	2	0	2		2	0	
	n	65	6	59		38	21	
	Missing, n	6	1	5		4	1	

Variable name	Description of variable	Total (N=71)	Men	Women	p-value	Caucasian women	African American women	p-value
Ayogurtw	**Yogurt** Cups/week, mean ± SD	2.3 ± 4.9	6.0 ± 8.3	1.8 ± 4.2	0.23	1.7 ± 3.7	2.1 ± 5.4	0.74
	Less than 1cup/week, %	67	43	70		67	55	
	1 cup/week, %	0	0	0		0	0	
	2 cup/week, %	5	0	5		7	0	
	3 cup/week, %	5	14	4		2	5	
	4 cup/week, %	11	14	11		12	5	
	5 cup/week, %	0	0	0		0	0	
	6 cup/week, %	5	0	5		5	5	
	At least 1 cup/day, %	2	14	2		2	0	
	2 or more cups/day, %	6	14	4		2	5	
	n	64	7	57		41	16	
	Missing, n	7	0	7		1	6	
ACheesew	**Cheese** Servings/week, mean ± SD	2.0 ± 2.1	1.3 ± 2.3	2.0 ± 2.1	0.49	2.3 ± 2.4	1.5 ± 1.3	0.11
	Less than 1 serving/week, %	38	60	36		24	36	
	1 serving/week, %	21	20	21		29	23	
	2 servings/week, %	12	0	13		12	14	
	3 servings/week, %	8	0	8		7	9	
	4 servings/week, %	8	0	8		10	5	
	5 servings/week, %	8	20	7		7	5	
	6 servings/week, %	0	0	0		0	0	
	At least 1 serving/day, %	6	0	7		10	0	
	2 or more servings/day, %	0	0	0		0	0	
	n	66	5	61		41	20	
	Missing, n	5	2	3		1	2	

Variable name	Description of variable	Total (N=71)	Men	Women	p-value	Caucasian women	African American women	p-value
A32	**Mustard, turnip, or collard greens** Number of times/week, mean ± SD	1.6 ± 1.6	3.0 ± 2.1	1.5 ± 1.4	0.01	0.9 ± 0.9	2.6 ± 1.5	<0.0001
	Less than once/week, %	25	0	28		43	0	
	1 time/week, %	28	29	28		31	23	
	2 times/week, %	24	14	25		21	32	
	3 times/week, %	14	29	13		5	27	
	4 times/week, %	3	14	2		0	5	
	5 times/week, %	3	0	3		0	9	
	6 times/week, %	0	0	0		0	0	
	At least once per day, %	3	14	2		0	5	
	2 or more times/day, %	0	0	0		0	0	
	n	71	7	64		42	22	
	Missing, n	0	0	0		0	0	
A33	**Canned salmon** Number of times/week, mean ± SD	0.3 ± 0.8	0.3 ± 0.8	0.3 ± 0.8	0.84	0.3 ± 0.8	0.5 ± 0.7	0.20
	Less than once/week, %	79	86	78		86	59	
	1 time/week, %	11	0	13		7	23	
	2 times/week, %	9	14	8		5	14	
	3 times/week, %	0	0	0		0	0	
	4 times/week, %	1	0	2		2	0	
	5 times/week, %	0	0	0		0	0	
	6 times/week, %	0	0	0		0	0	
	At least once/day, %	0	0	0		0	0	
	2 or more times/day, %	0	0	0		0	0	
	n	70	7	63		42	21	
	Missing, n	1	0	1		0	1	

Variable name	Description of variable	Total (N=71)	Men	Women	p-value	Caucasian women	African American women	p-value
ACOJw	**Calcium-fortified orange juice** Cups/week, mean ± SD	7.0 ± 5.1	12.0 ± 0	6.8 ± 4.7	0.31	6.2 ± 4.8	8.7 ± 4.6	0.45
	Less than 1 cup/week, %	25	0	8		10	0	
	1 cup/week, %	28	0	0		0	0	
	2 cups/week, %	24	0	8		10	0	
	3 cups/week, %	14	0	0		0	0	
	4 cups/week, %	3	0	31		40	0	
	5 cups/week, %	3	0	0		0	0	
	6 cups/week,%	0	0	23		10	67	
	At least 1 cup/day, %	3	100	8		2	0	
	2 or more cups/day, %	0	0	23		5	33	
	n	14	1	13		10	3	
	Missing, n	57	6	51		32	19	
ACOJwMO (set ACOJw missing as 0)	Cups/week, mean ± SD	1.4 ± 3.5	1.7 ± 4.5	1.4 ± 3.4	0.81	1.5 ± 3.5	1.2 ± 3.4	0.75
	n	71	7	64		42	22	
	Missing, n	0	0	0		0	0	

Variable name	Description of variable	Total (N=71)	Men	Women	p-value	Caucasian women	African American women	p-value
ABcereaw	**Calcium-fortified cereals** Cups/week, mean ± SD	0.3 ± 0.8	0	5.0 ± 1.7		4.5 ± 2.1	6.0 ± 0	0.67
	Less than 1 cup/week, %	79	0	0		0	0	
	1 cup/week, %	11	0	0		0	0	
	2 cups/week, %	9	0	0		0	0	
	3 cups/week, %	0	0	33		50	0	
	4 cups/week, %	1	0	0		0	0	
	5 cups/week, %	0	0	0		0	0	
	6 cups/week, %	0	0	67		50	100	
	At least 1 cup/day, %	0	0	0		0	0	
	2 or more cups/day, %	0	0	0		0	0	
	n	3	0	3		2	1	
	Missing, n	68	7	61		40	21	
ABcerwMO (set ABcereaw missing as 0)	Cups/week, mean ± SD	0.2 ± 1.1	0	0.2 ± 1.1	0.10	0.2 ± 1.0	0.3 ± 1.3	0.80
	n	71	7	64		42	22	
	Missing, n	0	0	0		0	0	
A37b	**Calcium risk** Does not take a calcium supplement or any capsule/tablet with calcium, %	77	86	76	0.56	66	95	0.01
	n	69	7	62		41	21	
	Missing, n	2	0	2		1	1	

Variable name	Description of variable	Total (N=71)	Men	Women	p-value	Caucasian women	African American women	p-value
A37c	**Vitamin D risk** Does not take a vitamin D supplement or any capsule/tablet with vitamin D, %	64	86	61	0.58	49	86	0.10
	n	69	7	62		41	21	
	Missing, n	2	0	2		1	1	
Aexr Aexminw Bexminw	**Exercise risk** Minutes/week, mean ± SD	119.2 ± 109.5	191.7 ± 131.1	111.0 ± 105.1	0.09	135.8 ± 127.7	73.2 ± 30.7	0.01
	<150 minutes/week, %	82	57	84		76	100	
	n	71	7	64		42	22	
	Missing, n	0	0	0		0	0	
AHFallr	**Risk of falling at home** Answered "no" to at least one of the fall prevention items A50-A53, %	75	57	77	0.26	83	64	0.08
A50	Throw rugs are not anchored and smooth, %	30	29	30	0.92	33	23	0.31
	n	70	7	63		41	22	
	Missing, n	1	0	1		1	0	
A51	No grab bars in bathroom, %	54	43	55	0.55	55	55	0.99
	n	71	7	64		42	22	
	Missing, n	0	0	0		0	0	
A52	No non-skid tape of non-skid mat in tub or shower area, %	28	29	28	0.98	31	23	0.49
	n	71	7	64		42	22	
	Missing, n	0	0	0		0	0	

Variable name	Description of variable	Total (N=71)	Men	Women	p-value	Caucasian women	African American women	p-value
A53	Does not turn on light or use night light when getting out of bed at night, %	10	14	10	0.69	12	5	0.32
	n	70	7	63		41	22	
	Missing, n	1	0	1		1	0	
ASmoTobr	**Smoking/tobacco risk , %**	17	33	16	0.28	12	23	0.28
	n	69	6	63		41	22	
	Missing, n	2	1	1		1	0	
A45	Currently smoking cigarettes, pipers or cigars, %	4	14	3	0.16	5	0	0.30
	n	71	7	64		42	22	
	Missing, n	0	0	0		0	0	
A48	Currently chewing tobacco, %	13	17	13	0.78	7	23	0.08
	n	69	6	63		41	22	
	Missing, n	2	1	1		1	0	

% Based on number of respondents (n), not total sample, unless otherwise indicated.
* % Based on respondents whose family member had a fracture.
** % Based on respondents who had a fracture.
$p < 0.05$ is considered statistically significant.

Table 6. Modifiable osteoporosis-related risk factors at Time 1 for the total sample

Number of modifiable risk factors	Total sample (n=67)	Men	Women	p-value	Caucasian women	African American women	p-value
	%	%	%		%	%	
0	0	0	0		0	0	
1	1	0	2		3	0	
2	7	17	7		10	0	
3	16	33	15		20	5	
4	33	0	36		38	33	
5	31	17	33		25	48	
6	10	33	8		5	14	
n Missing, n	67 4	6 1	61 3		40 2	21 1	
mean $\pm$ SD	4.2 $\pm$ 1.1	4.2 $\pm$ 1.7	4.2 $\pm$ 1.1	0.10	3.9 $\pm$ 1.1	4.7 $\pm$ 0.8	0.004
n	67	6	61		40	21	
Missing, n	4	1	3		2	1	

% Based on number of respondents (n), not total sample, unless otherwise indicated.
$p < 0.05$ is considered statistically significant.

Table 7. Number of modifiable osteoporosis-related risk factors at Time 1 for matched pairs

Number of modifiable risk factors (variable name = ANumOr)	Men	Women	p-value	Caucasian women	African American women	p-value
	%	%		%	%	
0	0	0		0	0	
1	0	2		3	0	
2	0	4		6	0	
3	33	12		18	0	
4	0	39		41	35	
5	33	35		26	53	
6	33	8		6	12	
mean $\pm$ SD	4.67 $\pm$ 1.53	4.25 $\pm$ 1.04	0.52	4.0 $\pm$ 1.1	4.76 $\pm$ 0.66	0.003
n	3	51		34	17	
Missing, n	4	13		8	5	

% Based on number of respondents (n), not total sample, unless otherwise indicated.
$p < 0.05$ is considered statistically significant.

Table 8. Number of modifiable osteoporosis-related risk factors at Time 2 for matched pairs

Number of modifiable risk factors (variable name = BNumOr)	Men	Women	p-value	Caucasian women	African American women	p-value
	%	%		%	%	
0	0	0		0	0	
1	0	10		12	6	
2	33	25		29	18	
3	0	24		29	12	
4	67	37		26	59	
5	0	4		3	6	
6	0	0		0	0	
mean $\pm$ SD	3.33 $\pm$ 1.15	3.0 $\pm$ 1.1	0.61	2.79 $\pm$ 1.07	3.41 $\pm$ 1.06	0.06
n	3	51		34	17	
Missing, n	4	13		8	5	

% Based on number of respondents (n), not total sample, unless otherwise indicated.
$p < 0.05$ is considered statistically significant.

Table 9. Number of modifiable risk factors reduced from Time 1 to Time 2 for matched pairs

Number of modifiable risk factors at Time 1 minus number of modifiable risk factors at Time 2	Total sample (n = 54) Time 1 minus Time 2	p-value	Men	Women	p-value	Caucasian women	African American women	p-value
	%		%	%		%	%	
-2	2		0	2		3	0	
0	26		0	27		26	29	
1	35		67	33		32	35	
2	19		33	18		24	6	
3	17		0	18		12	29	
4	2		0	2		3	0	
mean $\pm$ SD	1.26 $\pm$ 1.18	<0.0001	1.33 $\pm$ 0.58	1.25 $\pm$ 1.21	0.91	1.21 $\pm$ 1.23	1.35 $\pm$ 1.22	0.69
n	54		3	51		34	17	
Missing, n	17		4	13		8	5	

% Based on number of respondents (n), not total sample, unless otherwise indicated.
$p < 0.05$ is considered statistically significant.

Table 10. Additional changes from Time 1 to Time 2 for matched-pairs

Variable name	Description of variable	Time 1	Time 2	p-value
A13 B13	Has your doctor ever told you that you had osteoporosis? No, %	86	71	0.07
	Yes, %	14	29	
	n	56	56	
	Missing, n	15	15	
A19 A19	Do you currently drink milk? No, %	14	25	0.10
	Yes, %	86	75	
	n	59	59	
	Missing, n	12	12	
A34 B34	Do you eat calcium-fortified foods (such as calcium-fortified orange juice, calcium-fortified cereals - Total, Kellogg's Special K)? No, %	58	51	0.53
	Yes, %	42	49	
	n	45	45	
	Missing, n	26	26	
A36 B36	Do you take a vitamin/mineral supplement? No, %	49	34	0.09
	Yes, %	51	66	
	n	59	59	
	Missing, n	12	12	
A38 B38	Do you drink caffeinated beverages such as coffee, tea, and cola? No, %	17	19	0.81
	Yes, %	83	81	
	n	59	59	
	Missing, n	12	12	
A40 B40	Do you exercise? No, %	5	5	1.0
	Yes, %	95	95	
	n	59	59	

Variable name	Description of variable	Time 1	Time 2	p-value
	Missing, n	12	12	
A41 B41	If yes, how many times per week? mean ± SD	4.5 ± 1.8	5.5 ± 1.9	0.0014
	n	54	54	
A54 B54	Calcium needs increase after age 50. No, %	11	5	0.39
	Yes, % (correct answer)	89	95	
	n	38	38	
	Missing, n	33	33	
A55 B55	Only women, but not men get the bone disease called osteoporosis where bones become weaker and break more easily. No, % (correct answer)	66	75	0.41
	Yes, %	34	25	
	n	32	32	
	Missing, n	39	39	
A56 B56	Normal fruit juice has as much calcium as milk. No, % (correct answer)	65	74	0.41
	Yes, %	36	26	
	n	31	31	
	Missing, n	40	40	
A57 B57	Our bodies need vitamin D in order to absorb calcium. No, %	17	11	0.49
	Yes, % (correct answer)	83	89	
	n	35	35	
	Missing, n	36	36	
A58a B58a	Which of the following exercises are good for my bones? Swimming No, % (correct answer)	40	45	0.56
	Yes, %	60	55	
	n	53	53	
	Missing, n	18	18	

Variable name	Description of variable	Time 1	Time 2	p-value
A58b B58b	Walking No, %	6	6	1.0
	Yes, % (correct answer)	94	94	
	n	54	54	
	Missing, n	17	17	
A58c B58c	Gardening No, % (correct answer)	44	39	0.56
	Yes, %	56	61	
	n	54	54	
	Missing, n	17	17	
A58d B58d	Golf No, %	52	50	0.85
	Yes, % (correct answer)	48	50	
	n	54	54	
	Missing, n	17	17	
A59 B59	Dairy foods are the only foods high in calcium. No, % (correct answer)	68	68	1.0
	Yes, %	33	33	
	n	40	40	
	Missing, n	31	31	
A60 B60	Sunlight helps our bodies make vitamin D. No, %	6	0	0.15
	Yes, % (correct answer)	94	100	
	n	36	36	
	Missing, n	35	35	

% Based on number of respondents (n), not total sample, unless otherwise indicated.
$p < 0.05$ is considered statistically significant.
Variables preceded by A and B are for Time 1 and Time 2, respectively.

Table 11. Sample Characteristics of participants who completed Time 1 only versus participants who completed Time 1 and Time 2

Variable name	Description of variable	Participants who completed Time 1 only (n = 12)	Participants who completed Time 1 and Time 2 (n = 59)	p-value
A2	County, % Walton	17	20	0.78
	Madison	42	29	
	Oconee	17	14	
	Greene	25	37	
A3	Age, mean ± SD	74.3 ± 10.2	76.2 ± 7.2	0.46
	n	12	58	
A4	Gender, % Men	25	6.8	0.05
	Women	75	93.2	
A5	Ethnicity, % Caucasian	67	66	0.97
	African American	33	34	
A6a	Have you had a heel bone mass density test done before (not including the one which we did for you)? No, %	82	92	0.29
	Yes, %	18	8	
BMD	Heel BMD, mean ± SD	0.51 ± 0.20	0.45 ± 0.16	0.26
	n	12	58	
Tscore	Mean ± SD	-0.59 ± 1.75	-1.13 ± 1.42	0.26
	n	12	58	
wt	Weight (kg), mean ± SD	86.2 ± 18.7	72.2 ± 14.0	0.004
	n	12	59	
sht	Standing height (m), mean ± SD	1.66 ± 0.11	1.58 ± 0.09	0.03
	n	12	59	

Variable name	Description of variable	Participants who completed Time 1 only	Participants who completed Time 1 and Time 2	p-value
kht	Knee height (cm), mean ± SD	52.4 ± 4.0	50.0 ± 3.0	0.02
	n	12	59	
BMI	Body mass index (kg/m^2), mean ± SD	31.2 ± 5.0	28.8 ± 5.8	0.18
	n	12	58	
A10	Has anyone in your family ever had a fracture of broken bone after age 50? No, %	92	85	0.57
	Yes, %	8	16	
A11 A11a	If yes, who in your family had a fracture or broken bone after age 50? Mother, %*	100	33.3	0.20
A11b	Father, %	missing data	data was not reported because of missing data for non-participants	
A11c	Sister, %	0	11	0.73
A11d	Brother, %	0	22	0.60
A11e	None of the above, %	0	33	0.49
A11a-e	n	1	9	
A12	Do you have bone pain? No, %	55	41	0.41
	Yes, %	45	59	
	n	11	56	
A13	Has your doctor ever told you that you had osteoporosis? No, % Yes, % n Missing, n	missing data	data was not reported because of missing data for non-participants	

Variable name	Description of variable	Participants who completed Time 1 only	Participants who completed Time 1 and Time 2	p-value
A14	Have you had a fall within the past 1 year? No, %	92	66	0.08
	Yes, %	8	31	
	n	12	59	
A15	Have you had a fracture or broken bone after age 50? No, %	75	66	0.55
	Yes, %	25	31	
	n	12	59	
A16	If yes, at what age? mean ± SD	70 ± 19.8	64.4 ± 8.9	0.46
	n	2	18	
A17w	If yes, where? Hip, %**	0	10	0.57
A17x	Wrist, %**	0	25	0.33
A17y	Spine, %**	100	100	1.0
A17z	Others, %**	100	75	0.33
A17w-z	n	3	20	
A17a	Have you been taking excessive thyroid medication or high or prolonged doses of cortisone-like drugs for asthma, arthritis, or cancer? No, %	83	77	0.62
	Yes, %	17	23	
	n	12	56	
A17b	Are you taking hormone replacement therapy such as Raloxifene, Draloxifene, Premarin, Prempo? No, %	78	92	0.19
	Yes, %	22	8	
	n	9	50	

Variable name	Description of variable	Participants who completed Time 1 only	Participants who completed Time 1 and Time 2	p-value
A18	Did you drink milk as a child? No, %	8	7	0.86
	Yes, %	92	93	
	n	12	58	
A19	Do you currently drink milk?	missing data	data was not reported because of missing data for non-participants	
A20	How many glasses of milk do you drink?	missing data	data was not reported because of missing data for non-participants	
A21	What type of milk do you usually drink? skim, %	8	8	0.93
	1%, %	17	8	
	2%, %	42	46	
	Whole, %	25	25	
	Buttermilk, %	8	13	
	n	12	48	
A22	If you used to drink milk as a child but have stopped doing so, at what age did you stop drinking milk?	missing data	data was not reported because of missing data for non-participants	
A23	What type of breakfast cereal do you usually eat? Oatmeal, %	17	44	0.08
	Grits, %	33	32	0.94
	Ready-to-eat cereal, %	8	7	0.85
	n	12	59	
A24	How often do you eat breakfast cereal? mean $\pm$ SD	3.1 $\pm$ 2.5	4.7 $\pm$ 2.3	0.03
	n	12	56	

Variable name	Description of variable	Participants who completed Time 1 only	Participants who completed Time 1 and Time 2	p-value
A25	On average, how much milk do you usually eat on cereal each day?	missing data	data was not reported because of missing data for non-participants	
A26	What type of milk do you eat with your cereal? skim, %	9	15	0.78
	1%, %	18	11	
	2%, %	45	55	
	Whole, %	27	19	
	Buttermilk, %	0	0	
	n	11	47	
A27	Do you get stomachache, gas, or diarrhea after drinking milk? No, %	82	74	0.57
	Yes, %	18	26	
	n	11	57	
A28	How often do you eat yogurt (per week)? mean $\pm$ SD	2.0 $\pm$ 3.1	0.6 $\pm$ 1.0	0.13
	n	12	58	
A29	Each time you eat yogurt, how much yogurt do you usually eat? mean $\pm$ SD	1.3 $\pm$ 1.4	1.5 $\pm$ 1.5	0.79
A30	How often do you eat cheese (per week)? mean $\pm$ SD	2.4 $\pm$ 2.0	2.0 $\pm$ 1.9	0.5
	n	12	59	
A31	How many servings of cheese do you usually eat? mean $\pm$ SD	1.4 $\pm$ 0.7	1.3 $\pm$ 0.4	0.58
	n	10	56	
A32	How often do you eat mustard, turnip, or collard greens?	missing data	data was not reported because of missing data for non-participants	

Variable name	Description of variable	Participants who completed Time 1 only	Participants who completed Time 1 and Time 2	p-value
A33	How often do you eat canned salmon?	missing data	data was not reported because of missing data for non-participants	
A34	Do you eat calcium-fortified foods (such as calcium-fortified orange juice, calcium-fortified cereals - Total, Kellogg's K)?	missing data	data was not reported because of missing data for non-participants	
ACOJw	Number of cups of calcium-fortified juice consumed per week	missing data	data was not reported because of missing data for non-participants	
ABcereaw	Number of bowls of calcium-fortified cereal consumed per week	missing data	data was not reported because of missing data for non-participants	
A36	Do you take a vitamin/mineral supplement?	missing data	data was not reported because of missing data for non-participants	
A38	Do you drink caffeinated beverages such as coffee, tea and cola?	missing data	data was not reported because of missing data for non-participants	
ACCoffw	Number of cups of regular coffee consumed per week, mean $\pm$ SD	18.9 $\pm$ 11.3	14.2 $\pm$ 6.3	0.26
	n	9	28	
ACTeaw	Number of cups of regular tea cosumed per week, mean $\pm$ SD	8.0 $\pm$ 5.3	11.4 $\pm$ 5.7	0.35
	n	3	17	

Variable name	Description of variable	Participants who completed Time 1 only	Participants who completed Time 1 and Time 2	p-value
ACnColaw	Number of cans of regular cola consumed per week, mean ± SD	1.0 ± 1.7	7.5 ± 5.8	0.08
	n	3	15	
A40	Do you exercise?	missing data	data was not reported because of missing data for non-participants	
Aexminw	Number of minutes spent exercising per week, mean ± SD	155.4 ± 150.8	112.7 ± 100.9	0.28
	n	9	50	
A43	What type of exercises do you usually do? Walking, %	50	42	0.63
	Gardening, %	10	15	0.70
	Balance exercises taught at the Senior Center, %	40	64	0.16
	Others, %	40	25	0.34
	n	10	55	
A44	Have you smoked cigarettes, pipes or cigars in the past? No, %	67	63	0.8
	Yes, %	33	37	
	n	12	59	
A45	Are you currently smoking cigarettes, pipes or cigars?	missing data	data was not reported because of missing data for non-participants	
A46a	If yes, how often do you smoke?	missing data	data was not reported because of missing data for non-participants	

Variable name	Description of variable	Participants who completed Time 1 only	Participants who completed Time 1 and Time 2	p-value
A47	Have you chewed tobacco in the past? No, %	75	73	0.88
	Yes, %	25	27	
	n	12	59	
A48	Are you currently chewing tobacco?	missing data	data was not reported because of missing data for non-participants	
A49a	If yes, how often do you chew tobacco now?	missing data	data was not reported because of missing data for non-participants	
A54	Calcium needs increase after age 50.	missing data	data was not reported because of missing data for non-participants	
A55	Only women, but not men get the bone disease called osteoporosis where bones become weaker and break more easily.	missing data	data was not reported because of missing data for non-participants	
A56	Normal fruit juice has as much calcium as milk.	missing data	data was not reported because of missing data for non-participants	
A57	Our bodies need vitamin D in order to absorb calcium.	missing data	data was not reported because of missing data for non-participants	

Variable name	Description of variable	Participants who completed Time 1 only	Participants who completed Time 1 and Time 2	p-value
A58a	Which of the following exercises are good for my bones? Swimming	missing data	data was not reported because of missing data for non-participants	
A58b	Walking	missing data	data was not reported because of missing data for non-participants	
A58c	Gardening	missing data	data was not reported because of missing data for non-participants	
A58d	Golf	missing data	data was not reported because of missing data for non-participants	
A59	Dairy foods are the only foods high in calcium.	missing data	data was not reported because of missing data for non-participants	
A60	Sunlight helps our bodies make vitamin D.	missing data	data was not reported because of missing data for non-participants	
OTHERsu	Number of other nutritional supplements, Mean $\pm$ SD	0.7 $\pm$ 1.2	0.7 $\pm$ 1.2	0.85
	n	11	58	

Variable name	Description of variable	Participants who completed Time 1 only	Participants who completed Time 1 and Time 2	p-value
ACFr1	Did not consume at least 3 servings of calcium-rich and/or calcium-fortified foods per day, %	100	100	
A37b	Do not take a calcium supplement or any capsule/tablet with calcium, %	45	83	0.007
	n	11	58	
A37c	Do not take a vitamin D supplement or any capsule/supplement with vitamin D, %	73	95	0.02
	n	11	58	
Aexr	Exercise risk: Do not exercise for at least 150 minutes per week, %	25	17	0.51
	n	12	59	
AHFallr	Risk of falling at home, %	58.3	78.0	0.15
ANumOr	Number of modifiable osteoporosis-related risk factors, mean $\pm$ SD	3.5 $\pm$ 1.4	4.3 $\pm$ 1.0	0.02
	n	11	56	
	Illnesses in the past year, % n	12	59	
ill1	Anemia	8	12	0.72
ill2	Alzheimer's	0	2	0.65
ill3	Other dementia's	0	9	0.29
ill4	Cancer	8	7	0.85
ill5	Circulatory problems	9	20	0.38
ill6	Congestive heart failure	17	8	0.39
ill7	Constipation	42	44	0.88
ill8	Diabetes	55	31	0.13
ill9	Diarrhea	17	14	0.78
ill10	Glaucoma	17	17	0.98
ill11	Hearing problems	42	38	0.81
ill12	Heart disease	9	19	0.43
ill13	Hypertension	42	47	0.71

Variable name	Description of variable	Participants who completed Time 1 only	Participants who completed Time 1 and Time 2	p-value
ill14	Legally blind	0	7	0.35
ill15	Liver disease	8	0	0.03
ill16	Mental illness	8	7	0.85
ill17	Osteoporosis	17	12	0.65
ill18	Hip fracture	0	3	0.52
ill19	Pace maker	0	3	0.52
ill20	Parkinson's disease	0	2	0.65
ill21	Renal disease	0	5	0.42
ill22	Respiratory disease	0	10	0.25
ill23	Seizures	0	3	0.52
ill24	Skin rashes, bed sores	0	8	0.3
ill25	Stroke	8	15	0.53
ill26	Thyroid problems	0	12	0.2
ill27	Visual disturbances	8	27	0.16
ill28	Cataracts	50	44	0.71
ill29	Smoking: cigarettes, pipes, cigars, OR chewing tobacco	17	19	0.87
ill30	Surgery	17	25	0.52
ill31	Emergency room visit	25	10	0.16
ill32	Other	0	10	0.25
ill33	Arthritis	67	68	0.93
ill34	Pneumonia	8	5	0.66
ill35	Dizziness	33	41	0.64
ill36	Gout	8	3	0.45
ill37	Postural hypotension	9	9	0.97

Hypothesis 1: The prevalence of low BMD in ENP participants will be higher than a representative sample of older adults from NHANES III (Looker A.C., Orwoll, E.S., Johnston, C.C., Lindsay, R.L., Wahner, H.W., Dunn, W.L., Calvo, M.S., Harris, T.B., Heyse, S.P. (1997). Prevalence of low femoral bone density in older U.S. adults from NHANES III. *Journal of Bone and Mineral Research, 12,* 1761-1768.

Table 12
Prevalence of osteopenia/osteoporosis by total sample, gender and ethnicity versus NHANES III participants

	Total sample (%)	Men (%)	Women (%)	p-value	Caucasian women (%)	African American women (%)	p-value
Current study	60	43	62	0.33	67	52	0.27
NHANES III		31-53 (male cutoffs) 5-48 (female cutoffs)	50-68				

% Based on number of respondents (n), not total sample, unless otherwise indicated.
$p<0.05$ is considered statistically significant.

Hypothesis 2: More than 90% of ENP participants will have at least one modifiable risk factor for osteoporosis or fracture such as low intake of calcium foods (Less than 3 servings of calcium-rich and calcium-fortified foods combined), non-use of calcium supplements, non-use of vitamin D supplements, lack of exercise (Less than 150 minutes/week), high risk of falling at home (answered "no" to at least one of the fall prevention items 50-53), T-score (less than -1.0).

Our results indicated that 100% of ENP participants had at least one modifiable risk factor for osteoporosis or fracture. Specifically, 100% of subjects ate less than 3 servings of calcium-rich and calcium-fortified foods per day. Therefore, hypothesis is true.

Table 13. Prevalence of modifiable risk factors among the sample at Time1.

Type of modifiable risk for osteoporosis or fracture	Total sample	Men	Women	p-value	Caucasian women	African American women	p-value
Calcium food risk: Eats Less than 3 servings of calcium-rich and calcium-fortified foods/day, %	100	100	100	1.0	100	100	1.0
n	71	7	64		42	22	
Missing, n	0	0	0		0	0	
Calcium supplement risk: Does not take a calcium supplement, %	77	86	76	0.56	66	95	0.01
n	69	7	62		41	21	
Missing, n	2	0	2		1	1	
Vitamin D risk: Does not take a vitamin D supplement, %	64	86	61	0.58	49	86	0.10
n	69	7	62		41	21	
Missing, n	2	0	2		1	1	
Exercise risk: Exercise Less than 150 minutes per week, %	82	57	84	0.08	76	100	0.01
n	71	7	64		42	22	
Missing, n	0	0	0		0	0	

Type of modifiable risk for osteoporosis or fracture	Total sample	Men	Women	p-value	Caucasian women	African American women	p-value
Risk of falling at home: Answered "no" to at least one of the fall prevention questions, items A50-A53, %	75	57	77	0.26	83	64	0.08
n	71	7	64		42	22	
Missing, n	0	0	0		0	0	
Smoking/tobacco risk: Smokes cigarettes, pipes or cigars or chews tobacco, %	17	33	16	0.28	12	23	0.28
n	69	6	63		41	22	
Missing, n	2	1	1		1	0	

% Based on number of respondents (n), not total sample, unless otherwise indicated.
$p < 0.05$ is considered statistically significant.

Hypothesis 3: At least 80% of the seniors will reduce at least one of their modifiable risk factors after attending the Bone Health and Nutrition education program

We found that 74.6% of the participants reduced at least one of their modifiable risk factors after attending the Bone Health and Nutrition education program.

Table 14. Prevalence of modifiable osteoporosis-related risk factors at Time 1 and Time 2.

Variable name	Description of variable	% of sample at Time 1 variable n	% of sample at Time 2 variable n	p-value
ACFr1	**Calcium food risk (eats less than 3 servings of calcium-rich and calcium-fortified foods/day), %**	100	100	1.0
	n	59	59	
	Missing, n	12	12	
A20 B20	**Milk as beverage** Glasses/week, mean ± SD	5.5 ± 4.3	7.1 ± 4.7	0.006
	<1 glass/week, %	10	5	
	1 glass/week, %	10	7	
	2 glasses/week, %	12	12	
	3 glasses/week, %	12	2	
	4 glasses/week, %	2	7	
	5 glasses/week, %	5	0	
	6 glasses/week, %	2	7	
	At least 1 glass/day, %	33	33	
	2 or more glasses/day, %	14	26	
	n	42	42	
	Missing, n	29	29	

Variable name	Description of variable	% of sample at Time 1 variable n	% of sample at Time 2 variable n	p-value
A25 B25	**Milk with cereal** Glasses/week, mean ± SD	2.4 ± 3.0	3.2 ± 3.3	0.05
	<1 glass/week, %	37	39	
	1 glass/week, %	14	8	
	2 glasses/week, %	14	4	
	3 glasses/week, %	6	2	
	4 glasses/week, %	8	10	
	5 glasses/week, %	4	8	
	6 glasses/week, %	2	0	
	At least 1 glass/day, %	12	27	
	2 or more glasses/day, %	2	2	
	n	49	49	
	Missing, n	22	22	
Ayogurtw Byogurtw	**Yogurt** Cups/week, mean ± SD	2.4 ± 4.2	2.9 ± 3.7	0.59
	Less than 1cup/week, %	59	50	
	1 cup/week, %	0	0	
	2 cups/week, %	3	6	
	3 cups/week, %	0	0	
	4 cups/week, %	22	19	
	5 cups/week, %	0	0	
	6 cups/week, %	9	16	
	At least 1 cup/day, %	3	6	
	2 or more cups/day, %	3	3	
	n	32	32	
	Missing, n	39	39	

Variable name	Description of variable	% of sample at Time 1 variable n	% of sample at Time 2 variable n	p-value
ACheesew BCheesew	**Cheese** Servings/week, mean ± SD	1.9 ± 2.0	2.2 ± 2.3	0.56
	Less than 1 serving/week, %	35	33	
	1 serving/week, %	24	24	
	2 servings/week, %	14	8	
	3 servings/week, %	6	14	
	4 servings/week, %	8	8	
	5 servings/week, %	8	8	
	6 servings/week, %	0	0	
	At least 1 serving/day, %	6	6	
	2 or more servings/day, %	0	0	
	n	51	51	
	Missing, n	20	20	
A32 B32	**Mustard, turnip, or collard greens** Number of times/week, mean ± SD	1.7 ± 1.6	1.6 ± 1.6	0.43
	Less than once/week, %	23	28	
	1 time/week, %	28	28	
	2 times/week, %	26	21	
	3 times/week, %	12	14	
	4 times/week, %	4	4	
	5 times/week, %	4	2	
	6 times/week, %	0	0	
	At least once per day, %	4	4	
	2 or more times/day, %	0	0	
	n	57	57	
	Missing, n	14	14	

Variable name	Description of variable	% of sample at Time 1 variable n	% of sample at Time 2 variable n	p-value
A33 B33	**Canned salmon** Number of times/week, mean ± SD	0.4 ± 0.8	0.4 ± 0.7	0.66
	Less than once/week, %	80	71	
	1 time/week, %	7	20	
	2 times/week, %	11	7	
	3 times/week, %	0	2	
	4 times/week, %	2	0	
	5 times/week, %	0	0	
	6 times/week, %	0	0	
	At least once/day, %	0	0	
	2 or more times/day, %	0	0	
	n	56	56	
	Missing, n	15	15	
ACOJw BCOJw	**Calcium-fortified orange juice** Number of cups/week, mean ± SD	7.0 ± 5.1	10.3 ± 5.3	0.08
	Less than 1 cup/week, %	13	0	
	1 cup/week, %	0	0	
	2 cups/week, %	0	13	
	3 cups/week, %	0	0	
	4 cups/week, %	38	13	
	5 cups/week, %	0	0	
	6 cups/week, %	13	13	
	At least 1cup/day, %	13	0	
	2 or more cups/day, %	25	63	
	n	8	8	
	Missing, n	63	63	

Variable name	Description of variable	% of sample at Time 1 variable n	% of sample at Time 2 variable n	p-value
ACOJwMO BCOJwMO	**Calcium-fortified orange juice** Number of cups/week, mean ± SD	1.5 ± 3.6	3.5 ± 5.5	0.02
	n	59	59	
	Missing, n	12	12	
ABcereaw BBcereaw	**Calcium-fortified cereals** Number of cups/week, mean ± SD	4.5 ± 2.1	2.0 ± 0	0.34
	Less than 1 cup/week, %	0	11	
	1 cup/week, %	0	0	
	2 cups/week, %	0	100	
	3 cups/week, %	50	0	
	4 cups/week, %	0	0	
	5 cups/week, %	0	0	
	6 cups/week, %	50	0	
	At least 1 cup/day, %	0	0	
	2 or more cups/day, %	0	0	
	n	2	2	
	Missing, n	69	69	
ABcerwMO BBcerwMO (set missing ABcereaw, BBcereaw as 0)	**Calcium-fortified cereals** Number of cups/week, mean ± SD	0.3 ± 1.2	0.7 ± 2.3	0.15
	n	59	59	
	Missing, n	12	12	

Variable name	Description of variable	% of sample at Time 1 variable n	% of sample at Time 2 variable n	p-value
Atspdw Btspdw	**Calcium-fortified spreads** Number of times/week	0	0	
	Less than 1 teaspoon/week, %	0	0	
	1 teaspoon/week, %	0	0	
	2 teaspoons/week, %	0	0	
	3 teaspoons/week, %	0	0	
	4 teaspoons/week, %	0	0	
	5 teaspoons/week, %	0	0	
	6 teaspoons/week, %	0	0	
	At least 1 teaspoon/day, %	0	0	
	2 or more teaspoons/day, %	0	0	
	n	0	0	
ACHCw BCHCw	**Calcium-fortified hot chocolate** Cups/week	0	0	
	Less than 1 cup/week, %	0	0	
	1 cup/week, %	0	0	
	2 cups/week, %	0	0	
	3 cups/week, %	0	0	
	4 cups/week, %	0	0	
	5 cups/week, %	0	0	
	6 cups/week, %	0	0	
	At least 1 cup/day, %	0	0	
	2 or more cups/day, %	0	0	
	n	0	0	
ACasupr **BCasupr**	**Calcium risk** : Does not take a calcium supplement or any capsule/tablet with calcium, %	83	51	0.0003
	n	57	57	
	Missing, n	14	14	

Variable name	Description of variable	% of sample at Time 1 variable n	% of sample at Time 2 variable n	p-value
AVitDr BVitDr	**Vitamin D risk** : Does not take a vitamin D supplement or any capsule/tablet with vitamin D, %	67	61	0.13
	n	57	57	
	Missing, n	14	14	
Aexr Bexr	**Exercise risk** minutes/week	112.7 ± 100.9	107.6 ± 80.2	0.60
	<150 minutes/week, %	83	80	0.64
	n	59	59	
	Missing, n	12	12	
AHFallr	**Risk of falling at home, %**	78	88	0.40
A50 B50	Throw rugs are not anchored and smooth, %	31	12	0.01
	n	58	58	
	Missing, n	13	13	
A51 B51	No grab bars in bathroom, %	54	59	0.58
	n	59	59	
	Missing, n	12	12	
A52 B52	No non-skid tape or non-skid mat in tub or shower area, %	31	34	0.69
	n	59	59	
	Missing, n	12	12	
A53 B53	Does not turn on light or use night light when getting out of bed at night, %	7	5	0.70
	n	58	58	
	Missing, n	13	13	

Variable name	Description of variable	% of sample at Time 1 variable n	% of sample at Time 2 variable n	p-value
ASmoTobr BSmoTobr	**Smoking/tobacco risk, %**	18	13	0.43
	n	56	56	
	Missing, n	15	15	
A45 B45	Currently smoking cigarettes, pipers or cigars, %	3	3	1.0
	n	58	58	
	Missing, n	13	13	
A48 B48	Currently chewing tobacco, %	14	9	0.38
	n	56	56	
	Missing, n	15	15	

% Based on number of respondents (n), not total sample, unless otherwise indicated.
Variables preceded by A and B are for Time1 and 2 respectively.
$p<0.05$ is considered statistically significant.

Table 15
Change in the percentage of participants who consumed calcium-fortified foods or calcium supplement from Time 1 to Time 2

Hypothesis 4: At least 50% of the participants who did not consume calcium-fortified foods or calcium supplements at Time 1 will start to consume either calcium-fortified foods or take a calcium supplement or any capsule/tablet with calcium

Results indicated that 47.5% of participants who did not consume calcium-fortified foods or calcium supplements at Time 1 started to consume either calcium-fortified foods or took a calcium supplement or any capsule/tablet with calcium

Variable name	Description of variable	% of sample at Time 1 variable n	% of sample at Time 2 variable n	p-value
ACa BCa	**Did not consume calcium-fortified foods or take a calcium supplement, %**	43	24	0.08
	n	45	45	
	Missing, n	26	26	

% Based on number of respondents (n), not total sample, unless otherwise indicated.
$p<0.05$ is considered statistically significant.
Variables preceded by A and B are for Time1 and 2 respectively.

Table 16. Test-retest reliability data of questionnaire

Item	Same response	Different response	Number of categories	within 1 category	within 2 categories	within 3 categories	Total n same	% different	% 1 category	% within 2 categories	% within 3 categories	% within 0
B&C 10	54	4					58	93	7	0	0	0
B&C 12	57	1					58	98	2	0	0	0
B&C 13	54	3					57	95	5	0	0	0
B&C 14	52	6					58	90	10	0	0	0
B&C 15	52	5					57	91	9	0	0	0
B&C 16	11	4					15	73	27	0	0	0
B&C 17w	12	4					16	75	25	0	0	0
B&C 17x	12	4					16	75	25	0	0	0
B&C 17y	12	4					16	75	25	0	0	0
B&C 17z	10	6					16	63	38	0	0	0
B&C 17a	54	4					58	93	7	0	0	0
B&C 17b	51	5					56	91	9	0	0	0
B&C 19	52	6					58	90	10	0	0	0

Item	Same	Different	Number of	within	within	within	Total n	%	%	% within	% within	% within
	response	response	categories	1 category	2 categories	3 categories	same	different	1 category	2 categories	3 categories	0
B&C 23a	56	2					58	97	3	0	0	0
B&C 23b	55	3					58	95	5	0	0	0
B&C 23c	55	3					58	95	5	0	0	0
B&C 23d	57	1					58	98	2	0	0	0
B&C 24	37	8	10	5	2		52	71	15	10	4	0
B&C 25	38	7	10	3	2		50	76	14	6	4	0
B&C 26	47	2					49	96	4	0	0	0
B&C 27	56	2					58	97	3	0	0	0
B&C 28	43	3	10	10	2		58	74	5	17	3	0
B&C 29	23	7	5	6	1		37	62	19	16	3	0
B&C 30	39	1	10	13	3	2	58	67	2	22	5	3
B&C 31	48	6					54	89	11	0	0	0
B&C 32	33	5	10	17	3		58	57	9	29	5	0
B&C 33	48	4	10	6	0		58	83	7	10	0	0

Item	Same	Different	Number of	within	within	within	Total n	%	%	% within	% within	% within
	response	response	categories	1 category	2 categories	3 categories	same	different	1 category	2 categories	3 categories	0
B&C 34	48	8					56	86	14	0	0	0
B&C 35a1	19	4	5				23	83	17	0	0	0
B&C 35a2	16	5	10	1	1		23	70	22	4	4	0
B&C 35b2	5	2		1	2		10	50	20	10	20	0
B&C 35c1	1	2					3	33	67	0	0	0
B&C 35c2	1	2					3	33	67	0	0	0
B&C 35d1	0	1					1	0	100	0	0	0
B&C 35d2	0	1					1	0	100	0	0	0
B&C 36	55	3					58	95	5	0	0	0
B&C 37a	53	4					57	93	7	0	0	0
B&C 37b	52	6					58	90	10	0	0	0
B&C 37c	50	8					58	86	14	0	0	0
B&C 37d	55	2					57	96	4	0	0	0
B&C 37e	53	5					58	91	9	0	0	0

Item	Same	Different	Number of	within	within	within	Total n	%	%	% within	% within	% within
	response	response	categories	1 category	2 categories	3 categories	same	different	1 category	2 categories	3 categories	0
B&C 37g	57	1					58	98	2	0	0	0
B&C 37h	57	1					58	98	2	0	0	0
B&C 38	56	2					58	97	3	0	0	0
B&C 39a1	34	6	11				40	85	15	0	0	0
B&C 39a2	34	7	10				41	83	17	0	0	0
B&C 39b1	21	5	11				26	81	19	0	0	0
B&C 39b2	19	3	10	3	2		27	70	11	11	7	0
B&C 39c1	19	8	5				27	70	30	0	0	0
B&C 39c2	17	7	10	4			28	61	25	14	0	0
B&C 39d1							0	0	0	0	0	0
B&C 39d2							0	0	0	0	0	0
B&C 40	58	0					58	100	0	0	0	0
B&C 41	43	3	8	4	5		55	78	5	7	9	0
B&C 42	38	6	2	7	4		55	69	11	13	7	

Item	Same	Different	Number of	within	within	within	Total n	%	%	% within	% within	% within
	response	response	categories	1 category	2 categories	3 categories	same	different	1 category	2 categories	3 categories	0
B&C 43b	54	1					55	98	2	0	0	0
B&C 43c	53	2					55	96	4	0	0	0
B&C 43d	50	5					55	91	9	0	0	0
B&C 43e	50	5					55	91	9	0	0	0
B&C 45	57	1					58	98	2	0	0	0
B&C 46a	2	0					2	100	0	0	0	0
B&C 46b	0	1					1	0	100	0	0	0
B&C 49a	4	2					6	67	33	0	0	0
B&C 49b	2	2					4	50	50	0	0	0
B&C 50	54	4					58	93	7	0	0	0
B&C 51	57	1					58	98	2	0	0	0
B&C 52	56	2					58	97	3	0	0	0
B&C 53	58	0					58	100	0	0	0	0
B&C 54	44	8					52	85	15	0	0	0

Item	Same	Different	Number of	within	within	within	Total n	%	%	% within	% within	% within
	response	response	categories	1 category	2 categories	3 categories	same	different	1 category	2 categories	3 categories	0
B&C 55	35	15					50	70	30	0	0	0
B&C 56	41	14					55	75	25	0	0	0
B&C 57	39	11					50	78	22	0	0	0
B&C 58a	51	6					57	89	11	0	0	0
B&C 58b	56	1					57	98	2	0	0	0
B&C 58c	53	4					57	93	7	0	0	0
B&C 58d	54	3					57	95	5	0	0	0
B&C 59	34	14					48	71	29	0	0	0
B&C 60	36	8					44	82	18	0	0	0
B&C 70	11	5	8	7	2	1	26	42	19	27	8	4
B&C 71a	46	5					51	90	10	0	0	0
B&C 71b	47	4					51	92	8	0	0	0
B&C 71c	44	7					51	86	14	0	0	0
B&C 71d	46	5					51	90	10	0	0	0

Item	Same	Different	Number of	within	within	within	Total n	%	%	% within	% within	% within
	response	response	categories	1 category	2 categories	3 categories	same	different	1 category	2 categories	3 categories	0
B&C 71e	37	14					51	73	27	0	0	0
B&C 71f	42	9					51	82	18	0	0	0
B&C 71g	42	9					51	82	18	0	0	0
B&C 71h1	5	9					14	36	64	0	0	0
B&C 71h2	5	9					14	36	64	0	0	0
B&C 71h3	7	7					14	50	50	0	0	0
B&C 71h4	8	6					14	57	43	0	0	0
B&C 71h5	7	7					14	50	50	0	0	0
B&C 71h6	7	7					14	50	50	0	0	0
B&C 71h7	8	6					14	57	43	0	0	0
B&C 71i	47	4					51	92	8	0	0	0
B&C 71j1	8	3					11	73	27	0	0	0
B&C 71j2	5	6					11	45	55	0	0	0
B&C 71j4	8	3					11	73	27	0	0	0

Item	Same	Different	Number of	within	within	within	Total n	%	%	% within	% within	% within
	response	response	categories	1 category	2 categories	3 categories	same	different	1 category	2 categories	3 categories	0
B&C 71k	46	4					50	92	8	0	0	0
B&C 71l	46	4					50	92	8	0	0	0
B&C 71m	47	3					50	94	6	0	0	0
B&C 71n	48	2					50	96	4	0	0	0
B&C 71o	16	34					50	32	68	0	0	0
B&C 71p	27	10					37	73	27	0	0	0
B&C 71q	28	4	14	13	4	2	51	55	8	25	8	4

Table 17. Standing height of participants

Gender and ethnicity	Measured standing height mean ± SD	Adult standing height (calculated from measured knee height) mean ± SD
Caucasian men	177.4 ± 6.1 cm	174.5 ± 6.4 cm
African American men	178.0 ± 7.1 cm	173.0 ± 0cm
Caucasian women	158.4 ± 6.9 cm	155.6 ± 4.8 cm
African American women	156.5 ± 10.5 cm	159.3 ± 5.8 cm

Table 18. Spearman correlation between age and attendance with number of modifiable osteoporosis-related risk factors reduced from Time 1 to Time 2 and total number of self-reported changes

Variable name	Number of modifiable osteoporosis-related risk factors reduced from Time 1 to Time 2 variable name = NumRRed r	Number of modifiable osteoporosis-related risk factors reduced from Time 1 to Time 2 variable name = NumRRed p	Total number of self-reported changes variable name = B71q r	Total number of self-reported changes variable name = B71q p	Total number of self-reported changes (excluded B71o*) variable name = B71noo r	Total number of self-reported changes (excluded B71o*) variable name = B71noo p
Age	0.09	0.54	-0.15	0.26	-0.13	0.47
Attendance	0.13	0.35	0.20	0.13	-0.06	0.74

*B71o asked if participants adopted at least one of the ways to prevent falls that was mentioned in the Fall prevention and medication lesson.
$p < 0.05$ is considered statistically significant.

Table 19. Correlation (T-test) between gender, ethnicity, cognition, and being told by doctor that they had osteoporosis with number of modifiable osteoporosis-related risk factors and total number of self-reported changes

Variable name	Number of modifiable osteoporosis-related risk factors reduced from Time 1 to Time 2 variable name = NumRRed T-statistic	Number of modifiable osteoporosis-related risk factors reduced from Time 1 to Time 2 variable name = NumRRed p	Total number of self-reported changes variable name = B71q T-statistic	Total number of self-reported changes variable name = B71q p	Total number of self-reported changes (excluded B71o*) variable name = B71noo T-statistic	Total number of self-reported changes (excluded B71o*) variable name = B71noo
Gender	0.11	0.91	-0.4	0.69	-0.72	0.48
Ethnicity	-0.32	0.75	1.27	0.21	0.94	0.36
Cognition (<19 versus ≥20)	-0.75	0.46	0.25	0.80	0.09	0.93
Told by doctor that they had osteoporosis	-0.72	0.47	-1.93	0.06	-1.21	0.24

*B71o asked if participants adopted at least one of the ways to prevent falls that was mentioned in the Fall prevention and medication lesson.

October 3, 2000

Ms Margie Searcy
Director
Walton County Senior Center
P.O. Box 764
Monroe, GA 30655

Dear Ms Searcy

RE: BONE HEALTH AND NUTRITION PROGRAM

Thank you for taking the time to meet Ms Nikki Hawthorne and me to discuss the Bone Health and Nutrition Program at Walton County Senior Center.

Further to our meeting, please find enclosed copies of the flyers and sign up sheet.

We look forward to working closely with you. Please feel free to contact me at (706)542-4838 should you need more information.

Regards,

Jennifer Cheong
Project coordinator

Cc: Dr. Mary Ann Johnson, Ms Nikki Hawthorne

ARE YOUR BONES AS HEALTHY AS THEY COULD BE?

Free tests of bone health will be offered at your center on November 7, 2000.*

Please let your senior center know if you are interested.

Ultrasound test of your heel -- painless, takes about 1 minute, and results will be ready the same day

If tests show you are at risk for poor bone health, then you will be referred to your physician.

Please note that you need to be barefoot (without hosiery) during the heel test.

Please remember to bring your medications with you.

Tests will be performed by the University of Georgia Departments of Foods and Nutrition and Pharmacy.

FOR MORE INFORMATION PLEASE CONTACT:

Ms. Jennifer Cheong, Project Coordinator,
Department of Foods and Nutrition, University of Georgia,
Athens, GA 30602
706-542-4838 (EM : jjjen7@yahoo.com)

* You will be required to complete a Bone Health & Nutrition questionnaire.

Walton County Senior Center

List of clients who are interested in the Bone Health and Nutrition Program.

NAME	ADDRESS	TEL. NO.

October 6, 2000

Ms Eloise McCurley
Director
Madison County Senior Center
P.O. Box 777
Danielsville, GA 30633

Dear Ms McCurley:

RE: BONE HEALTH AND NUTRITION PROGRAM

Thank you for your interest in participating in the Bone Health and Nutrition Program by the University of Georgia. Further to our teleconversation this morning, I am pleased to enclose copies of the flyer and sign up sheet. Participants who did not sign up prior to November 30 are still eligible to enroll in the program on that day.

On November 30, we will be conducting both the Ultrasound test of the heel and the Nutrition and Health Questionnaire. On December 5 and 12, we will be conducting only the Nutrition and Health Questionnaire for participants whom we did not get to interview on November 30.

Please feel free to contact me at (706) 542-4838 should you need further information. We look forward to working with you.

Regards,

Jennifer Cheong
Project coordinator

Cc: Dr. Mary Ann Johnson, Ms Nikki Hawthorne

ARE YOUR BONES AS HEALTHY AS THEY COULD BE?

Free tests of bone health will be offered at your center on November 30, 2000.*

Please let your senior center know if you are interested.

Ultrasound test of your heel -- painless, takes about 1 minute, and results will be ready the same day

If tests show you are at risk for poor bone health, then you will be referred to your physician.

Please note that you need to be barefoot (without hosiery) during the heel test.

Please remember to bring your medications with you.

Tests will be performed by the University of Georgia Departments of Foods and Nutrition and Pharmacy.

FOR MORE INFORMATION PLEASE CONTACT:

Ms. Jennifer Cheong, Project Coordinator,
Department of Foods and Nutrition, University of Georgia,
Athens, GA 30602
706-542-4838 (EM : jjjen7@yahoo.com)

* You will be required to complete a Bone Health & Nutrition questionnaire.

Madison County Senior Center

List of clients who are interested in the Bone Health and Nutrition Program.

NAME	ADDRESS	TEL. NO.

October 6, 2000

Ms Marian Nolley
Director
Oconee County Senior Center
P.O. Box 144
Bishop, GA 30621

Dear Ms Nolley

RE: BONE HEALTH AND NUTRITION PROGRAM

Thank you for your interest in participating in the Bone Health and Nutrition Program by the University of Georgia. Further to our teleconversation this morning, I am pleased to enclose copies of the flyer and sign up sheet. Participants who did not sign up prior to December 1 are still eligible to enroll in the program on that day.

On December 1, we will be conducting both the Ultrasound test of the heel and the Nutrition and Health Questionnaire. On December 8, we will be conducting only the Nutrition and Health Questionnaire for participants whom we did not get to interview on December 1.

Please feel free to contact me at (706) 542-4838 should you need further information. We look forward to working with you.

Regards,

Jennifer Cheong
Project coordinator

Cc: Dr. Mary Ann Johnson, Ms Nikki Hawthorne

ARE YOUR BONES AS HEALTHY AS THEY COULD BE?

Free tests of bone health will be offered at your center on December 1, 2000.*

Please let your senior center know if you are interested.

Ultrasound test of your heel -- painless, takes about 1 minute, and results will be ready the same day

If tests show you are at risk for poor bone health, then you will be referred to your physician.

Please note that you need to be barefoot (without hosiery) during the heel test.

Please remember to bring your medications with you.

Tests will be performed by the University of Georgia Departments of Foods and Nutrition and Pharmacy.

FOR MORE INFORMATION PLEASE CONTACT:

Ms. Jennifer Cheong, Project Coordinator,
Department of Foods and Nutrition, University of Georgia,
Athens, GA 30602
706-542-4838 (EM : jjjen7@yahoo.com)

* You will be required to complete a Bone Health & Nutrition questionnaire.

Oconee County Senior Center

List of clients who are interested in the Bone Health and Nutrition Program.

NAME	ADDRESS	TEL. NO.

February 6, 2000

Ms Vivian Evans
Director
Greene County Senior Center
502 S. Walnut Street
Greesboro, GA 30642

Dear Ms Evans

RE: BONE HEALTH TEST AND LESSONS

It was a pleasure talking to you this morning. Further to our teleconversation, please find enclosed a copy of the flyer and sign up sheet for your clients.

Please feel free to contact me at (706) 542-4838 should you need further information.

Kind regards,

Jennifer Cheong

ARE YOUR BONES AS HEALTHY AS THEY COULD BE?

Free tests of bone health will be offered at your center on March 1, 2001.*

Please let your senior center know if you are interested.

Ultrasound test of your heel -- painless, takes about 1 minute, and results will be ready the same day

If tests show you are at risk for poor bone health, then you will be referred to your physician.

Please note that you need to be barefoot (without hosiery) during the heel test.

Please remember to bring your medications with you.

Tests will be performed by the University of Georgia Departments of Foods and Nutrition and Pharmacy.

FOR MORE INFORMATION PLEASE CONTACT:

Ms. Jennifer Cheong, Project Coordinator,
Department of Foods and Nutrition, University of Georgia,
Athens, GA 30602
706-542-4838 (EM : jjjen7@yahoo.com)

* You will be required to complete a Bone Health & Nutrition questionnaire.

<u>Greene County Senior Center</u>

List of clients who are interested in the Bone Health and Nutrition Program.

NAME	ADDRESS	TEL. NO.

FORM E

BONE HEALTH, NUTRITION AND PHYSICAL ACTIVITY CONSENT FORM

I, _____ agree to take part in the research titled "BONE HEALTH AND NUTRITION" conducted by Dr. Mary Ann Johnson from the Department of Foods and Nutrition at the University of Georgia. I understand that I do not have to take part if I do not want to. I can stop taking part without giving any reason, and without penalty. I can ask to have all of the information about me returned to me, removed from the research records, or destroyed. My decision to participate will not affect the services that I receive at the Senior Center.

The reason for this study is to test nutrition education programs about bone health to find out if older adults enjoy them and benefit from them.

If I volunteer to take part in this study, I will be asked to do the following things:

1) **Answer questions about my health, food, nutrition, and physical activity,**
2) **Have my bone health tested by an ultrasound test of my heel,**
3) **Listen to nutrition and health education programs about bone health,**
4) **Take part in a physical activity program to improve my strength and balance, and**
5) **Someone from the study may call me to clarify my information.**

I understand that these tests and questions are not for diagnostic purposes. The benefits for me are that the nutrition and health education programs may help me understand and improve my health.

No risk is expected but I may experience some discomfort when the researchers ask me questions about health, nutrition and physical activity. The researchers advise me that I should stop exercising if I experience any discomfort or chest pains.

No information about me, or provided by me during the research, will be shared with others without my written permission, except if it is necessary to protect my welfare (for example, if I need physician care) or if required by law. I will be assigned an identifying number and this number will be used on all of the questionnaires I fill out.

The investigator will answer any further questions about the research, now or during the course of the project (Ms Jennifer Cheong: 706-542-4838).

I will allow the staff to take my picture, videotape or record me while participating in the study. I can verbally refuse at anytime and my wishes will be upheld. My pictures will only be used to promote this nutrition, health, and physical activity program. The videotapes and pictures will be used to encourage other older adults to participate in these beneficial nutrition, health, exercise, and education programs. I will not be identified by my name in the videotapes or pictures.
Circle one: YES / NO. Initial _____.

I understand that I am agreeing by my signature on this form to take part in this research project and understand that I will receive a signed copy of this consent form for my records.

_____
Signature of Investigator Date

_____
Signature of Participant Date

_____
Address

_____
Phone Number

Questions or problems regarding your rights as a participant should be addressed to Ms. Julia Alexander; Institutional Review Board; Office of V.P. for Research; The University of Georgia; 604A Graduate Studies Research Center; Athens, GA 30602-7411; Telephone 706-542-6514.

BONE HEALTH, NUTRITION AND PHYSICAL ACTIVITY CONSENT FORM

I give my permission for the researchers to release my bone density results to my health care provider.
Circle one : YES / NO. Initial _____.

I give my permission for the researchers to obtain information about my medications from my health care provider and pharmacist.
Circle one : YES / NO. Initial _____.

Contact information for participant
Health Care Provider:_____
Address :_____
Telephone number :_____

Care giver / Next of kin:_____
Address :_____
Telephone number :_____

FORM E 1

BONE HEALTH, NUTRITION AND PHYSICAL ACTIVITY CONSENT FORM

I, _____ agree to take part in the research titled "BONE HEALTH AND NUTRITION" conducted by Dr. Mary Ann Johnson from the Department of Foods and Nutrition at the University of Georgia. I understand that I do not have to take part if I do not want to. I can stop taking part without giving any reason, and without penalty. I can ask to have all of the information about me returned to me, removed from the research records, or destroyed. My decision to participate will not affect the services that I receive at the Senior Center.

The reason for this study is to test nutrition education programs about bone health to find out if older adults enjoy them and benefit from them.

If I volunteer to take part in this study, I will be asked to do the following things:

1) **Answer questions about my health, food, nutrition, and physical activity,**
2) **Listen to nutrition and health education programs about bone health,**
3) **Take part in a physical activity program to improve my strength and balance, and**
4) **Someone from the study may call me to clarify my information.**

I understand that these tests and questions are not for diagnostic purposes. The benefits for me are that the nutrition and health education programs may help me understand and improve my health.

No risk is expected but I may experience some discomfort when the researchers ask me questions about health, nutrition and physical activity. The researchers advise me that I should stop exercising if I experience any discomfort or chest pains.

No information about me, or provided by me during the research, will be shared with others without my written permission, except if it is

necessary to protect my welfare (for example, if I need physician care) or if required by law. I will be assigned an identifying number and this number will be used on all of the questionnaires I fill out.

The investigator will answer any further questions about the research, now or during the course of the project (Ms Jennifer Cheong: 706-542-4838).

I will allow the staff to take my picture, videotape or record me while participating in the study. I can verbally refuse at anytime and my wishes will be upheld. My pictures will only be used to promote this nutrition, health, and physical activity program. The videotapes and pictures will be used to encourage other older adults to participate in these beneficial nutrition, health, exercise, and education programs. I will not be identified by my name in the videotapes or pictures.
Circle one: YES / NO. Initial _____.

I understand that I am agreeing by my signature on this form to take part in this research project and understand that I will receive a signed copy of this consent form for my records.

_____
Signature of Investigator Date

_____
Signature of Participant Date

_____
Address

_____
Phone Number

Questions or problems regarding your rights as a participant should be addressed to Ms. Julia Alexander; Institutional Review Board; Office of V.P. for Research; The University of Georgia; 604A Graduate Studies Research Center; Athens, GA 30602-7411; Telephone 706-542-6514.

BONE HEALTH, NUTRITION AND PHYSICAL ACTIVITY CONSENT FORM

I give my permission for the researchers to obtain information about my medications from my health care provider and pharmacist.
Circle one : YES / NO. Initial _____.

Contact information for participant
Health Care Provider:_____
Address :_____
Telephone number :_____

Care giver / Next of kin:_____
Address :_____
Telephone number :_____

PATIENT HISTORY FORM – Osteoporosis

Name:_____ Date:_____
Mailing Address:_____
Social Security Number:_____ Phone: (H)_____ (W)_____
DOB:_____Gender:_____ LMP_____
Possibly Pregnant: ____Yes ____No Height_____ Weight_____
Allergies_____ Reactions_____
_____ _____
_____ _____
Devices/Alerts_____

MEDICATION HISTORY (Prescription/OTC)

Name/ Strength	Directions	Start Date	Stop Date	Physician	Reason for Medication

MEDICAL HISTORY: Have you or any blood relative had (mark all that apply)

	Self	Relative		Self	Relative
High blood pressure	____	____	Heart disease	____	____
Asthma	____	____	Stroke	____	____
Cancer	____	____	Kidney disease	____	____
Depression	____	____	Mental illness	____	____
Lung disease	____	____	Substance abuse	____	____
Diabetes	____	____	Osteoporosis	____	____
Other_____					

SOCIAL HISTORY: Please indicate your tobacco, alcohol, caffeine and dietary habits.

Nicotine Use
____ never smoked
____ packs per day for ____ years
____ stopped ____ year(s) ago

Caffeine Intake
____ never consumed
____ drinks per day
____ stopped ____ year(s) ago

Alcohol Consumption
____ never consumed
____ drinks per day/week
____ stopped ____ year(s) ago

Diet Restrictions/Patterns
____ number of meals per day
____ food restrictions: _____
____ Vitamin D
____ Calcium

OTHER INFORMATION / COMMENTS

_____
Pharmacist Signature Date

Interpretation of your Bone Density Scan

We recommend that anyone with a T-score less than 0, or any individual with 3 or more risk factors for osteoporosis consult with their physician. It is often recommended that individuals testing positively for osteopenia/osteoporosis be referred by their primary care physician to a specialist for more complete central scan of the hip and spine. Insurance covers most high-risk individuals, so be sure to take this report to your primary care physician and obtain a referral to the DEXA specialist in your area.

The figure of specific interest in these numerical results is the SAHARA T-Score.

- If a T-Score is greater than (0), then the patient appears to have low risk for a future fracture.
- If a T-Score is less than or equal to (0) but greater than (-1.0), then the patient appears to have moderate risk for a future fracture.
- If a T-Score is less than or equal to (-1.0) then the patient appears to have high risk for experiencing a future fracture.

Your Est. Heel BMD _____ T-Score _____

-2 -1 0 +1

_____|_____|_____

High Risk Moderate Risk Low Risk

RISK FACTOR ANALYSIS CHECK:

- A family history of osteoporosis
- Female
- Small frame/Thin body build
- Caucasian or Asian descent
- Smoking
- Eating Disorder
- Fracture as an adult
- Over age 45
- Sedentary lifestyle (No routine exercise program)
- Low calcium intake
- High Alcohol/Caffeine intake
- Menopause, Amenorrhea, or Low testosterone level
- Use of certain medications, such as steroids (commonly used to treat asthma and arthritis)
- and thyroid hormones (if the does is too high)

Comments:_____

Remember that peripheral bone density scans of the heel are not necessarily representative of other parts of the body. Research does not show that there is a very strong correlation between heel measurements and hip/spine measurements, however, the correlation is not absolute. Many experts recommend that individuals testing with a SAHARA T-score below (0) be referred to a physician for a central DEXA scan of the hip and spine.

Please consult your healthcare professional for interpretation of your bone density scan.

ORIENTATION-MEMORY-CONCENTRATION TEST

Read all questions to the participant. Tell them that some of the questions may be easy and some may be hard – just do the best you can.

	Response	# of Errors	Max. Errors	Weight Factor	Total
1) What is the year now?			1	4	
2) What month is it now?			1	3	
Please repeat this phrase after me: JOHN BROWN, 42 MARKET STREET, CHICAGO *No score for this – it is a memory phrase for Item #6. Allow the person up to three trials for learning (repeating) the phrase. If the subject has not learned the phrase after three trials, record the value of "0" as the total score for Item #6, and proceed to Item #3.*					
3) Without looking at your watch or a clock, tell me about what time is it? *Note: score is correct if within one hour of actual time.*			1	3	
4) Count backwards from 20 to 1. *20, 19, 18, 17, 16, 15, 14, 13, 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1*			2	2	
5) Say the months of the year in reverse order. *DEC, NOV,OCT, SEPT, AUG, JULY, JUNE, MAY, APR, MAR, FEB, JAN*			2	2	
6) Please repeat the name and address I asked you to remember. *Count the number of items (5) in memory phrase recalled incorrectly. An answer of either Market or Market Street is acceptable.* John / Brown / 42 / Market Street / Chicago			5	2	
TOTAL SCORE					

Interpretation of corrected scores:

≤ 8	Normal or minimal impairment
9-19	Moderate impairment
≥ 20	Severe impairment

Source: katzman, R., Brown, T., Fuld, P., Peck, A., Schechter, R., Schimmel, H. Validation of a short orientation-memory-concentration test of cognitive impairment. *American Journal of Psychiatry* 140:734-739, 1983.

PARTICIPANT EVALUATION
BONE HEALTH AND NUTRITION

Read each question to the participant and record their answer.
Encourage the participant to answer all questions and to give the best answer they can.

Today's date : _____

Interviewer: _____

Circle one: PRE-TEST (before participants hear the nutrition and health lessons)
POST-TEST (after participants hear the nutrition and health lessons)

A1	Participant ID	____
A2	County	
A3	Age	____ years old
		Circle one
A4	Gender	(0) Male (1) Female
A5	Ethnicity	(1) White (2) Black (3) Hispanic (4) Asian (5) Other
A6a	Have you had a heel Bone Mass Density test done before? (not including the one which we did for you)	(1) Yes (2) No (9) Don't know
A6b	BMD (from heel scan, if performed)	
A7	Weight (in kg)	
A8	Height (in cm)	Standing height: Knee height
A9	BMI (calculate in kg/m^2)	
	FAMILY HISTORY	
A10	Has anyone in your family ever had a fracture or broken bone after age 50?	(1) Yes (0) No (9) Don't know
A11	If yes, who in your family had a fracture or broken bone after age 50?	Mother Father Sister Brother None of the above
	MEDICAL CONDITIONS/MEDICATIONS	
A12	Do you have bone pain?	(1) Yes (0) No (9) Don't know or missing
A13	Has your doctor ever told you that you had osteoporosis?	(1) Yes (0) No (9) Don't know or missing

A14	Have you had a fall within the past 1 year?	(1) Yes (0) No (9) Don't know or missing
A15	Have you had a fracture or broken bone after age 50?	(1) Yes (0) No (9) Don't know or missing
A16	If yes, at what age?	____ years old
A17	If yes, where. Please circle your answer	Please circle your answer Hip Wrist Spine Others (please specify location)
A17 a	Have you been taking excessive thyroid medication or high or prolonged doses of cortisone-like drugs for asthma, arthritis or cancer?	(1) Yes (0) No (9) Don't know or missing
A17 b	(Interviewer: ask this question for FEMALE subjects only) Are you taking hormone replacement therapy such as Raloxifene, Draloxifene, Premarin, Prempo?	(1) Yes (0) No (9) Don't know or missing
	DIET	
A18	Did you drink milk as a child?	(1) Yes (0) No (9) Don't know or missing
A19	Do you currently drink milk?	(1) Yes (0) No (9) Don't know or missing
A20	How many glasses of milk do you drink?	Less than 1 glass per week 1 glass per week 2 glasses per week 3 glasses per week 4 glasses per week 5 glasses per week 6 glasses per week At least 1 glass per day 2 or more glasses per day Don’t know or missing
A21	What type of milk do you usually drink?	(1)skim (2)1% (3)2% (4)whole (5)Buttermilk (9)Don't know or missing
A22	If you used to drink milk as a child but have stopped doing so, at what age did you stop drinking milk?	years old
A23	What type of breakfast cereal do you usually eat?	Brand : Oatmeal Grits Ready-to-eat cereal Don’t eat breakfast cereal

A24	How often do you eat breakfast cereal? (Interviewer: breakfast cereal includes oatmeal, grits, ready-to-eat cereals)	Less than 1 time per week 1 time per week 2 times per week 3 times per week 4 times per week 5 times per week 6 times per week At least 1 time per day 2 or more times per day Don't know or missing
A25	On average, how much milk do you usually eat on cereal each day?	Less than 1 cup per week 1 cup per week 2 cups per week 3 cups per week 4 cups per week 5 cups per week 6 cups per week At least 1 cup per day 2 or more cups per day Don't know or missing
A26	What type of milk do you eat with your cereal?	(1) Skim (2) 1% (3) 2% (4) Whole (5) Buttermilk (9) Don't know or missing
A27	Do you get stomachache, gas, or diarrhea after drinking milk?	(1) Yes (0) No (9) Don't know or missing
A28	How often do you eat yogurt?	Less than once per week 1 time per week 2 times per week 3 times per week 4 times per week 5 times per week 6 times per week At least once per day 2 or more times per day Don't know or missing
A29	Each time you eat yogurt, how much yogurt do you usually eat?	Less than 1/2 cup Between 1/2 cup and 1 cup About 1 cup More than 1 cup Don't know or missing

A30	How often do you eat cheese?	Less than once per week 1 time per week 2 times per week 3 times per week 4 times per week 5 times per week 6 times per week At least once per day 2 or more times per day Don't know or missing
A31	How many servings of cheese do you usually eat? (1 serving=1ounce=1slice)	_____ servings
A32	How often do you eat mustard, turnip, or collard greens?	Less than once per week 1 time per week 2 times per week 3 times per week 4 times per week 5 times per week 6 times per week At least once per day 2 or more times per day Don't know or missing
A33	How often do you eat canned salmon?	Less than once per week 1 time per week 2 times per week 3 times per week 4 times per week 5 times per week 6 times per week At least once per day 2 or more times per day Don't know or missing
A34	Do you eat calcium-fortified foods (such as calcium-fortified orange juice, calcium-fortified cereals - Total, Kellogg's K)?	(1) Yes (0) No (9) Don't know or missing
A35	If yes, what type, how much and how often do you eat calcium-fortified foods?	
	Type Amount	Frequency Less than once per week 1 time per week 2 times per week 3 times per week 4 times per week 5 times per week 6 times per week At least once per day 2 or more times per day Don't know or missing

	Type Amount	Frequency Less than once per week 1 time per week 2 times per week 3 times per week 4 times per week 5 times per week 6 times per week At least once per day 2 or more times per day Don't know or missing
	Type Amount	Frequency Less than once per week 1 time per week 2 times per week 3 times per week 4 times per week 5 times per week 6 times per week At least once per day 2 or more times per day Don't know or missing
	Type Amount	Frequency Less than once per week 1 time per week 2 times per week 3 times per week 4 times per week 5 times per week 6 times per week At least once per day 2 or more times per day Don't know or missing
	Type Amount	Frequency Less than once per week 1 time per week 2 times per week 3 times per week 4 times per week 5 times per week 6 times per week At least once per day 2 or more times per day Don't know or missing
A36	Do you take a vitamin / mineral supplement?	(1) Yes (0) No

A37	If yes, which of the following type of supplements do you take?	Please state brand. multivitamin _____ calcium supplement or any capsule/tablet with calcium_____ vitamin D supplement or any capsule/tablet with vitamin D _____ iron supplement _____ Others. please specify _____ Boost Ensure Other meal replacement. Specify brand.
A38	Do you drink caffeinated beverages such as coffee, tea and cola?	(1) Yes (0) No (9) Missing/Don't know
A39	If yes, what type of beverage, how much and how often do you drink? (cups for coffee and tea; cans for cola)	
	Type Amount	Frequency Less than once per week 1 per week 2 per week 3 per week 4 per week 5 per week 6 per week At least one per day 2 or more per day Don't know or missing
	Type Amount	Frequency Less than once per week 1 per week 2 per week 3 per week 4 per week 5 per week 6 per week At least one per day 2 or more per day Don't know or missing

	Type Amount	Frequency Less than once per week 1 per week 2 per week 3 per week 4 per week 5 per week 6 per week At least one per day 2 or more per day Don't know or missing
	Type Amount	Frequency Less than once per week 1 per week 2 per week 3 per week 4 per week 5 per week 6 per week At least one per day 2 or more per day Don't know or missing
	PHYSICAL ACTIVITY	
A40	Do you exercise?	(1) Yes (0) No (9) Missing
A41	If yes, how many times per week?	_____ times per week
A42	How many minutes per session of exercise?	_____ minutes
A43	What type of exercises do you usually do?	(1) Swimming (2) Walking (3) Gardening (4) Leg exercises taught at the Senior center (5) Others. Please specify.
	LIFESTYLE	
A44	Have you smoked cigarettes, pipes or cigars in the past?	(1) Yes (0) No (9) Missing
A45	Are you currently smoking cigarettes, pipes or cigars?	(1) Yes (0) No (9) Missing
A46	If yes, how often do you smoke?	(0) Never or less than once/year (1) A few times/month (2) A few times/week (3) Daily If daily, how many cigarettes, pipes or cigars/day
A47	Have you chewed tobacco in the past?	(1) Yes (0) No (9) Missing

A48	Are you currently chewing tobacco?	(1) Yes (0) No (9) Missing
A49	If yes, how often do you chew tobacco now?	(0) Never or less than once/year (1) A few times/month (2) A few times/week (3) Daily If daily, how many times/day
	FALL PREVENTION	
A50	The throw rugs in my house are anchored and smooth so I will not trip or fall.	(1) Yes (0) No (2) I do not have rugs (9) Don't know or missing
A51	My bathroom has grab bars so I will not fall.	(1) Yes (0) No (9) Don't know or missing
A52	I have non-skid tape or a non-skid mat in the tub or shower area so I will not slip or fall.	(1) Yes (0) No (9) Don't know or missing
A53	I turn on the light or use a night light when I get out of bed at night so I will not trip or fall.	(1) Yes (0) No (9) Don't know or missing
	KNOWLEDGE **Interviewer should say " I am going to ask you some questions about nutrition and health. Please answer yes, no, or don't know.**	
A54	Calcium needs increase after age 50.	(1) Yes (2) No (9) Don't know or missing
A55	Only women, but not men get the bone disease called osteoporosis where bones become weaker and break more easily.	(1) Yes (2) No (9) Don't know or missing
A56	Normal fruit juice has as much calcium as milk.	(1) Yes (0) No (9) Don't know or missing
A57	Our bodies need vitamin D in order to absorb calcium.	(1) Yes (2) No (9) Don't know or missing
A58	Which of the following exercises are good for my bones?	Please circle your answer. (1) Swimming (2) Walking (3) Gardening (4) Golf
A59	Dairy foods are the only foods high in calcium.	(1) Yes (0) No (9) Don't know or missing
A60	Sunlight helps our bodies make vitamin D.	(1) Yes (0) No (9) Don't know or missing

	ONLY WOMEN NEED TO ANSWER QUESTIONS A61TO A65	
A61	How old were you when you had your first menstrual period?	____ years old
A62	How old were you when you had your last menstrual period?	____ years old
	ASK THESE QUESTIONS ONLY AT THE POST-TEST (TIME 2)	
B66	What did you <u>like</u> about the bone health and nutrition lessons?	
B67	What did you <u>not like</u> about the bone health and nutrition lessons?	
B68	What did you <u>like</u> about the balance exercises?	
B69	What did you <u>not like</u> about the balance exercises?	
B70	On the average how many days of the week do you do the balance exercises (include at the senior center and at home)?	
B71	Have you tried or done any of the following since attending the bone health and nutrition education lessons? (Interviewer: please read each item and circle either YES or NO for item.) • Talked to my doctor about my heel bone mineral density test. YES / NO • Talked to my doctor about osteoporosis. YES / NO • Talked to my doctor about my taking medication prescribed for osteoporosis. YES / NO If yes, name of medication: _____ • Talked to my doctor about exercises that might improve my bone health. YES / NO • Increased my physical activity. YES / NO • Practiced balance exercises at home. YES / NO	

	• Ate more calcium-rich foods. YES / NO Is yes, what are the calcium-rich foods that you ate more of? milk, cheese, yogurt, sardines, canned salmon with bones, collard/mustard/turnip greens Others: please specify_____ • Ate more calcium-fortified foods. YES / NO If yes, what type of calcium-fortified foods that you ate more of? calcium-fortified juice, calcium-fortified cereals, calcium-fortified granola bars Others: please specify_____ • Started taking a calcium supplement. YES / NO • Started taking a vitamin D supplement. YES / NO • Started taking Lactaid milk. YES / NO • Tried using lactase tablets/drops. YES / NO • Adopted at least one of the ways to prevent falls that was mentioned in the Fall prevention and medication lesson. YES / NO • Any other changes which you have made? YES / NO If yes, please specify:_____ (Interviewer: calculate the total number of changes made: _____)	

MEDICATIONS AND ILLNESSES - IN THE PAST YEAR **NAME/ID:** _____

Obtain information from reliable source. This information was provided by: client, caretaker, other _____?

IN THE PAST YEAR	YES (1)	NO (0)	DON'T KNOW
Total number of PRESCRIPTION medications			
Total number of NON -PRESCRIPTION medications, not counting vitamins and minerals			
Multiple vitamin mineral supplement? 0 = no, 1 = (1) Yes			
Number of other nutritional supplements?			
Total number of illnesses - fill in when finished below.			
1) Anemia			
2) Alzheimer's			
3) Other dementia's			
4) Cancer			
5) Circulatory problems			
6) Congestive heart failure			
7) Constipation			
8) Diabetes			
9) Diarrhea			
10) Glaucoma			
11) Hearing problems			
12) Heart disease			
13) Hypertension			
14) Legally blind			
15) Liver disease			
16) Mental illness			
17) Osteoporosis			
18) Hip fracture			
19) Pace maker			
20) Parkinson's disease			
21) Renal disease			
22) Respiratory disease			
23) Seizures			
24) Skin rashes, bed sores			
25) Stroke			
26) Thyroid problems			
27) Visual disturbances			
28) Cataracts			
29) Smoking: cigarettes, pipes, cigars, OR chewing tobacco			
30) Surgery			
31) Emergency room visit in the past year?			
32) Other?			
33) Arthritis			
34) Pneumonia			
35) Dizziness			

36) Gout			
37) Postural Hypotension			

PARTICIPANT EVALUATION
BONE HEALTH AND NUTRITION

Read each question to the participant and record their answer.
Encourage the participant to answer all questions and to give the best answer they can.

Today's date : _____

Interviewer: _____

Circle one: PRE-TEST (before participants hear the nutrition and health lessons)
POST-TEST (after participants hear the nutrition and health lessons)

B1	Participant ID	____
B2	County	
B3	Age	____ years old
		Circle one
B4	Gender	(0) Male (1) Female
B5	Ethnicity	(1) White (2) Black (3) Hispanic (4) Asian (5) Other
B6a	Have you had a heel Bone Mass Density test done before? (not including the one which we did for you)	(1) Yes (2) No (9) Don't know
B6b	BMD (from heel scan, if performed)	
B7	Weight (in kg)	
B8	Height (in cm)	Standing height: Knee height
B9	BMI (calculate in kg/m^2)	
	FAMILY HISTORY	
B10	Has anyone in your family ever had a fracture or broken bone after age 50?	(1) Yes (0) No (9) Don't know
B11	If yes, who in your family had a fracture or broken bone after age 50?	Mother Father Sister Brother None of the above
	MEDICAL CONDITIONS/MEDICATIONS	
B12	Do you have bone pain?	(1) Yes (0) No (9) Don't know or missing
B13	Has your doctor ever told you that you had osteoporosis?	(1) Yes (0) No (9) Don't know or missing

B14	Have you had a fall within the past 1 year?	(1) Yes (0) No (9) Don't know or missing
B15	Have you had a fracture or broken bone after age 50?	(1) Yes (0) No (9) Don't know or missing
B16	If yes, at what age?	____ years old
B17	If yes, where. Please circle your answer	Please circle your answer Hip Wrist Spine Others (please specify location)
B17 a	Have you been taking excessive thyroid medication or high or prolonged doses of cortisone-like drugs for asthma, arthritis or cancer?	(1) Yes (0) No (9) Don't know or missing
B17 b	(Interviewer: ask this question for FEMALE subjects only) Are you taking hormone replacement therapy such as Raloxifene, Draloxifene, Premarin, Prempo?	(1) Yes (0) No (9) Don't know or missing
	DIET	
B18	Did you drink milk as a child?	(1) Yes (0) No (9) Don't know or missing
B19	Do you currently drink milk?	(1) Yes (0) No (9) Don't know or missing
B20	How many glasses of milk do you drink?	Less than 1 glass per week 1 glass per week 2 glasses per week 3 glasses per week 4 glasses per week 5 glasses per week 6 glasses per week At least 1 glass per day 2 or more glasses per day Don’t know or missing
B21	What type of milk do you usually drink?	(1) Skim (2) 1% (3) 2% (4) Whole (5) Buttermilk (9) Don't know or missing
B22	If you used to drink milk as a child but have stopped doing so, at what age did you stop drinking milk?	years old
B23	What type of breakfast cereal do you usually eat?	Brand : Oatmeal Grits Ready-to-eat cereal Don’t eat breakfast cereal

B24	How often do you eat breakfast cereal? (Interviewer: breakfast cereal includes oatmeal, grits, ready-to-eat cereals)	Less than 1 time per week 1 time per week 2 times per week 3 times per week 4 times per week 5 times per week 6 times per week At least 1 time per day 2 or more times per day Don't know or missing
B25	On average, how much milk do you usually eat on cereal each day?	Less than 1 cup per week 1 cup per week 2 cups per week 3 cups per week 4 cups per week 5 cups per week 6 cups per week At least 1 cup per day 2 or more cups per day Don't know or missing
B26	What type of milk do you eat with your cereal?	(1) Skim (2) 1% (3) 2% (4) Whole (5) Buttermilk (9) Don't know or missing
B27	Do you get stomachache, gas, or diarrhea after drinking milk?	(1) Yes (0) No (9) Don't know or missing
B28	How often do you eat yogurt?	Less than once per week 1 time per week 2 times per week 3 times per week 4 times per week 5 times per week 6 times per week At least once per day 2 or more times per day Don't know or missing
B29	Each time you eat yogurt, how much yogurt do you usually eat?	Less than 1/2 cup Between 1/2 cup and 1 cup About 1 cup More than 1 cup Don't know or missing

B30	How often do you eat cheese?	Less than once per week 1 time per week 2 times per week 3 times per week 4 times per week 5 times per week 6 times per week At least once per day 2 or more times per day Don't know or missing
B31	How many servings of cheese do you usually eat? (1 serving=1ounce=1slice)	_____ servings
B32	How often do you eat mustard, turnip, or collard greens?	Less than once per week 1 time per week 2 times per week 3 times per week 4 times per week 5 times per week 6 times per week At least once per day 2 or more times per day Don't know or missing
B33	How often do you eat canned salmon?	Less than once per week 1 time per week 2 times per week 3 times per week 4 times per week 5 times per week 6 times per week At least once per day 2 or more times per day Don't know or missing
B34	Do you eat calcium-fortified foods (such as calcium-fortified orange juice, calcium-fortified cereals - Total, Kellogg's K)?	(1) Yes (0) No (9) Don't know or missing
B35	If yes, what type, how much and how often do you eat calcium-fortified foods?	
	Type Amount	Frequency Less than once per week 1 time per week 2 times per week 3 times per week 4 times per week 5 times per week 6 times per week At least once per day 2 or more times per day Don't know or missing

	Type Amount	Frequency Less than once per week 1 time per week 2 times per week 3 times per week 4 times per week 5 times per week 6 times per week At least once per day 2 or more times per day Don't know or missing
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	Type Amount	Frequency Less than once per week 1 time per week 2 times per week 3 times per week 4 times per week 5 times per week 6 times per week At least once per day 2 or more times per day Don't know or missing
B36	Do you take a vitamin / mineral supplement?	(1) Yes (0) No

B37	If yes, which of the following type of supplements do you take?	Please state brand. multivitamin _____ calcium supplement or any capsule/tablet with calcium_____ vitamin D supplement or any capsule/tablet with vitamin D _____ iron supplement _____ Others. please specify _____ Boost Ensure Other meal replacement. Specify brand.
B38	Do you drink caffeinated beverages such as coffee, tea and cola?	(1) Yes (0) No (9) Missing/Don't know
B39	If yes, what type of beverage, how much and how often do you drink? (cups for coffee and tea; cans for cola)	
	Type Amount	Frequency Less than once per week 1 per week 2 per week 3 per week 4 per week 5 per week 6 per week At least one per day 2 or more per day Don't know or missing
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	PHYSICAL ACTIVITY	
B40	Do you exercise?	(1) Yes (0) No (9) Missing
B41	If yes, how many times per week?	_____ times per week
B42	How many minutes per session of exercise?	_____ minutes
B43	What type of exercises do you usually do?	(1) Swimming (2) Walking (3) Gardening (4) Leg exercises taught at the Senior center (5) Others. Please specify.
	LIFESTYLE	
B44	Have you smoked cigarettes, pipes or cigars in the past?	(1) Yes (0) No (9) Missing
B45	Are you currently smoking cigarettes, pipes or cigars?	(1) Yes (0) No (9) Missing
B46	If yes, how often do you smoke?	(0) Never or less than once/year (1) A few times/month (2) A few times/week (3) Daily If daily, how many cigarettes, pipes or cigars/day
B47	Have you chewed tobacco in the past?	(1) Yes (0) No (9) Missing

B48	Are you currently chewing tobacco?	(1) Yes (0) No (9) Missing
B49	If yes, how often do you chew tobacco now?	(0) Never or less than once/year (1) A few times/month (2) A few times/week (3) Daily If daily, how many times/day
	FALL PREVENTION	
B50	The throw rugs in my house are anchored and smooth so I will not trip or fall.	(1) Yes (0) No (2) I do not have rugs (9) Don't know or missing
B51	My bathroom has grab bars so I will not fall.	(1) Yes (0) No (9) Don't know or missing
B52	I have non-skid tape or a non-skid mat in the tub or shower area so I will not slip or fall.	(1) Yes (0) No (9) Don't know or missing
B53	I turn on the light or use a night light when I get out of bed at night so I will not trip or fall.	(1) Yes (0) No (9) Don't know or missing
	KNOWLEDGE **Interviewer should say " I am going to ask you some questions about nutrition and health. Please answer yes, no, or don't know.**	
B54	Calcium needs increase after age 50.	(1) Yes (2) No (9) Don't know or missing
B55	Only women, but not men get the bone disease called osteoporosis where bones become weaker and break more easily.	(1) Yes (2) No (9) Don't know or missing
B56	Normal fruit juice has as much calcium as milk.	(1) Yes (0) No (9) Don't know or missing
B57	Our bodies need vitamin D in order to absorb calcium.	(1) Yes (2) No (9) Don't know or missing
B58	Which of the following exercises are good for my bones?	Please circle your answer. (1) Swimming (2) Walking (3) Gardening (4) Golf
B59	Dairy foods are the only foods high in calcium.	(1) Yes (0) No (9) Don't know or missing
B60	Sunlight helps our bodies make vitamin D.	(1) Yes (0) No (9) Don't know or missing

	ONLY WOMEN NEED TO ANSWER QUESTIONS A61TO A65	
B61	How old were you when you had your first menstrual period?	____ years old
B62	How old were you when you had your last menstrual period?	____ years old
	ASK THESE QUESTIONS ONLY AT THE POST-TEST (TIME 2)	
B66	What did you <u>like</u> about the bone health and nutrition lessons?	
B67	What did you <u>not like</u> about the bone health and nutrition lessons?	
B68	What did you <u>like</u> about the balance exercises?	
B69	What did you <u>not like</u> about the balance exercises?	
B70	On the average how many days of the week do you do the balance exercises (include at the senior center and at home)?	
B71	Have you tried or done any of the following since attending the bone health and nutrition education lessons? (Interviewer: please read each item and circle either YES or NO for item.) • Talked to my doctor about my heel bone mineral density test. YES / NO • Talked to my doctor about osteoporosis. YES / NO • Talked to my doctor about my taking medication prescribed for osteoporosis. YES / NO If yes, name of medication: _____ • Talked to my doctor about exercises that might improve my bone health. YES / NO • Increased my physical activity. YES / NO • Practiced balance exercises at home. YES / NO	

	• Ate more calcium-rich foods. YES / NO Is yes, what are the calcium-rich foods that you ate more of? milk, cheese, yogurt, sardines, canned salmon with bones, collard/mustard/turnip greens Others: please specify_____ • Ate more calcium-fortified foods. YES / NO If yes, what type of calcium-fortified foods that you ate more of? calcium-fortified juice, calcium-fortified cereals, calcium-fortified granola bars Others: please specify_____ • Started taking a calcium supplement. YES / NO • Started taking a vitamin D supplement. YES / NO • Started taking Lactaid milk. YES / NO • Tried using lactase tablets/drops. YES / NO • Adopted at least one of the ways to prevent falls that was mentioned in the Fall prevention and medication lesson. YES / NO • Any other changes which you have made? YES / NO If yes, please specify:_____ (Interviewer: calculate the total number of changes made: _____)	

PARTICIPANT EVALUATION
BONE HEALTH AND NUTRITION

Read each question to the participant and record their answer.
Encourage the participant to answer all questions and to give the best answer they can.

Today's date : _____

Interviewer: _____

Circle one: PRE-TEST (before participants hear the nutrition and health lessons)
POST-TEST (after participants hear the nutrition and health lessons)

C1	Participant ID	____
C2	County	
C3	Age	____ years old
		Circle one
C4	Gender	(0) Male (1) Female
C5	Ethnicity	(1) White (2) Black (3) Hispanic (4) Asian (5) Other
C6a	Have you had a heel Bone Mass Density test done before? (not including the one which we did for you)	(1) Yes (2) No (9) Don't know
C6b	BMD (from heel scan, if performed)	
C7	Weight (in kg)	
C8	Height (in cm)	Standing height: Knee height
C9	BMI (calculate in kg/m^2)	
	FAMILY HISTORY	
C10	Has anyone in your family ever had a fracture or broken bone after age 50?	(1) Yes (0) No (9) Don't know
C11	If yes, who in your family had a fracture or broken bone after age 50?	Mother Father Sister Brother None of the above
	MEDICAL CONDITIONS/MEDICATIONS	
C12	Do you have bone pain?	(1) Yes (0) No (9) Don't know or missing
C13	Has your doctor ever told you that you had osteoporosis?	(1) Yes (0) No (9) Don't know or missing

C14	Have you had a fall within the past 1 year?	(1) Yes (0) No (9) Don't know or missing
C15	Have you had a fracture or broken bone after age 50?	(1) Yes (0) No (9) Don't know or missing
C16	If yes, at what age?	____ years old
C17	If yes, where. Please circle your answer	Please circle your answer Hip Wrist Spine Others (please specify location)
C17 a	Have you been taking excessive thyroid medication or high or prolonged doses of cortisone-like drugs for asthma, arthritis or cancer?	(1) Yes (0) No (9) Don't know or missing
C17 b	(Interviewer: ask this question for FEMALE subjects only) Are you taking hormone replacement therapy such as Raloxifene, Draloxifene, Premarin, Prempo?	(1) Yes (0) No (9) Don't know or missing
	DIET	
C18	Did you drink milk as a child?	(1) Yes (0) No (9) Don't know or missing
C19	Do you currently drink milk?	(1) Yes (0) No (9) Don't know or missing
C20	How many glasses of milk do you drink?	Less than 1 glass per week 1 glass per week 2 glasses per week 3 glasses per week 4 glasses per week 5 glasses per week 6 glasses per week At least 1 glass per day 2 or more glasses per day Don't know or missing
C21	What type of milk do you usually drink?	(1) Skim (2) 1% (3) 2% (4) Whole (5) Buttermilk (9) Don't know or missing
C22	If you used to drink milk as a child but have stopped doing so, at what age did you stop drinking milk?	years old
C23	What type of breakfast cereal do you usually eat?	Brand : Oatmeal Grits Ready-to-eat cereal Don't eat breakfast cereal
C24	How often do you eat breakfast cereal? (Interviewer: breakfast cereal includes oatmeal, grits, ready-to-eat cereals)	Less than 1 time per week 1 time per week 2 times per week

		3 times per week 4 times per week 5 times per week 6 times per week At least 1 time per day 2 or more times per day Don't know or missing
C25	On average, how much milk do you usually eat on cereal each day?	Less than 1 cup per week 1 cup per week 2 cups per week 3 cups per week 4 cups per week 5 cups per week 6 cups per week At least 1 cup per day 2 or more cups per day Don't know or missing
C26	What type of milk do you eat with your cereal?	(1) Skim (2) 1% (3) 2% (4) Whole (5) Buttermilk (9) Don't know or missing
C27	Do you get stomachache, gas, or diarrhea after drinking milk?	(1) Yes (0) No (9) Don't know or missing
C28	How often do you eat yogurt?	Less than once per week 1 time per week 2 times per week 3 times per week 4 times per week 5 times per week 6 times per week At least once per day 2 or more times per day Don't know or missing
C29	Each time you eat yogurt, how much yogurt do you usually eat?	Less than 1/2 cup Between 1/2 cup and 1 cup About 1 cup More than 1 cup Don't know or missing

C30	How often do you eat cheese?	Less than once per week 1 time per week 2 times per week 3 times per week 4 times per week 5 times per week 6 times per week At least once per day 2 or more times per day Don't know or missing
C31	How many servings of cheese do you usually eat? (1 serving=1ounce=1slice)	_____ servings
C32	How often do you eat mustard, turnip, or collard greens?	Less than once per week 1 time per week 2 times per week 3 times per week 4 times per week 5 times per week 6 times per week At least once per day 2 or more times per day Don't know or missing
C33	How often do you eat canned salmon?	Less than once per week 1 time per week 2 times per week 3 times per week 4 times per week 5 times per week 6 times per week At least once per day 2 or more times per day Don't know or missing
C34	Do you eat calcium-fortified foods (such as calcium-fortified orange juice, calcium-fortified cereals - Total, Kellogg's K)?	(1) Yes (0) No (9) Don't know or missing
C35	If yes, what type, how much and how often do you eat calcium-fortified foods?	
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C36	Do you take a vitamin / mineral supplement?	(1) Yes (0) No

C37	If yes, which of the following type of supplements do you take?	Please state brand. multivitamin _____ calcium supplement or any capsule/tablet with calcium_____ vitamin D supplement or any capsule/tablet with vitamin D _____ iron supplement _____ Others. please specify _____ Boost Ensure Other meal replacement. Specify brand.
C38	Do you drink caffeinated beverages such as coffee, tea and cola?	(1) Yes (0) No (9) Missing/Don't know
C39	If yes, what type of beverage, how much and how often do you drink? (cups for coffee and tea; cans for cola)	
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Nutrition Education Program
Participant Evaluation Form
(*Client Satisfaction Form)*

Please Circle Your Answer:

1. How would you rate the quality of the nutrition education program you received?

4	3	2	1
Excellent	Good	Fair	Poor

2. Did you find the nutrition education information to be useful and interesting?

4	3	2	1
Excellent	Good	Fair	Poor

3. Overall, how satisfied were you with the nutrition education program received?

4	3	2	1
Excellent	Good	Fair	Poor

4. Did you learn anything new?

NO YES