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ORIGINAL ARTICLE

Knowledge, attitudes, beliefs, and health behaviors of bone health among Caribbean Hispanic/Latino adults

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Abstract

Summary Few studies have examined knowledge and perceptions of osteoporosis among Caribbean Latino adults. Confusion regarding the term osteoporosis was noted. Doctors were viewed as trusted sources of health information, although descriptions of a paradoxical relationship emerged. This study can be used to inform culturally tailored interventions for osteoporosis prevention.

Purpose The overall goal of this study was to assess knowledge, attitudes, and beliefs of bone health and osteoporosis among Caribbean Latino adults aged ≥ 50 years.

Methods This triangulated mixed methods study included completion of a quantitative questionnaire and participation in one of four focus groups to obtain information on (1) general health, (2) knowledge about bone health and osteoporosis, (3) sources of information about bone health, and (4) prevention knowledge and personal responsibility. Quantitative data were analyzed using SAS, and qualitative data were analyzed using descriptive and structural coding by two independent research members.

Results The majority of participants were female (73%), Dominican (84%), and low income (82% < $20,000) with a mean age of 68.4 (± 8.5) years. Most participants had heard of osteoporosis (90%); however, the majority were not able to accurately describe this chronic condition. Health care providers were viewed as most trusted sources of health information, despite feelings of being rushed during their visits, with limited communication about preventative care. Most participants felt that nutrition and exercise were important for overall health.

Conclusions Caribbean Hispanic adults in this study reported knowledge of osteoporosis and nutritional factors associated with prevention of this chronic condition. However, qualitatively, there was confusion between osteoporosis and other bone and joint conditions. Culturally specific interventions to promote prevention of osteoporosis are urgently needed for this underserved, high-risk population.

Keywords Hispanic/Latino · Osteoporosis prevention · Awareness · Aging

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Introduction

Osteoporosis is a silent disease that often remains undetected until complicated by fracture. Osteoporosis-related fractures pose significant physical and emotional burden to the individual and considerable financial strain for society [1, 2]. According to the most recent (2013–2014) national estimates, osteoporosis and low bone mass affect more than 55.5% (59 million) of US adults aged 50 years and older [3]. Contrary to the commonly held belief that osteoporosis primarily affects non-Hispanic/Latino white women (non-Hispanic white will be used from here on), there is growing evidence that Hispanic/Latino (Latino will be used from here on) men and women have a similar age-adjusted prevalence of osteoporosis as non-Hispanic white men (Latino, 5.9% vs. non-Hispanic white, 6.0%) and women (Latino, 20.5% vs. non-Hispanic white, 17.0%) [3]. Of further concern, the Latino population is projected to have one of the most rapid increases in the incidence of fracture (2.7-fold) and related annual direct medical costs (from $754 million in 2005 to more than $2 billion by 2025) compared with non-Hispanic white and black populations [1].

Osteoporosis prevention is key, as there is no cure for this chronic condition and pharmacological treatment is associated with increased risks and side effects [4–6]. Thus, strategies aimed at preventing and managing osteoporosis through lifestyle modification are ideal. Few theory-based interventions focusing on dietary and physical activity behavior change for bone health have been designed specifically for Latino adults, particularly those of Caribbean origin, likely because of the underlying belief that this population is not at high risk for osteoporosis. There are likely unique risk factors, as well as cultural factors, in this population that need consideration in developing culturally and linguistically tailored interventions targeting bone health. Few studies have investigated knowledge and beliefs of osteoporosis and/or practice of preventative health behaviors in this population [7–9]; however, the majority of these studies collected data using surveys, and to our knowledge, none were conducted among Caribbean Latino adults living on the US mainland. Given that bone status may vary across the Latino subgroups [10], there is a need to assess knowledge and beliefs of osteoporosis and its risk factors among Caribbean Latinos to target prevention efforts in this community.

The objective of this study was to understand the knowledge, attitudes, and beliefs of bone health and osteoporosis, and the facilitators and barriers for improving health behaviors for osteoporosis prevention among Caribbean Latino men and women, using quantitative and qualitative data. This information will provide insight and guidance for researchers and other public health professionals in developing tailored bone health interventions and programs for Caribbean Latino adults living on the US mainland.

Methods

This triangulated mixed methods study included quantitative questionnaires and four semi-structured focus groups with 45 Caribbean Hispanic/Latino adults to obtain information on knowledge, attitudes and beliefs of osteoporosis, and health behaviors related to bone health. This study was approved by the University of Massachusetts Lowell Institutional Review Board.

Study population

A total of 45 participants were recruited through flyers and in-person recruitment from the Senior Center in Lawrence, MA. Participants were included in the study if they were (1) aged 50 years and older, (2) self-reported being of Caribbean Latino Origin, and (3) did not report serious medical conditions that would prevent them from participating in the focus groups. The Lawrence Senior Center serves 200–400 adults per day (> 5000 per year), providing health and social services and referrals to social and educational programs and volunteer opportunities for the community. Those who were interested ($n = 46$) in participating provided the bilingual research staff with contact information. Phone calls were made by the trained bilingual interviewer to screen and invite each person to join the study; one individual was not eligible. All 45 eligible participants provided written informed consent and participated in the focus groups.

Qualitative and quantitative data collection

Qualitative and quantitative data were collected on similar topics at the same time from the 45 Caribbean Latino adults, analyzed separately, and then complemented, as this methodology improves validity through triangulation and convergence of multiple and different sources of information [11]. Four separate focus groups were held in a quiet, private room at the Lawrence Senior Center. All participants provided written informed consent at the beginning of each focus group. A trained bilingual interviewer, as well as a bilingual focus group moderator, was available to explain and answer any questions about the consent forms.

The bilingual moderator administered a *quantitative questionnaire* to participants at the beginning of each focus group. A bilingual interviewer was available to help those who were illiterate to complete the questionnaire. The

questionnaire, developed by the research team, obtained information on sociodemographics, health status, and health-related behaviors, as well as knowledge, attitudes, and beliefs towards osteoporosis. The questionnaire was developed based on an earlier study examining knowledge, beliefs, and risk factors for osteoporosis in Hispanic women [7]. It included a total of 28 questions, organized into four domains: (1) general health; (2) knowledge about bones, bone health, and osteoporosis, (3) sources of information about bone health, and (4) prevention knowledge and personal responsibility (Appendix).

The moderator facilitated each focus group using a moderator's guide to address the four domains described above (Appendix). The moderator's guide was developed by the research team with expertise in bone, nutrition, and policy and health communication and was reviewed for cultural appropriateness and content accuracy. Each focus group was approximately 90 min in length. Focus groups were audio-recorded, and the trained interviewer took notes during each session. Recordings were transcribed verbatim in the original language by a research assistant. Data were analyzed in Spanish to capture any subtle nuances or cultural concepts discussed.

Mixed method analysis

Qualitative analysis In the first phase of the analysis, all transcripts were first read and reviewed by two independent research team members (SA and NM) to identify initial concepts and themes [12]. In the second phase, using descriptive and structural coding [13], SA and NM independently organized the data, whereby participants' responses and text segments were placed into pre-selected nodes based on the four domains of the structured questionnaire.

During the coding process, several themes emerged. For example, *participants were aware that osteoporosis is a disease that affects bone health*, but *participants had limited knowledge of bone health.* Additional themes that emerged were added to existing themes. These included *knowledge of osteoporosis is influenced by personal experience* and *participants obtained bone health information from various sources* (e.g., library, doctor's office, and television). Once concepts and themes were identified and finalized, SA and NM discussed finalized themes to confirm that all a priori and emergent themes were captured by both. Microsoft Office Excel (2013) was used to organize the data analyzed via descriptive and structural coding [13].

Quantitative data from the questionnaires were analyzed using SAS (version 9.4; SAS Institute, Cary, NC, USA). Descriptive statistics were used to describe demographic variables and frequencies for health variables.

Mixed methods analysis Quantitative results were compared with the themes that emerged from the qualitative analysis to examine consistencies and/or discrepancies and broaden the understanding of the results.

Results

The sample consisted of 45 participants, primarily female (73%) with a mean age of 68.4 (± 8.5) years (Table 1). The majority were low income (51% < $10,000 and 82% < $20,000 per year) and were born in the Dominican Republic (84%); 49% were retired, while 22% were currently working. A total of 20% ($n = 9$) reported being told by a doctor that they had osteoporosis, 22% ($n = 10$) thin or weak bones, and 26.7% ($n = 12$) issues with vertebral column (Table 1).

Table 1 Sociodemographic and health characteristics, $N = 45$

	N (%)
Age (years)	68.4 ± 8.5
Female	33 (73)
Marital status	
Married	16 (36)
Single	9 (20)
Divorced/separated	14 (31)
Widowed	6 (13)
Income	
< $10,000	23 (51)
$10,000–$19,999	14 (31)
$20,000–$29,999	2 (4)
≥ $30,000	3 (7)
No answer	3 (7)
Education	
< 5th grade	10 (22)
5th to 8th grade	11 (24)
9–12th grade or GED	7 (16)
Some college/bachelor's degree	8 (18)
No response	9 (20)
Place of birth	
Puerto Rico	7 (16)
Dominican Republic	38 (84)
BMI (kg/m^2)	29
Self-reported diabetes	14 (31)
Self-reported arthritis	21 (47)
Self-reported heart disease	8 (18)
Self-reported osteoporosis	10 (22)

Not all frequencies add to 45 due to missing data

Quantitative results

General knowledge about bones, bone health, and osteoporosis

The majority of participants had heard or read about osteoporosis (90%) or knew someone with osteoporosis (53%) (Table 2). Most (94%) also considered osteoporosis to be a serious disease, and more than two thirds agreed (22%) or strongly agreed (49%) that osteoporosis is as serious as diabetes, heart disease, or cancer.

Sources of information about bone health and osteoporosis

Major sources of information about osteoporosis included health fairs (51%) and the internet (58%); other sources included TV or radio (49%), newspaper or magazine (49%), their doctor (40%), and family, friends, or neighbors (33%) (Table 2).

Prevention knowledge and personal responsibility

While 94% of participants were concerned about getting osteoporosis, 64% perceived a possibility of getting it. Diet (66%) and, to a lesser extent, exercise (44%) were perceived as risk factors for osteoporosis, and while 76% considered that family history was a risk factor, 91% assigned personal responsibility for their bone health (Table 2).

Participants were asked to report the frequency of consumption of nine foods/food groups that were primarily rich in calcium and vitamin D, such as milk, yogurt, nuts, fish, and green leafy vegetables. Overall, participants reported consumption of milk, cheese, and beans/legumes almost daily; broccoli and other green leafy vegetables almost once a week; and yogurt, nuts, and fish almost once a month (Fig. 1). A total of 57.7% ($n = 26$) of participants reported taking a calcium and/or vitamin D supplement.

Table 2 Knowledge and beliefs of osteoporosis, $N = 45$

	N (%)
Has heard or read about osteoporosis	40 (90)
Knows someone with osteoporosis	24 (53)
Sources of information about osteoporosis	
TV or radio	22 (49)
Internet	26 (58)
Doctor	18 (40)
Newspaper or magazine	22 (49)
Health fair	23 (51)
Friends, family, or neighbors	15 (33)
Views osteoporosis as serious as diabetes, heart disease, or cancer	
Not at all	4 (9)
Slightly agree	5 (11)
Agree	10 (22)
Strongly agree	22 (49)
Seriousness of osteoporosis	
Not at all	1 (2)
Some	7 (16)
A lot	35 (78)
Concerns about getting osteoporosis	
Not at all	1 (2)
Some	8 (18)
A lot	34 (76)
Likelihood of getting osteoporosis	
Not at all	8 (18)
Some	18 (40)
A lot	11 (24)
Perceives dietary factors affect bones	
Not at all	10 (22)
Some	11 (24)
A lot	19 (42)
Exercise affects bones	
Not at all	21 (47)
Some	6 (13)
A lot	14 (31)
How responsible are you for your bone health?	
Not at all	2 (4)
Some	4 (9)
A lot	37 (82)
How much does your family history affect your bones?	
Not at all	10 (22)
Some	16 (36)
A lot	18 (40)

Not all frequencies add to 45 due to missing data

Qualitative results from focus groups

Information about bone health and osteoporosis

As noted above, most participants had heard of osteoporosis; however, when asked to describe osteoporosis many described painful bones with deformities, particularly of the hands and fingers. One participant expressed the following:

> "*Los dedos de ella se le deformaron, y entonces dijeron (los doctores) que era una osteoporosis que deformaba. Y ella no podía caminar, ni podía hacer nada, porque ella se deformó completamente.*"
> "Her fingers were deformed, and then [the doctors] said it was an osteoporosis that deformed. And she could not

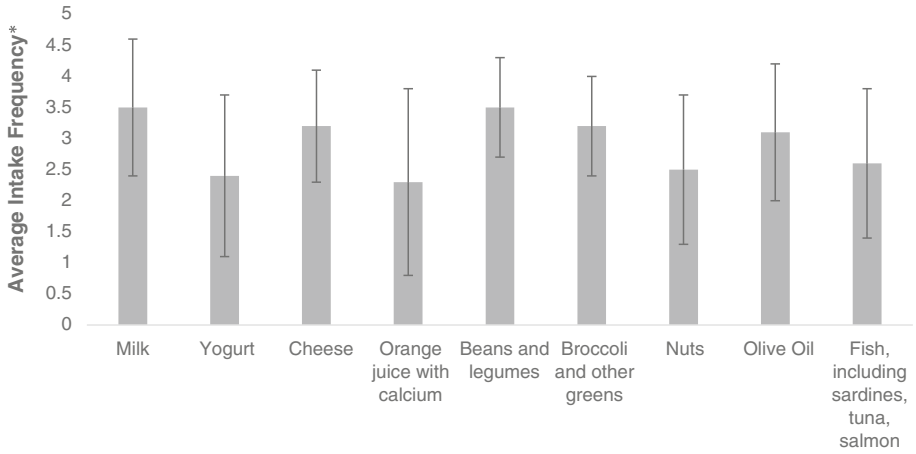

Fig. 1 Mean (standard deviation) of eating habits, intake frequency, range 0–4 ([0] never; [1] < 1month; [2] one time per month; [3] at least 1 week; [4] daily)

walk, nor could do anything, because she was completely deformed."

Information on bone health and osteoporosis gathered from various sources

Participants mentioned specific daytime television shows (*Despierta America*), workshops at senior centers, and their primary care physicians as sources of information about bone health and osteoporosis. Some participants reported being auto-didactic and finding out information in books, going to the library, and conducting searches on the internet. Others reported having heard about osteoporosis in their native countries, mainly those from the Dominican Republic. Medicaid fact sheets mailed to their homes were also cited as accessible sources of health and osteoporosis information.

Paradoxical doctor-patient relationship Medical doctors were viewed as the most reliable and trustworthy source of health information; however, most participants reported that their doctors had not talked with them about osteoporosis. Participants who reported their doctor as their main source of information for osteoporosis were those who reported being diagnosed with the disease.

As participants spoke about confidence in their doctors as the most trusted sources of health information, unexpectedly, descriptions of a paradoxical relationship with doctors emerged. Although, they trusted their doctor's knowledge and competence, most participants felt rushed during visits and did not received detailed information about current medical conditions and/or suggestions of ways for maintaining good health. Some participants expressed the following:

"*Mi médico solamente me dice: ¨Eso es para ayudarte del dolor¨, pero no me dice el por qué.*"
"*My doctor only tells me: That's to help you with the pain, but he does not tell me why.*"

And …

"*..Que casi el médico no informa, el médico tú vas, te examina, te da una receta y ya; como que el médico de aquí escudriña muy poco.*"
"*The doctor doesn't inform. You go, doctor checks you up, gives you a prescription and that's it; it's like the doctors here [U.S.] scrutinize very little.*"

Lack of language concordance was one factor mentioned as a major barrier to speaking freely with their doctors. In addition to language, ethnic concordance was expressed as a factor influencing the quality of the doctor-patient interactions. Some participants reported warmer and more personal interactions with Latino doctors who communicated with them in their native language (Spanish) vs. doctors who communicated in English. For example:

"*cuando uno le hace una pregunta la explicación no es explicita. Por eso es que a mí me gusta buscar un médico que hable mi idioma.*"
"*When one asks a question the explanation is not explicit. That's why I like to search for doctors who speak my language.*"

And…

"*Mi médico no me ha orientado. No sé si es porque el habla otro idioma y yo hablo otro…*"

"*My doctor has not made me aware [of osteoporosis]. I do not know if it's because he speaks one language and I speak another.*"

Messages associated with childhood memories of being told to drink milk Most participants noted recommendations by family members and other authoritative figures during childhood to drink milk for good health and strong bones. Perceptions regarding parent's low education level were reported as a primary reason for lack of knowledge among parents about osteoporosis; however, participants expressed that their parents were knowledgeable about the connection between dietary behaviors and health. Most participants recalled their mothers and/or grandmothers stressing the importance for children to drink milk for good bone health, especially for bone health later in adulthood.

Prevention knowledge

Awareness of nutrition, exercise, and osteoporosis While reported awareness of bone health and the etiology of osteoporosis was limited, it was evident that participants were aware of the importance of nutrition and exercise for overall health. Healthy diets, exercise, and weight control were reported as preventive factors for osteoporosis. The consumption of dairy products and foods high in calcium and vitamin D were mentioned as important nutrients for bone health. When prompted about specific foods that could aid in the prevention of osteoporosis (i.e., reducing risk of osteoporosis), participants mentioned fish, particularly salmon and sardines, milk, and milk products, such as cheese and yogurt. Vegetables, fruit, and nuts, or "*semillitas*," were also mentioned by some participants. Participants placed emphasis on fresh food and the need to avoid junk food and excess red meat. They focused on the importance of dietary habits in early childhood and how that could affect bone health later in adulthood. Participants expressed the following:

"*Yo sé que la osteoporosis, o la enfermedad del sistema óseo viene también con la alimentación. Yo no puedo tomar nada lácteo y siempre mi mamá me decía que yo iba a tener quizá problemas con los huesos, porque como era alérgica a la leche y yo sé que la leche contiene mucho calcio. Entonces, ya yo, mentalmente desde pequeña venía sabiendo de que algún día iba a tener problema con los huesos, pero, como ella me está mencionando, tengo a veces muchos dolores en, en, en mis huesos, quizá también es por eso.*"

"*I know that osteoporosis, or bone system disease is related to your diet. [Since I was a child,] I could not take any type of dairy and my mom would always tell me that I will probably have bone problems...I know that milk contains a lot of calcium. That's why since childhood I knew that one day I would have problems with my bones*".

"*Bueno puede venir de que hay niños que cuando están chiquitos no toman leche… por el calcio. Los niños cuando no toman leche pequeños, pues casi siempre están enfermos, con algún problema y yo digo que será por eso.*"

"*Well, you can get [osteoporosis] because as children … some do not drink milk and do not get calcium. When children do not take milk, they get sick all the time and have health problems, and I would say that may be the reason [of getting osteoporosis]*."

And…

"*Porque mi mamá [que tiene osteoporosis] yo sé que ella casi nunca le gustaba comer cosas que le dan calcio, nunca.*"

"*My mother [who has osteoporosis], I know that she almost never liked to eat food rich in calcium, almost never.*"

And…

"*uno en su juventud se alimenta mal y cuando uno ya está cayendo en la edad, pues entonces todo eso, esos problemas se reflejan.*"

"*(While young) if we continue eating junk food and stuff like that and do not take caution with the types of food we eat, we are exposed to suffer from osteoporosis.*"

Poor dietary habits (e.g., eating junk foods, foods high in fat and salt) were associated with poor bone health, whereas the consumption of fresh and natural foods was positively associated with bone health. As one participant explained:

"*Si seguimos comiendo comida chatarra y esas cosas así y no tomamos precaución en nuestra comida que debemos de comer, estamos expuestos a sufrir de osteoporosis.*"

"*If we keep eating junk food and things like that and we do not take precaution in eating the food that we should eat, we are exposed to suffer from osteoporosis.*"

And…

"*Para mí la osteoporosis da cuando uno se descuida, no se alimenta, no toma leche, no toma calcio, no come vegetales; como ella dijo, falta de fruta, frutas naturales de las que sembramos en nuestro patio.*"
"*To me, osteoporosis occurs when one does not take care of oneself, and does not eat well, drink milk, take calcium, eat vegetables; … lack of fruit [in the diet], natural fruit, the kind you cultivate in your own backyard.*"

While participants overall expressed the importance of physical activity and exercise for good health, only a small proportion described a positive link between physical activity and bone health. Some viewed the lack of physical activity, common in their communities, as a risk factor for osteoporosis. One participant particularly expressed:

"*También una persona que sea ociosa, que no haga ejercicio, puede obtener la osteoporosis*"
"*Also a person who is lazy, who does not exercise, can get osteoporosis*"

Misinformation related to osteoporosis prevention As participants spoke about the relationships between nutrition, physical activity, and osteoporosis, inconsistencies and misinformation regarding osteoporosis prevention emerged. Most participants reported basic knowledge regarding food sources of calcium and vitamin D. Some participants referred to vitamin D as the "sun" vitamin and mentioned the need to take supplements due to lack of direct sunlight in the northeast. However, most were not very clear about dietary sources of vitamin D.

In contrast, participants were familiar with calcium sources. Milk and other dairy products were the most common sources of calcium mentioned. Green vegetables, nuts, and fish were also listed as sources of calcium. Orange juice was frequently cited as a good source of calcium; however, most participants did not seem to be aware that calcium is added to orange juice through fortification.

Most participants agreed that "*el ejercicio es muy bueno para los huesos*" ("*exercise is very good for the bones*"). However, they could not provide a concrete reason, nor describe the mechanism as to why or how physical activity is beneficial for bone health. Walking and Zumba classes were reported as preferred ways of engaging in physical activity.

Personal responsibility

Individuals have a personal responsibility for one's health The majority of participants expressed that personal responsibility was one of the most important factors for an individual's current health status. Participants described this responsibility as educating oneself and seeking information (especially after the diagnosis of a disease), prioritizing asking questions at the doctor's office, and following through with recommendations provided by doctors. Participants also expressed that self-motivation and dedication are important. Participants stated that an individual's "*voluntad*" (will), "*interes*" (interest), and "*autoestima*" (self-esteem) could influence one's self-motivation and dedication to engaging in healthy lifestyle behaviors.

Barriers to a healthy lifestyle While participants agreed that personal responsibility is a major factor in one's own health status, they recognized contextual factors that can inhibit or support an individual's ability to prioritize their health. Lack of control or motivation to follow a healthy diet and engage in frequent physical activity were viewed primarily as individual failures. However, when prompted about barriers that would inhibit individuals to engage in healthy lifestyle behaviors, contextual factors, such as the high price of good quality, healthy foods (e.g., fresh fruit and vegetables), and lack of information and knowledge (e.g., low education level, limited awareness of disease), were viewed as major barriers. For example:

"*La gente fracasa por falta de conocimiento.*"
"*People fail for lack of knowledge.*"

And…

"*Y a veces uno puede ser responsable, pero también la falta de información que uno no tiene quizá a uno lo hace irresponsable también.*"
"*Sometimes one can be responsible, however lack of information can cause someone to be irresponsible.*"

Participants also mentioned lack of "open-mindedness" to trying different foods or changing dietary behaviors, such as eating more green leafy vegetables and reducing portion sizes of rice, plantains, white bread, and other starches. Lack of planning ahead and scheduling time to cook healthy meals at home, along with finding time during the day to engage in physical activity, were also mentioned as barriers. Interestingly, some participants mentioned the high prevalence of a "sweet tooth" among Latinos, and a low tolerance

for drinks and desserts with lower or no sugar content, as a major barrier to reducing intake of foods and drinks that are higher in sugar.

Use of vitamins, minerals, and other herbal or natural supplements Most of the participants who consumed supplements consumed these products based on their doctor's recommendations. The most commonly consumed vitamin and/or mineral supplements included calcium and vitamins C, D, and E. Those who did not consume supplements expressed that there was no need when following a healthy diet. Some described advice given to them from their doctors in their native country, whereby it was recommended to consume a diet rich in a variety of healthy foods, instead of consuming supplemental forms of vitamins and minerals. Regarding the use and consumption of other herbal/natural supplements, some mentioned consuming fruit and/or vegetable homemade drinks, both hot and cold, to promote good health. Others mentioned consuming homemade remedies to alleviate colds or other medical symptoms.

Discussion

This mixed methods study explored in-depth the perceptions and experiences regarding bone health and osteoporosis among older Latino adults. While participants reported high knowledge of osteoporosis, as assessed by a quantitative questionnaire, when asked qualitatively, participants often confused osteoporosis with other bone and join conditions, suggesting limited knowledge of this chronic health condition. Further, our findings indicate the need for doctors and other health care providers, who are viewed as the most trusted sources of health information in this population, to offer clear and culturally tailored prevention information about bone health. This is particularly important, as the majority of participants reported obtaining information about bone health after being diagnosed with osteoporosis.

There is a need to increase awareness and knowledge of osteoporosis, particularly among Caribbean Latino adults, as this population presents with a higher or similar prevalence of osteoporosis as compared with non-Hispanic whites [14]. In the current study, most participants had heard of osteoporosis and the majority agreed or strongly agreed that osteoporosis is a serious disease. This is in contrast to an earlier study that found that Latino women were more concerned with developing heart disease, diabetes, and cancer than osteoporosis [7]. A high level of confusion regarding the severity, prevention, and treatment of osteoporosis among individuals has been reported in different populations [15], with some studies reporting limited knowledge of osteoporosis and/or confusion regarding risk and prevention [16, 17] and others documenting significant concerns with developing osteoporosis [18]. More importantly, most of the participants reported having knowledge of osteoporosis when assessed through questionnaire, but, qualitatively, many participants did not accurately describe osteoporosis. This suggests familiarity with the term "osteoporosis," but confusion regarding pathophysiology of this chronic condition. In one of the few previous studies among Hispanics, Geller and Derman [7] found that 70% of Hispanic and African American women knew what osteoporosis was based on a quantitative multiple choice question. However, as in two other studies in Hispanic adults, knowledge and attitudes about osteoporosis were not assessed qualitatively [8, 9]. Studies of other groups of older adults have also reported confusion when describing osteoporosis, with many describing manifestations of arthritis, consistent with our findings [19]. This is plausible, as it is estimated that over 3.1 million Latino adults have arthritis, with Puerto Rican and Dominican adults experiencing the highest prevalence across the Latino subgroups [20]. Irrespective of the differences in prevalence among Latino subgroups, measures of arthritis-attributable effect indicate that this condition significantly impacts the lives of all Latino adults [20], which may explain the confusion with osteoporosis, an asymptomatic condition.

Similar to our findings, others have reported that Latino adults view their health care providers as experts of medical information [21]. While most participants trusted health care providers, they expressed feelings of being rushed during visits and receiving inadequate information on current medical conditions or on preventative care. Participants in the current study reported a low active role in their patient-physician interactions, consistent with other studies of Latino patients [22, 23]. Factors related to a low active patient role may be related to participant's low acculturation level, lack of familiarity with the US health care system, speaking Spanish only, and/or being foreign born [22, 23]. Patient activation interventions, by which patients develop specific skills on question formulation and collection of health-related information, may be an effective mechanism to increase patient activation and reduce health disparities in health care services access and quality among Latinos [22]. In addition, interventions aimed at clinicians and staff around building rapport that focus on qualities such as compassion, caring, kindness, and cultural sensitivity, has been shown to be important among Latino patients for increasing patient-physician communication [24].

An additional complication to providing education on osteoporosis includes an observed tendency for Latino adults to rely primarily on same day appointments rather than planned preventative visits and to receive care to address symptomatic problems rather than for prevention of chronic conditions [25]. Strategies for helping patients keep scheduled appointments may be needed, as Latino adults have been shown to be at high risk of missing planned primary care appointments [25]. Because of the trust in physicians and health care providers, primary care may be a targeted location for bone health interventions in this population, a model recommended by the US Preventative Services Task Force for the prevention of cardiovascular disease [26]. Fostering positive and culturally sensitive patient-provider relationships may also improve appointment keeping among this population [27].

Diet and exercise are important modifiable risk factors for bone health and were viewed as important for overall heath by the majority of participants in the current study. Dietary calcium and vitamin D were mentioned as the primary nutrients important for bone health, which is not surprising given that much of the research on diet and bone has focused on these nutrients [28–30], although other nutrients and foods have also been shown to be important for bone health [31–35]. Many factors, such as cultural beliefs and traditions, acculturation, food availability, and socioeconomic status, influence dietary intake [36, 37]. Recent data from the Hispanic community Health Study/Study of Latinos shows variation in dietary intake across Latino subgroups, with the lowest intake of folate, iron, and calcium for Dominicans and lowest intakes of vitamin C and fiber for Puerto Ricans, compared to the other groups [37]. This population typically consumes diets rich in starchy root vegetables and fried meats and low in fruit and vegetables, which likely contributes to low intakes of vitamins and minerals important for bone [37, 38]. Data from the National Health Interview Survey showed that fewer Latino adults met CDC recommendations for physical activity compared with non-Hispanic whites [39]. These results suggest that although poor dietary quality and sedentary behavior may have significant adverse effects on bone health, knowledge that this negatively impacts bone is not sufficient for changing behavior. To our knowledge, the formulation and use of theory-based, culturally tailored materials and interventions aimed to reduce risk of osteoporosis have not yet been done in this population.

The quantitative results reflected the content of the four themes identified in the qualitative analysis. Mainly, high levels of awareness about osteoporosis and perceptions that arise from personal experiences with the disease. Results from the focus groups expanded and added specific information about participant's knowledge, attitudes, and behaviors related to osteoporosis' causes and prevention. While most of the participants knew about osteoporosis, focus group results revealed inconsistencies and confusion about the nature of the disease that conflicted with their preventive strategies. In addition, the qualitative data expanded knowledge about perceptions of interactions with doctors, which they highly valued but did not consider offered timely and sufficient preventive information about osteoporosis.

Our study has several limitations that should be considered. This study included only individuals who self-identified as Puerto Rican or Dominican, and therefore, generalizability to other Latino subgroups may be limited. Demographics of our sample were similar to those of all participants at the Senior Center (69% female, 81.1% Hispanic, 32% aged 60–70 years). Questions on dietary intake were limited to frequency of consumption of nine foods and/or food groups due to time constraints. This does not provide a comprehensive assessment of overall dietary quality; however, future research is needed to examine the relationship between dietary quality and bone health in this population. Lastly, the majority of participants were female, consistent with other studies of Caribbean Latino older adults [40].

In conclusion, this study identified several important themes with respect to bone health in this underserved and underrepresented population. There were discrepancies between self-reported knowledge of osteoporosis and nutrition-related factors assessed through quantitative and qualitative methods. These suggested poor understanding of what osteoporosis is and a need for education and prevention initiatives in this population. There were unique perspectives about osteoporosis that can be incorporated into current health care practices and culturally tailored interventions to promote bone health for this population. Careful consideration of the views of doctors and use of health care services are needed to develop future relevant interventions.

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Compliance with ethical standards

This study was approved by the University of Massachusetts Lowell Institutional Review Board.

Conflicts of interest None.

Appendix. Quantitative questionnaire and focus group moderator guide

<table>
<tr><th colspan="2">SHORT QUESTIONNAIRE</th></tr>
<tr><td colspan="2">TODAY'S DATE _____/_____/_____ Study ID: _____</td></tr>
<tr><td>Birthdate: _____/_____/_____

Sex: 1. Male
2. Female</td><td>Your approximate Weight: _____pounds
Your approximate Height: _____feet ____in</td></tr>
<tr><td colspan="2">What was the last grade you completed in school: _____</td></tr>
<tr><td>Marital Status:
1. Married
2. Single
3. Divorced
4. Separated
5. Widowed
6. Other_____</td><td>What is your annual household income?
1. Less than 10,000
2. 10,000-19,999
3. 20,000-29,999
4. 30,000-39,999
5. 40,000-49,999
6. 50,000-59,999
7. 60,000-69,999
8. 70,000 or more</td></tr>
<tr><td>Place of Birth
1. U.S. mainland
2. Puerto Rico
3. Dominican Republic
4. Cuba
5. Central America
6. South America
7. Mexico
8. Other_____</td><td>Employment:
1. Work full-time
2. Work part-time
3. Do not work, looking for work
4. Physical or mental health condition prevents you from working
5. Retired
6. Other _____</td></tr>
</table>

HEALTH QUESTIONS

Has your physician ever told you that you have: (please circle all that apply)

1. Diabetes? Yes No
   If yes, do you take medication? Yes No
2. High blood pressure? Yes No
   If yes, do you take medication? Yes No
3. Cancer? Yes No
   If yes, do you take medication? Yes No
4. Arthritis? Yes No
   If yes, do you take medication? Yes No
5. Heart Disease? Yes No
   If yes, do you take medication? Yes No
6. Osteoporosis? Yes No
   If yes, do you take medication? Yes No
7. Weak or thin bones, or any other problem with your bones? Yes No
   If yes, do you take medication? Yes No
8. Problems or issues with your vertebral column or your vertebrates? Yes No
   If yes, do you take medication? Yes No
9. Other (specify)_____ If yes, do you take medication? Yes No

Do you know what osteoporosis is?

1. Yes
2. No

Have you heard or read about osteoporosis before?

1. Yes ➔ from where have you heard or read about osteoporosis?
   a. TV
   b. Radio
   c. Internet
   d. Doctor's office or health center
   e. Newspaper/magazine /Brochure / handout
   f. Health fairs
   g. Friends/family/neighbors/acquaintances
2. No

Do you know anyone who has **osteoporosis**?

1. Yes ➔ what is your relationship to this person? a. family, b. friend, c. neighbor, d. acquaintance
2. No

Now we would like to get your opinion on some health and diet issues. **Please indicate your response to the following statements/questions by crossing out or circling the number which most corresponds to your evaluation.**				
How much do you agree with this statement: Osteoporosis is as serious as diabetes, heart disease, or cancer.	0 not at all	1 Slightly agree	2 agree	3 Strongly agree
How concerned are you about getting osteoporosis?	0 not at all	1 Some		2 A Lot
How likely are you to get osteoporosis?	0 not at all	1 Some		2 A Lot
How serious is osteoporosis?	0 not at all	1 Some		2 A Lot
How much would you say what you eat affects your bones?	0 not at all	1 Some		2 A Lot
How much would you say your daily exercise affects your bones or bone health?	0 not at all	1 Some		2 A Lot
How responsible are you for your bone health?	0 not at all	1 Some		2 A Lot
How much would you say your genes/family history affect your bones or bone health?	0 not at all	1 Some		2 A Lot

Eating habits						
How often do you drink milk? 	0 Never	1 less than once per month	2 Once per month	3 at least once per week	4 daily
How often do you eat yogurt? 	0 Never	1 less than once per month	2 Once per month	3 at least once per week	4 daily
How often do you eat cheese? 	0 Never	1 less than once per month	2 Once per month	3 at least once per week	4 daily
How often do you eat beans or legumes? 	0 Never	1 less than once per month	2 Once per month	3 at least once per week	4 daily
How often do you eat nuts? 	0 Never	1 less than once per month	2 Once per month	3 at least once per week	4 daily
How often do you eat broccoli or other greens? 	0 Never	1 less than once per month	2 Once per month	3 at least once per week	4 daily
How often do you drink orange juice with calcium? 	0 Never	1 less than once per month	2 Once per month	3 at least once per week	4 daily
How often do you eat any of the following types of fish? sardines, tuna, salmon 	0 Never	1 less than once per month	2 Once per month	3 at least once per week	4 daily
How often do you eat olive oil? 	0 Never	1 less than once per month	2 Once per month	3 at least once per week	4 daily

Dietary attitudes				
In general, would you say that your **health** is:	0 Poor	1 Good	2 Very good	3 Excellent
How important to you is it that the foods you usually eat are healthy?	0 not at all	1 Somewhat	2 Moderately	3 Extremely
How much would you say that you make a conscious effort to try to eat healthy?	0 not at all	1 Somewhat	2 Moderately	3 Extremely

Would you like to change any aspects of your eating?

1. No
2. Yes ➔

If yes, what are the most important things that stop you from making these changes to your eating?

1. taste
2. convenience
3. familiarity
4. safety
5. freshness (how well the food keeps)
6. nutrition knowledge
7. price
8. sweets and other food helps me cope with stress
9. time to prepare

Do you take vitamin and/or mineral supplements?

1. No
2. Yes ➔

   Do you take calcium and vitamin D in a combined or multivitamin supplement? Yes No

   Do you take a calcium only supplement? Yes No

   Do you take a vitamin D only supplement? Yes No

Do you take an herbal or other natural supplement?

1. No
2. Yes ➔ Does your doctor know your take these supplements? Yes No

Focus group moderator guide: knowledge of bone health in Hispanic older adults

1. Facilitator's welcome (1–2 min)

Introduce yourself and the note taker and send the Sign-In Sheet with a few quick demographic questions around to the group while you are introducing the focus group.

"*Welcome and thank you for volunteering to take part in this focus group. You have been asked to participate as your point of view is important. I realize you are busy and I appreciate your time.*
My name is _____ and I am the moderator today."

2. Introduction and instruction to participants (1–3 min)

Ask the group if anyone has participated in a focus group before. Explain that focus groups are being used more and more often in health and human services research.

About focus groups.
"*The purpose of this focus group discussion is to learn from you about your thoughts, feelings, and what you have heard/read about your bones and your bone health. We hope to learn things that we can use to improve knowledge and behaviors related to bone health in the Latino community. In this group, we are doing both questionnaires and focus group discussions. The reason for using both of these tools is that we can get more in-depth information from a smaller group of people in focus groups. This allows us to understand the context behind the answers given in the written survey and helps us explore topics in more detail than we can do in a written survey.*"

3. Administer and collect questionnaire (10–15 min)
4. Ground rules and logistics (3–5 min)

Discuss and agree with participants on the following rules.

- *The most important rule is that only one person speaks at a time. There may be a temptation to jump in when someone is talking but please wait until they have finished.*
- *There are no wrong answers; we are looking for different points of view. You can speak up whether you agree or disagree. We would like everyone to participate, and I may call on you if I have not heard from you in a while*
- *Information provided in the focus group must be kept confidential. What is said in this room stays here. We want everyone to feel comfortable sharing when sensitive issues come up.*
- *Stay with the group and please do not have side conversations.*
- *We will be tape recording the group. We want to capture everything you have to say. We will not identify anyone by name in our report. You will remain anonymous.*
- *Turn off cell phones if possible.*
- *Does anyone have any questions? (answers)*

Logistics

- *The focus group discussion will take will last about 1 h (60 min.).*
- *Feel free to move around.*
- *Where is the bathroom? Exit?*
- *Help yourself to refreshments.*

(**Turn on the recorder**)

5. Warm up (5–10 min)

"*Please take the first few minutes to get to know the person seated next to you. I'm going to ask you to introduce him/her to the group. I'd like you to tell us something about that person such as their interests and hobbies.*"

6. Guiding questions

General knowledge about bones, bone health, and osteoporosis (10–15 min)

- What do you know about bone health?
- What do you know about osteoporosis?
- How do you get osteoporosis?
- How concerned are you about getting osteoporosis?
- What are the chances you will get osteoporosis?
- How serious is osteoporosis? Would you say osteoporosis is as serious as diabetes, heart disease or cancer? Why?

Sources of information about bone health (5–10 min)

- Where have you read or heard about osteoporosis?
- What has your doctor/provider told you about osteoporosis?
- What types of messaging have you seen or heard about osteoporosis—this could be anything, for example a billboard, or a pamphlet from your doctor, or a telenovela?
- If I say "Got-milk?" or "Toma Leche," does that remind you of something?

- Where do you get information about health?
- What sources of health information do you trust more?
- Would you feel comfortable asking your doctor/provider about your bones? Probe: Why/why not?

Prevention knowledge (5–10 min)

- How can you prevent osteoporosis?
- How much does your diet affect your bones?
- What can you eat to help your bones?
- What kinds of food have calcium?
- What kinds of food have vitamin D?
- How does regular exercise affect your bones?

Personal agency (10–15 min)

- How personally responsible is a person for getting osteoporosis?
- If there is a history of osteoporosis in your family, what kind of things can you do to prevent getting osteoporosis?
- How often do you eat calcium-rich foods, like milk, etc.?
- If eating more nutritious food helps your bones, what would it take for you to eat more nutritious foods, particularly those rich in calcium and Vitamin D? *if not mentioned, probe about taste, convenience, familiarity, safety, freshness (how well the food keeps), nutrition knowledge, price, sweets and other food helps me cope with stress, time to prepare*
- If exercising more minutes/hours per day helps your bones, what would it take for you to exercise at least 30–45 min a day?
- What's stopping you from [eating more nutritious foods] [exercising more]?
- How confident are you that you can [eat more nutritious foods] [exercise more]?
- Do you regularly take vitamin and mineral supplements? Why do or do not you?
- Do you regularly take herbal or other natural supplement? Why do or do not you?

Use of technology (1–2 min)

Ask for a show of hands as a "yes" response to the following questions. Research assistant will tally counts for each response.

- Do you use your mobile phone to text with other people?
- Do you use a smart phone to use apps?
- Do you use email?
- Do you use social media, like Facebook?

Concluding remarks (1–5 min)

- *Thank you for participating. This has been a very successful discussion*
- *Your opinions will be a valuable asset to the study*
- *We hope you have found the discussion interesting*
- *If there is anything you are unhappy with or wish to complain about, please contact me xxxxxx @ xxx-xx-xxxx*
- *I would like to remind you that any comments shared today will remain anonymous*
- *Before you leave, please hand in your completed personal details questionnaire*

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