

## Original Research

# Comparing the T scores from bone sonometer measurements in Hispanic and non-Hispanic white women

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### ABSTRACT\*

Ethnicity is an important risk factor for the development of osteoporosis. Non-Hispanic white or Asian women are commonly considered at higher risk than other ethnicities. Hispanics in the U.S. are of Mexican, Caribbean, Central American, or South American descent. Conclusive data on the relative risk of osteoporosis in Hispanic women based upon heritage within the Hispanic population are not available.

**Objective:** To investigate whether Hispanic white women are at a significantly lower risk than non-Hispanic whites for the development of osteoporosis.

**Methods:** Cross-sectional study. **Setting:** Community health screenings. **Participants:** Hispanic and non-Hispanic white women.

**Intervention:** Bone density measurements of the non-dominant heel. **Descriptive statistics and inferential statistics including regression analyses** were performed using SPSS 14.0. **Main Outcomes Measure:** T scores.

**Results:** Overall, measurements were obtained from 352 women (209 Hispanic & 143 non-Hispanic white) ranging in age from 55-97 years old. The mean T score obtained for Hispanic women was -1.194 and -1.280 for non-Hispanic white women. The correlation between the obtained T score and age was negative ( $r = -0.36, p < 0.01$ ), reflecting bone loss with increasing age. Regression analysis using age and ethnicity showed that ethnicity was a non-significant contributor to the best-fit regression line ( $t = 0.60, p = 0.55$ ).

**Conclusion:** This study indicates that Hispanic white women may be at comparable risk of developing osteoporosis as non-Hispanic white women.

**Keywords:** Osteoporosis. Ethnic Groups. Regression Analysis. United States.

### RESUMEN

La etnia es un importante factor de riesgo para el desarrollo de la osteoporosis. Las mujeres blancas o asiáticas están consideradas como de mayor riesgo que otras etnias. Los hispanos en los Estados Unidos son descendientes de mejicanos, caribeños, centro o sudamericanos. No están disponibles datos concluyentes del riesgo relativo de osteoporosis en mujeres hispanas en base a la herencia en la población hispana.

**Objetivo:** Investigar si las mujeres hispanas blancas tienen significativamente menor riesgo de desarrollar osteoporosis que las blancas no hispanas.

**Métodos:** Estudio transversal. **Ámbito:** cribado de salud comunitaria. **Participantes:** Mujeres blancas hispanas y no hispanas. **Intervención:** medidas de densidad ósea en el talón no dominante. Se realizó estadística descriptiva e inferencial, incluyendo un análisis de regresión, utilizando SPSS 14.0.

**Variables de resultados principales:** T score.

**Resultados:** Se obtuvieron medidas de 352 mujeres blancas (209 hispanas y 143 no hispanas) que oscilaban entre 55-97 años. La media de T score obtenido de las mujeres blancas hispanas fue de -1,194 y el de las no hispanas de -1,280. La correlación entre el T score obtenido y la edad fue negativa ( $r = -0,36, p < 0,01$ ), reflejando que la pérdida de peso aumenta con la edad. El análisis de regresión usando edad y etnia mostró que la etnia no era un contribuidor significativo para un mejor ajuste de la línea de regresión ( $t = 0,60, p = 0,55$ ).

**Conclusión:** Este indica que las mujeres blancas hispanas tienen un riesgo comparable de desarrollar osteoporosis que las mujeres blancas no hispanas.

**Palabras clave:** Osteoporosis. Grupos étnicos. Análisis de regresión. Estados Unidos.

(English)

### INTRODUCTION

A 2004 report of the Surgeon General states that 10 million Americans over the age of 50 have osteoporosis, and another 34 million are at risk for developing this debilitating disease. The World Health Organization (WHO) defines osteoporosis as a T score for measured bone mineral density below -2.5 standard deviations of the mean of young adult controls.<sup>1</sup> Annually, roughly 1.5 million people in the U.S. suffer a bone fracture related to osteoporosis.

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Hip fractures account for 300,000 hospitalizations each year. It is estimated that approximately 20 percent of senior citizens who suffer a hip fracture die within a year of fracture and roughly the same percentage of individuals with a hip fracture is placed in a nursing home within a year.<sup>2</sup> A recent study by Kern et al. suggests a direct association of population-based screenings for osteoporosis with fewer incidents of hip fractures.<sup>3</sup> These findings underscore an unmet need to identify women who are most likely to fracture a bone. A study of postmenopausal white women enrolled in the National Osteoporosis Risk Assessment (NORA) reported more than half (52%) of women who experienced an osteoporotic fracture within 1 year had a bone mineral density T score that showed osteopenia, but not osteoporosis.<sup>4</sup> The direct care costs for osteoporotic fractures alone have been estimated to amount for \$18 billion each year.<sup>5</sup> This economic burden is expected to increase if action to prevent osteoporosis is not taken.

Ethnicity is an important risk factor for the development of osteoporosis. A common perception is non-Hispanic white or Asian women are at higher risk than Hispanic women. A frequently referenced statement from the National Osteoporosis Foundation (NOF) is: "Caucasian and Asian women are more likely to develop osteoporosis. However, African American and Hispanic women are at significant risk for developing the disease".<sup>5,6</sup> Studies investigating bone-mineral-density (BMD) and fracture risk in women of different ethnicities have revealed conflicting evidence regarding osteoporosis risk.<sup>7</sup> NORA results indicate that Hispanic women are at higher risk for developing osteoporosis than non-Hispanic white women.<sup>4,8,9</sup> However, NHANES III data suggest a slightly lower risk for Hispanic women of developing osteoporosis than for non-Hispanic white women based upon higher BMD measurements.<sup>10,11</sup> Two studies comparing non-Hispanic white and Hispanic white women found these two groups to have comparable levels of femoral BMD but a reduced risk for hip fractures in non-Hispanic white women.<sup>10,12</sup> Barrett-Connor and colleagues describe differences in BMD in women from five ethnic groups and found slightly lower BMD in Hispanic women compared to white women.<sup>13</sup>

General guidelines need refinement to reflect changing population dynamics. The NOF reports that "10 percent of Hispanic women aged 50 (half the percentage of non-Hispanic white and Asian women) and older are estimated to have osteoporosis, and 49 percent are estimated to have low bone mass. Twenty percent of non-Hispanic white and Asian women aged 50 and older are estimated to have low bone mass".<sup>5</sup> These statistics raise the question of appropriate osteoporosis prevention in Hispanic white women who are of Caucasian descent.

Early detection is critical to prevent the debilitating consequences of osteoporosis. Osteoporosis can be effectively treated if it is detected before significant bone loss has occurred; thus, screening is of utmost importance. If health care providers

and the public mistakenly believe that Hispanic women are at lower risk for this disease, opportunities for appropriate prevention may be forfeited. A recent article discussing clinical issues related to osteoporosis screening highlighted the importance of routine BMD measurements in all women over the age of 65 and in individuals who have had a fragility fracture. "Compliance with this recommendation alone would be a great advance in comparison with current practice".<sup>14</sup> A review of professional continuing medical education articles confirms that misperceptions about appropriate screening are being propagated.<sup>15</sup>

Between 36-49% of older Hispanic women (age  $\geq 50$ ) of Mexican heritage have experienced significant loss of bone density. NHANES III data indicate that 13-16% of these women (100,000) already have osteoporosis.<sup>16</sup> Hispanics in the United States are themselves a diverse group coming from Mexican, Caribbean, Central American, or South American descent. Work by Geller and Derman suggests that African-American and Hispanic women were less educated in behaviors that promote and maintain optimal bone mass. The authors concluded that women of these ethnicities are less likely to practice appropriate lifestyle and dietary habits to decrease their risk of osteoporosis. Adequate daily dietary calcium intake was found in less than 10% of women in the study, with "only 13% taking daily calcium supplements to augment this deficit and less than one-half of women exercising at a minimal level of 20 minutes/3 times a week".<sup>17</sup> This group also had limited knowledge of osteoporosis and perceived this condition to be less of a health threat than breast cancer, heart disease, diabetes, or Alzheimer's disease. Few perceived their ethnicity to be a factor to consider in assessing the risk of osteoporosis.

Previous studies had shown that Hispanic women, along with non-Hispanic white women, consume less calcium than the recommended dietary allowance in all age groups. Research findings from a study conducted by Tranquilli et al. suggest that the dietary intake of calcium, phosphorus and magnesium is significantly reduced in osteoporotic women and correlated with bone mineral content. Dietary studies show calcium and magnesium intakes were even lower than the recommended daily allowance in women with normal bone density.<sup>18</sup>

Another area of concern arises from the aging of the global population. Since the likelihood of osteoporotic fracture increases with age and loss of bone density, it is estimated that the number of hip fractures worldwide will increase sharply over the next half century, especially in Asia and Latin America. In the U.S., the Hispanic population is growing at a faster rate than the non-Hispanics: For the projection period between 1995 to 2025, Hispanics account for 44 percent of the growth in the Nation's population (44 percent of a total of 72 million persons added to the Nation's population). The Census Bureau estimates the Hispanic population will nearly triple between 1995 and 2050.<sup>19</sup>

The present study focuses on Hispanic women in South Florida, whose risk for osteoporosis may be different from the Mexican American population of previous studies with the specific objective of determining whether Hispanic white women are at a significantly lower risk than non-Hispanic whites for the development of osteoporosis.

## METHODS

Bone density measurements were used to assess the osteoporosis risk in Hispanic women in South Florida. Data were collected during several community health screenings attended by at least one of the authors. Booths were set-up at health fairs and anyone could approach for testing free of charge. Most of the health fairs were conducted in areas of high concentrations of Cuban Americans. Cuban Americans are dissimilar from Mexican Americans in that they are of Caucasian heritage instead of native Central American (e.g. Mayan, Aztec). The research project was reviewed and approved by the Institutional Review Board of 'blinded' University. Each subject self-reported gender, age, and ethnicity. In addition, the health screener visually confirmed the gender and ethnicity reported by the participants. Bone density measurements were performed on each subject's non-dominant heel by asking each subject which hand they write with. Measurements were taken using a Hologic Sahara Bone Sonometer by individuals who had received training in the proper use of the bone sonometer. T scores were obtained directly from instrument readings subsequent to calibration; data were entered into Microsoft Excel by two of the researchers.

Descriptive, as well as, inferential statistics were used to analyze the data. An independent t-test was used to determine statistically significant differences between the groups and subsequent correlation analysis was performed to investigate the relationship between T scores and age. Stepwise regression analysis was used to obtain the impact of ethnicity independent of age effects. All statistical analyses were carried out using SPSS version 14.0.

## RESULTS

Four hundred and four total bone density measurements were performed. Data are presented for 352 women of which 209 were Hispanic and 143 were non-Hispanic whites. Excluded from this analysis were results from males and women of other ethnicities. Study participants ranged from 55 to 97 years of age with a mean of 70.1 (SD=9.8). The mean age of Hispanics was 68.5 (SD=8.5) years, while the mean age of non-Hispanic white was 72.4 (SD=11.1) years ( $t = -3.88, p < 0.01$ ). The correlation between the obtained T scores and age was negative ( $r = -0.36, p < 0.01$ ), reflecting bone loss with increasing age. The T scores by ethnicity and age category are contained in Table 1.

The overall mean T score for the sample was -1.23 with a standard deviation of 1.04. The mean T score obtained for Hispanic women was -1.194 (SD= 0.93) and -1.280 (SD= 1.18) for non-Hispanic white women. The regression coefficient for the linear regression employing both age and ethnicity was non-significant for ethnicity ( $t = 0.60, p = 0.55$ ). A retrospective statistical power analysis revealed greater than 90% power to detect a change in  $R^2$  of 0.05.

Age (Yrs)	n	Overall Mean (SD)	Hispanic Mean (SD; n)	Non-Hispanic White Mean (SD; n)
51-60	69	-0.800 (0.946)	-1.011 (0.837; 44)	-0.428 (1.026; 25)
61-70	130	-1.04 (0.939)	-1.086 (0.889; 87)	-0.955 (1.039; 43)
71-80	88	-1.48 (0.969)	-1.360 (0.884; 55)	-1.667 (1.083; 33)
> 80	65	-1.73 (1.146)	-1.561 (1.228; 23)	-1.829 (1.102; 42)

\*T scores obtained from heel scans using a Sahara Bone Sonometer. SD= standard deviation

## DISCUSSION

The results suggest that women in this study, regardless of ethnicity, are at comparable risk of developing osteoporosis. Although non-Hispanic white or Asian women are commonly considered being at higher risk than Hispanic women, many Hispanic women in South Florida are of Hispanic white (Caucasian) heritage and, based on the results of this study, at least at the same risk of developing osteoporosis as non-Hispanic white women.

Consistent with other studies,<sup>10,12</sup> the correlation between the obtained T scores and age was negative, reflecting bone loss with increasing age. Differences in age distribution between groups were accounted for by conducting regression analysis. Interestingly, our data indicate a slower progression of bone loss in Hispanic women than non-Hispanic

white women. The observed slower progression of bone loss in Hispanic white women appears to be consistent with the decreasing femur neck BMD levels in Mexican American women versus non-Hispanic white women described by Looker et al. However, these results are based upon different bone sites and data collection techniques. Further research should be conducted to confirm or refute this finding.

Participants presented themselves to undergo osteoporosis screening or not; and thus, were not randomly selected from the population. Another limitation of this study lies in the lack of certainty regarding participants' ethnicities. Even though visual checks were performed by the screeners, ethnicity was self-reported by participants and a formal breakdown of different subgroups within the Hispanic population was not possible. Although the

prevalent method for bone densitometry assessment has been dual-energy x-ray absorptiometry (DXA), the use of ultrasound devices has gained acceptance. Research shows a significant correlation in results produced by either method.<sup>20</sup> The Hologic Sahara bone sonometer was used in this study due to its portability to and from the community health screening sites.

Comparable data are scarce. Many of the studies discussed here presented data from Mexican American women and reported on femoral BMD. Data on BMD and fracture risk from other bone sites in Hispanic women were lacking.<sup>6,8</sup> Formal subgroup analyses among Hispanics were not performed.<sup>12</sup> Results from the present study are a first step in assessing the relative risk of osteoporosis in Hispanics based on heritage within the Hispanic population and, if confirmed by future

studies, have the potential for informing screening recommendations.

## CONCLUSIONS

This study indicates that Hispanic women of Caucasian heritage and non-Hispanic white women may be at comparable risk of bone loss. These findings suggest further policy implications if health care providers mistakenly believe that some women are not at risk for this debilitating disease. Opportunities for appropriate prevention may be forfeited. Further prospective studies should be undertaken to evaluate the osteoporosis risk differential among ethnic groups including examining the differences in Hispanic and Caucasian women using DXA. In addition, future research should be conducted to validate the slower bone loss seen in Hispanics within this study.

## References

1. The WHO Study Group: Assessment of fracture risk and its application to screening for postmenopausal osteoporosis. Geneva: World Health Organization; 1994.
2. DHHS. Bone health and osteoporosis: a report of the Surgeon General - Executive Summary. Rockville, MD: U.S. Department of Health and Human Services; 2004.
3. Kern LM, Powe NR, Levine MA, Fitzpatrick AL, Harris TB, Robbins J, Fried LP. Association between Screening for Osteoporosis and the Incidence of Hip Fracture. *Ann Intern Med* 2005;142(3):173-81.
4. Siris ES, Chen YT, Abbott TA, Barrett-Connor E, Miller PD, Wehren LE, Berger ML. Bone mineral density thresholds for pharmacological intervention to prevent fractures. *Arch Intern Med* 2004;164:1108-12.
5. NOF. Fast Facts. National Osteoporosis Foundation. Available at: <http://www.nof.org/osteoporosis/diseasefacts.htm>. (Accessed Aug. 15, 2005).
6. NOF. Prevention - Who's at Risk? National Osteoporosis Foundation. Available at: <http://www.nof.org/prevention/risk.htm>. (Accessed Aug. 15, 2005).
7. Babbar RK, Handa AB, Lo CM, Guttmacher SJ, Shindedecker R, Chung W, Fong C, Ho-Asjoe H, Chan-Ting R, Dixon LB. Bone health of immigrant chinese women living in New York City. *Journal of Community Health* 2006;31(1):7-23.
8. Siris E, Miller P, Barrett-Connor E, Abbott T, Sherwood L, Berger M. Design of NORA, the National osteoporosis risk assessment program: A longitudinal US registry of postmenopausal women. *Osteoporos Int* 1998;8(Suppl 1):S62-9.
9. Siris E, Miller P, Barrett-Connor E, et al. Identification and fracture outcomes of undiagnosed low bone mineral density in postmenopausal women: Results from the National Osteoporosis Risk Assessment. *JAMA* 2001;286:2815-22.
10. Looker A, Orwoll E, Johnston CJ, et al. Prevalence of low femoral bone density in older U.S. adults from NHANES III. *J Bone Miner Res* 1997;12(11):1761-8.
11. Looker AC, Wahner HW, Dunn WL, Calvo MS, Harris TB, Heyse SP, Johnston CC Jr, Lindsay R. Updated data on proximal femur bone mineral levels of US adults. *Osteoporos Int* 1998;8(5):468-89.
12. Zingmond D, Melton Lr, Silverman S. Increasing hip fracture incidence in California Hispanics, 1983-2000. *Osteoporos Int* 2004;15(8):603-10.
13. Barrett-Connor E, Siris E, Wehren L, et al. Osteoporosis and fracture risk in women of different ethnic groups. *J Bone Miner Res* 2005;20(2):185-94.
14. Raisz L. Clinical practice. Screening for osteoporosis. *N Engl J Med* 2005;353(2):164-71.
15. ANA. Menopausal Health. American Nurses Association, The Nurses Foundation, and the MBK Associates, LLC. Available at: <http://www.nursingworld.org/mods/archive/mod152/cemhb1.htm>. (Accessed Aug. 15, 2005).
16. NIH. Latino Women and Osteoporosis. National Institutes of Health Osteoporosis and Related Bone Diseases - National Resource Center. 1/2003. Available at: <http://www.osteo.org/newfile.asp?doc=r602i&doctitle=Latino+Women+and+Osteoporosis&doctype=HTML+Fact+Sheet>. (Accessed Aug. 15, 2005).
17. Geller S, Derman R. Knowledge, beliefs, and risk factors for osteoporosis among African-American and Hispanic women. *J Natl Med Assoc* 2001;93(1):13-21.
18. Tranquilli A, Lucino E, Garzetti G, Romanini C. Calcium, phosphorus and magnesium intakes correlate with bone mineral content in postmenopausal women. *Gynecol Endocrinol* 1994;8(1):55-8.
19. Campbell P. Population Projections for States by Age, Sex, Race, and Hispanic Origin: 1995 to 2025. U.S. Bureau of the Census Population Division. 1996:PPL-47.
20. Moris M, Peretz A, Tjeka R, Negaban N, Wouters M, Bergmann P. Quantitative ultrasound bone measurements: normal values and comparison with bone mineral density by dual X-ray absorptiometry. *Calcif Tissue Int* 1995;57(1):6-10.