Short Report

Determining Osteoporosis Risk in Older Colono Adults from Rural Amazonian Ecuador Using Calcaneal Ultrasonometry

FELICIA C. MADIMENOS,1,2,3 MELISSA A. LIEBERT,2 TARA J. CEPON-ROBINS,7 J. JOSH SNOGDGRASS,2 AND LAWRENCE S. SUGIYAMA2

1Department of Anthropology, Queens College, CUNY, Flushing, New York 11367
2Department of Anthropology, University of Oregon, Eugene, Oregon 97403

Objective: Low bone density and osteoporosis prevalence, while well-documented in wealthy nations, are poorly studied in rural, non-clinical contexts in economically developing regions such as Latin America. This study contributes preliminary osteoporosis risk data for a rural Colono (mestizo) population from Amazonian Ecuador. 

Methods: Anthropometrics were collected for 119 adult participants (74 females, 45 males [50–90 years old]). Heel bone density and T-scores were recorded using calcaneal ultrasonometry

Results: Approximately, 33.6% of the participants had low bone density and were at high-risk for osteoporosis. Four times as many females as males were considered high-risk. Consistent with epidemiological literature, advancing age was significantly associated with lower bone density values (P = 0.001).

Conclusions: Low bone density and osteoporosis prevalence are expected to increase in this and other economically transitioning populations, yet infrastructure to monitor this changing epidemiological landscape is almost non-existent. Human biologists are uniquely positioned to contribute data from remote populations, a critical step toward initiating increased resource allocation for diagnosis and prevention. Am. J. Hum. Biol. 27:139–142, 2015. © 2014 Wiley Periodicals, Inc.

INTRODUCTION

Osteoporosis is a skeletal disorder characterized by low bone mass, reduced bone micro-architecture and strength, and heightened fracture risk. An increasing global health problem, osteoporosis affects ~75 million people worldwide causing more than 8.9 million fractures annually (IOF, 2012). In terms of disability-adjusted life-years lost, the burden of osteoporosis is greater than for most other non-communicable diseases (IOF, 2012). While low bone density and heightened fracture risk are well-documented among wealthy nations, this issue has been poorly studied in rural, non-clinical contexts in economically developing regions such as in Latin America. Numerous explanations have been posited for this, including regional preoccupation with infectious disease, the assumption that bone loss is an inevitable component of aging, and limited diagnostic resources. However, as the total number of low bone mass-related fractures is projected to increase to 21.3 million worldwide by 2050, with a concomitant rise in socioeconomic impact (Gullberg et al., 1997), there is an urgent need to identify at-risk populations early in order to target preventative strategies that may attenuate these projections.

While data that are available from Latin America suggest that osteoporosis rates are similar to those in the US and Europe, these studies are biased in their focus on more economically developed countries such as Argentina and Chile that boast the highest life expectancy and standard of living in the region (Morales-Torres and Gutierrez-Urena, 2004). These countries also have comparatively better resources to provide patients with diagnoses and treatments. Therefore, the aim of this study is to provide preliminary data on bone health in a rural Ecuadorian Colono (mestizo) adult population and investigate age- and sex-associated risks of developing osteoporosis. This dataset provides a critical step toward improving knowledge of skeletal health in non-urbanized, economically transitioning contexts, thereby increasing osteoporosis awareness among participant populations and potentially stimulating regional investment in diagnostic tests and affordable treatment.

PARTICIPANT POPULATION AND HYPOTHESES

Study participants include Colono adults living in rural communities in the Upano River Valley of Morona-Santiago, Ecuador. Historically, the Upano Valley was inhabited by indigenous populations; however, with agrarian reform policies beginning in the 1960s, increasing numbers of non-indigenous Colonos settled in the region. While Colonos here engage in animal husbandry and agricultural production, many simultaneously participate in the market economy through sale and consumption of goods and wage labor employment. The combination of rural, agrarian lifeways, and increasing market integration produces a distinct economic and nutritional landscape shared across many Latin American populations (Rivera et al., 2004). Compared to local indigenous groups, such as the Shuar however, Colonos are experiencing a later stage of this economic and nutrition transition (Liebert et al., 2013).

Due to greater market integration in general among Colonos compared to native Shuar, we hypothesize that Colonos will exhibit rates of low bone density that is more aligned with data from populations in more industrialized...
Female participants, height and weight were recorded; body mass index (BMI) was calculated as weight (kg)/height (m)^2. Total Population by sex and combined T-score based on participant’s risk of developing osteoporosis.

<table>
<thead>
<tr>
<th>Low-risk (T-score: &gt; −1.8)</th>
<th>High-risk low BMD (T-score: ≤ −1.8)</th>
<th>Total population by sex and combined</th>
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<tbody>
<tr>
<td>n</td>
<td>Mean (SD)</td>
<td>n</td>
</tr>
<tr>
<td>Female</td>
<td>Age (years) n = 42 62.01 (8.08)</td>
<td>Height (cm) n = 32 145.74 (14.29)</td>
</tr>
<tr>
<td></td>
<td>Height (cm) 145.74 (14.29)</td>
<td>BMI (kg/m²) 29.10 (4.74)</td>
</tr>
<tr>
<td>Males</td>
<td>Age (years) n = 37 65.28 (10.44)</td>
<td>Height (cm) n = 8 159.89 (6.0)</td>
</tr>
<tr>
<td></td>
<td>Height (cm) 159.89 (6.0)</td>
<td>Height (cm) 151.84 (9.23)</td>
</tr>
<tr>
<td>Total Population by T-score and Sex Combined</td>
<td>Age (years) n = 79 63.50 (9.35)</td>
<td>Height (cm) n = 40 152.37 (13.21)</td>
</tr>
<tr>
<td></td>
<td>Weight (kg) 66.36 (11.77)</td>
<td>Weight (kg) 54.68 (5.71)</td>
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<td>hBMD (g/cm²) 0.490 (0.08)</td>
<td>hBMD (g/cm²) 0.291 (0.06)</td>
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<td>BMI (kg/m²) 27.11 (3.96)</td>
<td>BMI (kg/m²) 23.93 (3.83)</td>
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Low-risk participants had T-scores greater than the cut-off value, −1.8, while high-risk included those individuals with T-scores of −1.8 or lower. In clinical settings, where available, high risk participants would undergo a follow-up examination using DEXA to establish osteoporosis status.

RESULTS

Anthropometrics and BMD data are presented in Table 1. Forty individuals (33.6%) were considered at high-risk for developing osteoporosis, with four times as many females (80.0%) than males (20.0%) in this category. A one-way ANOVA test confirmed a significant effect of sex on BMD, with females generally exhibiting lower values than males [F (1, 117) = 6.311, P = 0.013]. Of 74 female participants, 72 (97.3%) were post-menopausal and, of these, 31 (43.1%) were considered high-risk for osteoporosis. Among 45 males, eight (17.8%) also exhibited BMD values in the high-risk category. While heightened risk was documented across participants, linear regression analyses indicated a strong association between advanced age and reduced bone mass (p = 0.001; R² = 0.90).

DISCUSSION

While results are preliminary and sample size is small, this study represents one of the few that documents osteoporosis risk using calcaneal ultrasonometry from a non-industrialized, non-clinical context and, specifically, for any Amazonian Ecuadorian population. Normative skeletal health data are available for indigenous Amazonian Shuar (Madimenos et al., 2011), yet that sample is substantially younger than the Colono cohort; therefore, issues related to demographic differences prevent useful comparisons with Colonos.

Since DEXA is the only means of diagnosing osteoporosis, and QUS techniques do not permit a clinical distinction between individuals with low BMD and osteoporosis, most cross-population prevalence data are not directly comparable with the current study. While recognizing complexities in comparing these data, Table 2 presents an overview of low bone density (osteopenia) and osteoporosis rates across Latin American and US populations and includes Colonos who qualify as high-risk (T-score ≤ −1.8). The rates of low bone density were determined using a Sahara Ultrasonometer, a portable device highly correlated with DEXA.
BMD among Colono females is within the range of other Latin American countries and the US, a trend that is less obvious in Colono males. Although additional conclusions must remain conservative due to limitations mentioned above, this overview emphasizes a larger, overarching issue. Lack of diagnostic tools has resulted in limited prevalence data for many global populations, and specifically in Latin American regions. Consequently, a disproportionate number of publications on osteoporosis risk as determined by DEXA are available from more economically developed regions. Cost-efficient and portable QUS techniques are the best alternative, and yet such devices are not widely utilized for determining osteoporosis risk across diverse and remote populations. This creates challenges for cross-population comparisons and for identifying and implementing prevention and treatment strategies for potentially high-risk demographics.

Colono participants in the present study are primarily from small, rural communities undergoing rapid economic and lifestyle change, characteristics that create unique epidemiological challenges that are not typically found among Western, industrialized populations. While it remains unclear the extent to which osteoporosis risk is associated with age and sex among “traditionally living” populations, among Colonos who are at the rural margins of the market economy, greater bone loss with advancing age and significantly lower BMD among females have been preliminarily demonstrated. This phenomenon may be partly a consequence of rapid adverse health effects of the socioeconomic and nutrition transitions.

The shifting socioeconomic and demographic landscape coupled with pervasive regional issues such as disparities in access to health care and diagnostic tools highlight that the burden of low bone density and osteoporosis, as with other non-communicable disease, may be ultimately hardest felt in these transitioning communities. Given the economic and societal costs of osteoporosis, Latin American health authorities will face enormous public health challenges in the coming years unless efforts are made toward increasing regional osteoporosis awareness. Human biologists who study health in non-Western groups are uniquely positioned to contribute epidemiological data from more remote, rural locales typically overlooked in clinical population-based studies, data that can highlight the regional need for resource allocation toward prevention and treatment of chronic disease.

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LITERATURE CITED


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