Prevalence of Prevention and Treatment Modalities Used in Populations at Risk of Osteoporosis

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Study Objective: Determine prevalence of osteoporosis screening and prevention and modes of treatment in women older than 65 years at risk of osteoporosis.

Methods: Retrospective chart review of older female patients seeking osteoporosis screening in the community setting.

Results: 399 women at risk of low bone mineral density (BMD) underwent dual-energy x-ray absorptiometry scanning. Among participants younger than 65 years (n=52), low BMD was diagnosed in 44.2%; among participants older than 65 years (n=347), low BMD was diagnosed in 70.0%, a statistically significant difference (P=.001).

Conclusion: From a community-level perspective, the authors have shown that osteoporosis screening at local senior centers, living facilities, and health fairs is an effective tool for identifying low BMD in women at high risk of osteopenia and osteoporosis.

It is estimated that 1.5 million fractures occur annually as a result of osteoporosis and 25 million people in the United States today are affected by this condition, a condition that is, to some extent, preventable. Prevention becomes more valuable when the costs of treatment are considered. It is estimated that $18 billion is spent annually in the United States for direct and indirect costs associated with treating osteoporosis and 25 million people in the United States today are affected by this condition. A condition that is, to some extent, preventable. Prevention becomes more valuable when the costs of treatment are considered. It is estimated that $18 billion is spent annually in the United States for direct and indirect costs associated with treating osteoporosis. It is estimated that $18 billion is spent annually in the United States for direct and indirect costs associated with treating osteoporosis. It is estimated that $18 billion is spent annually in the United States for direct and indirect costs associated with treating osteoporosis.

While HRT is effective in the treatment of low BMD, results from the Heart and Estrogen/Progestin Replacement Study Follow-up (HERS II) and the Women’s Health Initiative (WHI) study indicate that HRT is not protective against cardiovascular and noncardiovascular diseases, as was once thought. New research has shown that HRT is in fact associated with increased risk of cardiovascular disease, stroke, breast cancer, and gallbladder disease. Conclusions indicate that women not start HRT solely for the prevention of such conditions. In addition, new recommendations issued by the American Heart Association advise that women do not start or continue HRT for the prevention of coronary heart disease. Our current study was carried out before the public release of results from the HERS II and WHI studies.

Alendronate and risedronate belong to a class of medications called bisphosphonates. Alendronate and risedronate slow the loss of bone, increase BMD, and reduce the risk of spine and hip fractures. These medications are also effective in preventing fractures among adults at high risk of osteoporosis. Results from the Fracture Intervention Trial suggest no significant reduction in fracture incidence among those with higher bone mineral density (BMD). However, in women with bone loss, treatment reduced the risk of clinical fractures by 36%.

Treatment options can vary from person to person. Adequate dietary intake of calcium and vitamin D, weight-bearing exercise, and medication can maintain proper BMD. Antiresorptive medications are available that alter the bone remodeling cycle and slow the resorptive stage of the cycle while having no effect on the formation stage of the cycle. As a result, bone formation continues at a greater rate than resorption and BMD can actually increase. Antiresorptive medications such as estrogens, alendronate sodium, risedronate sodium, and raloxifene hydrochloride are approved by the US Food and Drug Administration for the prevention and treatment of postmenopausal osteoporosis. Calcitonin-salmon is approved only for treatment. In addition, anabolic drugs such as fluoride, growth hormone, and parathyroid hormone are a new advance in the treatment of osteoporosis.
approved for treatment of steroid-induced osteoporosis in men and women as a result of long-term use of glucocorticoid medications. In addition, alendronate is approved for treatment of osteoporosis in men.

Raloxifene is approved for the treatment and prevention of osteoporosis. Raloxifene belongs to a class of drugs called selective estrogen receptor modulators (SERMs) and has been shown to prevent bone loss at the spine and hip. In some cases, it also increases BMD at these sites. Unlike estrogens, raloxifene does not stimulate uterine or breast tissue. Currently, data are insufficient to make recommendations about the cardiovascular protective effects of raloxifene.

Finally, calcitonin is a naturally occurring hormone that is involved in calcium regulation and bone metabolism. In women who are at least 5 years beyond menopause, calcitonin slows bone loss, increases spinal BMD, and reduces the risk of spinal fracture.

Even with these promising treatment modalities, the current standard of care is to rely on clinical symptoms at presentation to begin prevention or therapeutic options. Determining the prevalence of current levels of diagnosis and therapeutic intervention in those at risk of poor outcomes as a result of low BMD (eg, fractures and disability), provides an indicator of the effectiveness of community-level health intervention.

Previous studies have examined vulnerable populations and those traditionally overlooked for osteoporosis prevention, yet they have failed to document whether populations traditionally at high risk of osteoporosis are receiving appropriate levels of care.

We hypothesize that a large number of individuals at risk of osteoporosis would be significantly more likely to have low BMD but are not more likely to have been evaluated or receive treatment, compared with individuals who are not at high risk of bone loss. To evaluate this hypothesis, we conducted a community screening of older female patients to examine the prevalence of preventive therapy and screening in high-risk populations.

### Methods

An area physician group practice conducted a community-based osteoporosis-screening program in 1999 to increase access to BMD testing among the elderly. The purpose of the program was to extend BMD testing and counseling to area senior citizen facilities. During the practice’s yearlong program, 635 women attended voluntary osteoporosis screening sessions provided at local senior centers, living facilities, and health fairs.

Participants were assessed for risk of osteoporosis, screened for BMD, given a diagnosis based on BMD levels, and referred for follow-up care as necessary.

Screening for osteoporosis was conducted using axial scan measurements. The mobile screening instrument was a dual-energy x-ray absorptiometry (DXA) scanner, enabling measurements of the hip and spine. The scanner was secured in a large motorized vehicle.

Normal or low BMD was diagnosed in women participating in this screening program. Women who had low BMD had a further diagnosis of osteopenia or osteoporosis as determined by using the guidelines for T scores from the World Health Organization (Table 1).

In addition to receiving diagnostic assessment in the original osteoporosis awareness program, patients were offered lifestyle counseling and therapeutic assessments by physicians from the group practice.

For the current study, we completed a retrospective review of patient charts for women who attended the voluntary osteoporosis screening through the aforementioned community-based program. Valid measurements were obtained for 477 of the 635 women who participated in that program.

The Institutional Review Board of the Synergy Medical

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### Table 1

**World Health Organization Osteoporosis Guidelines: Bone Mineral Density Measurements From Dual-energy X-ray Absorptiometry Scanner**

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>T Score</th>
</tr>
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<tbody>
<tr>
<td>Normal bone mineral density</td>
<td>&gt; -1</td>
</tr>
<tr>
<td>Osteopenia</td>
<td>-1 to -2.49</td>
</tr>
<tr>
<td>Osteoporosis</td>
<td>≤ -2.5</td>
</tr>
</tbody>
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### Table 2

**Osteoporosis: Characteristics of Women Attending Screening Program (N=399)**

| Characteristic No. (%) |
|------------------------|--------------------------|
| Age, yr*               |                          |
| ≤65                    | 52 (13.0)                |
| >65                    | 347 (87.0)               |
| Race                   |                          |
| African American       | 51 (12.8)                |
| White                  | 328 (82.2)               |
| Other                  | 20 (5.0)                 |
| Low Bone Mineral Density Diagnosed | 267 (66.9) |
| Osteopenia             | 148 (55.4)               |
| Osteoporosis           | 119 (44.6)               |

* The mean age was 74.9 years.
and estimated amounts of daily consumption (in ounces and cups). Daily intake of dietary calcium was determined from this self-report. A cutoff of 1500 mg of dietary calcium was used as the recommended daily intake for postmenopausal women not taking estrogen and adults aged 65 years or older.

Results

Demographics

A total of 477 women from the original osteoporosis awareness program qualified as being at risk of loss of BMD based on established guidelines on age, gender, family and personal history, menopausal history, dietary risk, and comorbidities and medication use based on NOF guidelines. Of these, 399 participants underwent DXA scanning for osteoporosis screening. Data analysis was confined to this group (Table 2).

Data on menopausal history and steroid use were recorded for only 398 of the 399 subjects in this retrospective review. Further, though NOF criteria indicate that estrogen deficiency as a result of early or surgically induced menopause is a risk factor for low BMD, for the purposes of the current study, we further defined this group as any women having a partial or total hysterectomy before age 55 years and those women who reached menopause before age 40. The use of HRT was also evaluated by investigators.

Table 3
Osteoporosis: Low Bone Mineral Density Among High-risk and Low-risk Groups (N=399)

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>Low Bone Mineral Density, No. (%)</th>
<th>Odds Ratio (CI)*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age, yr</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;65</td>
<td>347 (87.0)</td>
<td>243 (70.0)</td>
</tr>
<tr>
<td>&lt;65</td>
<td>52 (13.0)</td>
<td>23 (44.2)</td>
</tr>
<tr>
<td><strong>Menopause‡</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Premature</td>
<td>98 (24.6)</td>
<td>63 (64.3)</td>
</tr>
<tr>
<td>Natural</td>
<td>300 (75.4)</td>
<td>204 (68)</td>
</tr>
<tr>
<td><strong>Daily Dietary Calcium Intake§</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;1500 mg</td>
<td>229 (83.9)</td>
<td>154 (67.2)</td>
</tr>
<tr>
<td>&gt;1500 mg</td>
<td>44 (16.1)</td>
<td>33 (75)</td>
</tr>
<tr>
<td><strong>Steroid Use‡</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>24 (6.0)</td>
<td>20 (83.3)</td>
</tr>
<tr>
<td>No</td>
<td>374 (94.0)</td>
<td>247 (66.0)</td>
</tr>
</tbody>
</table>

* Odds ratios were not calculated for nonsignificant analyses.
† P = .001.
‡ Data on menopausal history and steroid use were recorded for only 398 of the 399 subjects in this retrospective review.
§ Data on daily dietary calcium intake were recorded for only 273 of the 399 subjects in this retrospective review.

Lifestyle choices were noted in the initial awareness program, and those findings were therefore available to study investigators, including the amount of tobacco use, alcohol use, and participation in weight-bearing exercise. Dietetic risk was evaluated by self-report of food types (dairy and nondairy) and estimated amounts of daily consumption (in ounces and cups). Daily intake of dietary calcium was determined from this self-report. A cutoff of 1500 mg of dietary calcium was used as the recommended daily intake for postmenopausal women not taking estrogen and adults aged 65 years or older.
Although data on dietary calcium intake were available for only 273 (68.4%) of the 399 subjects in this retrospective review, we found that most of these women (229 [83.9%]) were at risk based on low calcium consumption (<1500 mg/d). Only 44 (16.1%) women reported daily calcium intake greater than 1500 mg.

Twenty-four (6.0%) women were on prolonged glucocorticoid therapy. As already noted, data on steroid use were available for all but one of the subjects in our sample group. The total number of women in whom low BMD was diagnosed was 267 (66.9%), of which 243 (91%) were in the group of women older than 65 years. Of the 267 women in whom low BMD was diagnosed—201 (75.3%) of which had newly diagnosed low BMD—148 (55.4%) had osteopenia diagnosed and 119 (44.6%) had osteoporosis diagnosed.

Bone Loss Risk
To determine differences in BMD based on risk factors, we ran χ² analyses (Table 3).

Low BMD was diagnosed in less than half (23 [44.2%]) of the participants younger than 65 years (n=52) after physicians reviewed their T scores from the DXA scan. Among participants older than 65 years (n=347), low BMD was diagnosed in most (243 [70.0%], \(P=0.001\)).

There were no significant differences \(P=0.539\) in low BMD between women at risk of osteoporosis from premature menopause (n=98), including those women who had undergone hysterectomy previous to age 55 (63 [64.3%]), and the remaining 300 women who reported natural menopause.

Of the women at risk of osteoporosis based on insufficient dietary intake of calcium (n=229), more than half (154 [67.2%]) had low BMD. Of those women with sufficient dietary calcium intake (n=44), most (33 [75%]) still had low BMD (\(P=0.578\)).

Those women reporting steroid use for the treatment of comorbid conditions (n=24) were more likely to have bone loss (20 [83.3%]) than the 374 non-steroid users, though again the difference was not significant (\(P=0.121\)).

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Those women reporting steroid use for the treatment of comorbid conditions (n=24) were more likely to have bone loss (20 [83.3%]) than the 374 non-steroid users, though again the difference was not significant (\(P=0.121\)).

Differences in BMD in patients on HRT were significant, however (\(P=0.003\)). Among 86 current HRT users, low BMD was observed in 31 (36.8%). Of the 38 women who discontinued use of HRT, low BMD was observed in 14 (36.8%).

Odds ratio for hormone replacement therapy in patients older than 65 years was 0.45 (\(P=0.01\), CI 0.2 – 0.8).

Odds ratio for patients with an average daily dietary calcium intake of less than 1500 mg who were placed on calcium supplementation was 0.004 (\(P=0.01\), CI 0.00024 – 0.067). Odds ratios were not calculated for non-significant analyses.

† Data on menopausal history and steroid use were recorded for only 398 of the 399 subjects in this retrospective review.
‡ Data on daily dietary calcium intake were recorded for only 273 of the 399 subjects in this retrospective review.
Discussion

From a community-level perspective, we have shown that osteoporosis screening at local senior centers, living facilities, and health fairs is an effective tool in identifying low BMD in women at high risk of osteopenia and osteoporosis. Most (323 [81%]) of the 399 women screened had no history of osteoporosis. Of the 267 women diagnosed with low BMD, 201 (75.2%) were newly diagnosed at the time of screening. The large number of new cases identified with low BMD through this screening program indicates that most women at high risk of low BMD remain unidentified and untreated.

Although women at high risk in this community sample were more likely to have low BMD diagnosed than those women not at risk, they were not more likely to be treated—either with medications (antiresorptive therapy, bisphosphonates, HRT) or calcium supplementation. With an odds ratio of 2.8, women aged 65 years and older were almost three times more likely to be diagnosed with low BMD than women 65 years and older (19.6%, \(P=.01\)). Women who were at risk based on premature menopause were more likely to be using HRT (34.7%) than women who went through natural menopause (17.3%), though this difference was not significant. Women who were at risk based on dietary calcium intake were less likely to use calcium supplementation (23.6%) than women who were not at risk (31.8%, \(P=.001\)).

The risk groups based on age did not differ in their use of osteoporosis medications or calcium supplementation. The risk groups based on menopausal status did not differ in their use of osteoporosis medications and calcium supplementation. The risk groups based on dietary calcium intake did not differ in their use of osteoporosis medications and HRT. Finally, the risk groups based on steroid use did not differ in their use of osteoporosis medications, HRT, or calcium supplementation.

### Table: Risk Factors for Low Bone Mineral Density

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>Risk increases with age.</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td>Because women have less bone mass than men and lose bone tissue more rapidly, especially after menopause, women are at higher risk.</td>
</tr>
<tr>
<td><strong>Family History and Personal History of Adult Fractures</strong></td>
<td>A history of susceptibility to fractures may be hereditary. Further, a personal history of fractures in adulthood also increases fracture risk.</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td>Asian and non-Hispanic white women are most at risk of developing osteoporosis, but African American and Hispanic women are also at risk.</td>
</tr>
<tr>
<td><strong>Bone Structure and Body Weight</strong></td>
<td>Thin and small-boned women (&lt;127 pounds) are at increased risk.</td>
</tr>
<tr>
<td><strong>Menopausal and Menstrual History</strong></td>
<td>Estrogen deficiency as a result of menopause is a risk factor for low bone mineral density (BMD).</td>
</tr>
<tr>
<td><strong>Lifestyle</strong></td>
<td>Individuals’ lifestyle choices can affect their levels of BMD. Some factors that increase risk are: cigarette smoking, excessive alcohol consumption, inadequate daily intake of dietary calcium, and lack of weight-bearing exercise.</td>
</tr>
<tr>
<td><strong>Medications and Chronic Diseases</strong></td>
<td>Prolonged use (&gt;6 months) of certain medications to treat chronic disorders and disease, namely: glucocorticoids, thyroid hormones, anticonvulsants, antacids that contain aluminum, gonadotropin-releasing hormones, methotrexate sodium as use in the treatment of cancer, cyclosporine A, heparin sodium, and cholestyramine.</td>
</tr>
</tbody>
</table>

times more likely to have a diagnosis of low BMD than women younger than 65 years. However, they were no more likely to report use of preventive pharmacologic therapy, HRT, or calcium supplementation. There was no significant difference in diagnosis of low BMD between groups based on dietary calcium intake. A greater proportion of women on steroid therapy had a diagnosis of low BMD; however, they were not more likely to report pharmacologic therapy or calcium supplementation.

Women who had premature menopause, including those women with surgically induced menopause before age 55, were at similar risk of low BMD as women reporting natural menopause. However, in this group of high-risk women, they were not more likely to receive preventive pharmacologic therapy or calcium supplementation. Their use of HRT differed from that of women reporting natural menopause, and the difference was statistically significant, but it is unknown whether they were on HRT as a protective treatment against the risk of low BMD. Again, this study was conducted before the distribution of current guidelines on HRT use.

Our study did not address reasons women take HRT or the reasons women discontinue that therapy. In addition, while it is reasonable to expect that osteoporosis therapy through pharmacologic treatment, HRT, and calcium supplementation would be prescribed and used in women with diagnosed low BMD, we chose to leave the determination of the use of these postdiagnosis modes of therapy for a future study.

Some limitations in our study restrict the conclusions we can reasonably draw. The subjects in this retrospective study were elderly female participants in an elective osteoporosis screening and testing program—a self-selected convenience sample. Although they may be a unique group (ie, healthy enough to attend voluntary osteoporosis screening), this fact would not alter the within-group comparisons.

Additionally, measurement bias may also dilute some of the findings of this study. We were unable to delineate dietary calcium intake amounts based on self-reported data. Therefore, substantial crossover may exist between the at-risk group and nonrisk group. We believe that greater specificity in dietary intake data would have further supported our findings, namely, that prevalence of treatment among the at-risk group is currently insufficient.

Comment
Women at high risk of osteopenia and osteoporosis have low BMD effectively diagnosed through consistent osteoporosis screening at local senior centers, living facilities, and health fairs. Our results suggest that groups at high risk of low BMD are not being evaluated and treated at a rate necessary to prevent further decreases in BMD and eventual fractures. Given the limitations of retrospective analysis, it is difficult to draw firm conclusions. When the associations observed in this study are coupled with the findings and support of previous studies, however, it is not surprising that osteopenia, osteoporosis, and related fractures are prevalent in the United States.

In the absence of portable BMD screening in communities, women do not have ready access to the level of preventive health care that is necessary to reduce the burden of osteoporosis in the United States. Relying on clinical presentation of vertebral fractures and loss of previously attained adult height to identify low BMD does not allow for the early recognition of low BMD when preventive strategies such as moderate doses of bisphosphonates would be helpful.

Our study discovered that 75% of women with low BMD diagnosed in the original osteoporosis awareness program had their condition newly diagnosed even though they were at high risk, should have been routinely screened, and could have had diagnosis earlier. Our study shows that high-risk, postmenopausal women are not being appropriately evaluated for low BMD early enough.

Regardless of the availability of a portable Dxa scanner to diagnose low BMD, adequate calcium intake through dietary intake or supplementation should be encouraged. Additionally, osteoporosis screening is useful only if patients receive appropriate counseling from their physicians and the recommended preventive modes of therapy are initiated. Further study is in progress to determine if patients in the original osteoporosis awareness program complied with physicians’ recommended treatment and prevention strategies.

Acknowledgment
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