Osteoporosis Screening by Community Pharmacists: Use of National Osteoporosis Foundation Resources

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Objectives: To assess the feasibility of establishing an osteoporosis screening program in rural community pharmacies based on information and resources provided by the National Osteoporosis Foundation (NOF), to survey primary care providers regarding the usefulness of this screening program, and to recommend strategies for pharmacists interested in working with patients at risk for osteoporosis. Design and Participants: Pharmacists and/or nurses enrolled women 65 years of age and older into the study, measured calcaneal bone density, administered a questionnaire to ascertain subjects’ osteoporosis risk factors, and provided NOF literature to subjects. With their agreement, women’s bone mass data and risk factor assessments were provided to primary care providers along with NOF’s Physician’s Guide to Prevention and Treatment of Osteoporosis. These providers were surveyed as to whether they found this information useful. Setting: Five independent community pharmacies in rural Wisconsin. Results: We enrolled and tested 133 women. Of these, 122 (92%) agreed to have information mailed to their primary health care providers. These 57 providers were surveyed and 24 (42%) responded; of these 24, 20 (83%) found the information they received useful. Conclusion: A community pharmacy-based osteoporosis screening program using NOF materials was well accepted by physicians. NOF resources and recommendations can provide a strong foundation for such programs.

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Osteoporosis, a disease characterized by loss of bone mass and skeletal fragility, is a major public health problem in the United States. In this country, osteoporosis contributes to approximately 1.3 million fractures annually. In 1995 osteoporotic fractures led to more than 400,000 hospitalizations, 2.5 million physician visits, and 180,000 nursing home admissions. Direct costs of treating osteoporosis are estimated to be $13.8 billion per annum, an amount expected to triple by 2040 as the population ages.

As the disease has no manifestations prior to fracture, strategies to reduce its personal and economic burdens require measurement of bone mass in the population most likely to be affected. Low bone density is the best predictor of fracture risk. A variety of techniques are available to measure bone density, including single energy X-ray absorptiometry, quantitative computed tomography, radiographic absorptiometry, and quantitative ultrasound. The gold standard, however, is dual energy X-ray absorptiometry (DXA). Unfortunately, relatively few individuals have access to the more expensive, stationary dual X-ray absorptiometers used to measure central (hip and spine) bone mass. Therefore, measurement of peripheral (e.g., heel) bone density by inexpensive, portable units is necessary to meet the need for broader testing of the population.

Osteoporosis screening in community pharmacies is feasible, given such pharmacies’ accessibility to patients, stable presence in the community, and staff pharmacists’ relationships with patients and primary health care providers. Furthermore, pharmacists can play a key role in promoting adherence to pharmaceutical osteoporosis therapy, for which adherence is often poor. Additionally, with their expertise regarding over-the-counter products, pharmacists can encourage the use of calcium.
and/or multivitamin supplements by those clients likely to have deficiencies due to diet or lifestyle.

Although pharmacies have only recently begun offering osteoporosis screenings, community pharmacists have been providing a variety of health screening and other services for years. Available services now include blood pressure and cholesterol measurement, anticoagulation monitoring, and asthma follow-up.\textsuperscript{15–17} For any of these services, the pharmacist who is familiar with the recent literature and current guidelines is best able to assist clients and answer prescribers' questions. In the aforementioned areas, expert guidelines provide invaluable tools for pharmacists.\textsuperscript{18–22}

The recently published National Osteoporosis Foundation (NOF) report “Osteoporosis: Review of the Evidence for Prevention, Diagnosis, and Treatment and Cost-Effectiveness Analysis” should prove similarly helpful, as these guidelines clearly identify individuals for whom bone mass measurement is indicated (see Table 1).\textsuperscript{1} Additionally, the NOF guidelines include treatment recommendations based on bone density and risk factors. NOF recommends antiresorptive therapy for all women with T-scores $<-2$ or for women with T-scores $<-1.5$ who have any of the risk factors listed in Table 1. The T-score is the number of standard deviations above or below the mean for the young normal reference population. Osteoporosis is defined as a T-score $<-2.5$. The NOF guidelines, together with NOF educational resources, constitute valuable tools for the creation of pharmacy-based osteoporosis screening programs.

Although peripheral bone density measurement devices are being used at pharmacies, senior citizen centers, and other venues, there are few published reports on programs involving their use. Therefore, it is unclear whether these programs have implemented NOF recommendations. Similarly unclear is the extent to which the pharmacy services are accepted by physicians.\textsuperscript{11,12} In this article we describe a pilot pharmacy-based osteoporosis screening program that used NOF guidelines and provided NOF educational materials to clients and physicians. We also report on our assessment of primary care providers' responses to this program and offer practical suggestions for pharmacists interested in providing screening and other osteoporosis-related services to patients at risk for the disease. Rural pharmacies were used in this study, as residents in rural areas may have especially limited access to bone density measurements.

**Objectives**

The study reported in this article had the following objectives: to assess the feasibility of establishing, in rural community pharmacies, an osteoporosis screening program based on information and resources provided by NOF and to survey primary care providers regarding the usefulness of this screening program. On the basis of our findings, we recommend strategies for pharmacists interested in working with patients at risk for osteoporosis.

**Table 1. Groups the National Osteoporosis Foundation Recommends for Bone Density Testing**\textsuperscript{a}

<table>
<thead>
<tr>
<th>Category</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>All women 65 years of age and older</td>
<td>Postmenopausal women younger than 65 if they have one or more specific risk factors:</td>
</tr>
<tr>
<td></td>
<td>Current cigarette smoking</td>
</tr>
<tr>
<td></td>
<td>Personal history of adult fracture</td>
</tr>
<tr>
<td></td>
<td>Adult fracture in a first-degree relative</td>
</tr>
<tr>
<td></td>
<td>Low body weight (&lt; 127 lb)</td>
</tr>
<tr>
<td>Postmenopausal women who present with fractures</td>
<td>Women considering therapy for osteoporosis</td>
</tr>
<tr>
<td>Women who have been on hormone replacement therapy for prolonged periods</td>
<td></td>
</tr>
</tbody>
</table>

\textsuperscript{a} The National Osteoporosis Foundation considered cost-effectiveness of hip and spine dual energy X-ray absorptiometry for diagnosis of osteoporosis when making these recommendations. When screening in a pharmacy setting or when using a less expensive technology for screening purposes, it may be reasonable to use simpler, broader testing criteria. All postmenopausal women who have not been tested previously and who are not on a bisphosphonate. It may also be reasonable to test older men (65) who are underweight, who have had adult fractures, or who currently smoke cigarettes. Source: Reference 1.

**Methods**

We selected a convenience sample of five independent pharmacies in rural Wisconsin. Seven pharmacists and two registered nurses participated in all aspects of the program. In preparation for the study, all participants attended a half-day seminar conducted by University of Wisconsin pharmacy (MEE, NLK, PDM) and medical school faculty (NCB) to review osteoporosis epidemiology, pathophysiology, prevention, diagnosis, and therapy. Additionally, the seminar covered bone mass measurement using hip-and-spine and heel instruments, and participants received hands-on training with the Peripheral Instantaneous X-Ray Imager (PIXI) (GE Lunar Corporation, Madison, Wis.), an instrument that uses DXA technology (see Figure 1).\textsuperscript{23}

The project was approved by the UW Health Sciences Human Subjects Committee, and all participants provided written informed consent. Permission for the project pharmacists to mea-

![Figure 1. The Lunar PIXI from GE Medical Systems, shown above with laptop and printer, is a peripheral DXA bone densitometer that provides bone mineral density assessment of either the heel or the forearm in only 5 seconds.](image-url)
sure bone mass without a physician order was provided by the State of Wisconsin Department of Health. The targeted enrollment (100 women) was based on a projected primary care provider survey response rate of 50%. We anticipated that 50 subjects would provide a reasonably narrow confidence interval (CI) for our hypothesis that 60% of primary care physicians would find the results useful (95% CI of 46%–74%).

One month before we began recruiting subjects, each pharmacy mailed letters to all physicians of regular pharmacy clients describing the project and soliciting their comments. No comments were received in response to this mailing. Subsequently, each pharmacy recruited its own study subjects by posting notices in the pharmacy 3 to 6 weeks before the date of the first screening. Each woman who expressed interest was asked to fill out a prescreening questionnaire, which was evaluated by the recruiting nurse or pharmacist. To simplify this pilot project, we used only the first NOF criterion for bone mass measurement and enrolled only women who were at least 65 years old. Additionally, we excluded women who had had a previous bone density test or who were receiving osteoporosis treatment. We believed that the physician would have already considered osteoporosis in such women, so that bone density testing in the pharmacy could be seen as unnecessary. Although not required by the study protocol, two pharmacies retained these questionnaires. As part of the informed consent process, each potential subject was asked whether she wished to have the results sent to her primary health care provider. Women were also asked to complete a bone health questionnaire at the time they gave consent (see Figure 2). Enrolled subjects received an appointment to return when PIXI would be at the pharmacy. Women were neither charged nor paid for participating in the study.

We gave careful consideration to the selection of a peripheral bone density measurement device. Calcaneal bone measurements with either ultrasound or X-ray absorptiometry are correlated with measurements at axial sites, and both predict fracture risk. We chose X-ray absorptiometry over ultrasound for two reasons. First, measurements with PIXI are “dry” and measurements can be made with a sock or stocking on the foot. DXA is the only calcaneal measurement technology that does not require exposure of the bare foot to a water bath or a gel, an aspect of ultrasound we felt some clients would find unappealing. Second, testing with PIXI is very rapid (30 seconds versus up to several minutes for some ultrasound units), which makes it more practical for screenings in busy community pharmacies.

 PIXI is portable, requires no external shielding, runs on standard electrical current, and has a dedicated laptop computer and printer. Analysis is automated. The software selects a region of interest (ROI) within the os calcis, and the printout includes a heel image with the ROI. Bone density is expressed as an absolute quantity (grams/cm²) and as relative to the reference database, i.e., the T-score. PIXI bone mineral density (BMD) precision (%CV) reported by the manufacturer is 1.5%. As part of routine quality control, each day before performing calcaneal bone mass measurements using PIXI, we scanned an aluminum heel phantom. Measurements for the phantom averaged 99.1% of its stated value of 0.553 grams/cm² (range, 98.2%–100.4%) for an overall precision of 0.8%. Figures 3 and 4 show PIXI bone density printouts for normal and osteoporotic women, respectively.

For each pre-enrolled and walk-in subject, the pharmacist or nurse documented that the consent form and bone health questionnaire were complete, measured left heel bone density, reviewed the printout of the bone density test with the subject, and explained how her BMD compared with measurements in the reference database. The pharmacist or nurse also advised each woman to discuss her results with her primary health care provider and gave each patient a copy of the NOF brochures Facts About Osteoporosis, Arthritis, and Osteoarthritis and Stand Up to Osteoporosis. Finally, the pharmacist or nurse answered clients’ general questions regarding osteoporosis, calcium and vitamin D, and lifestyle issues relevant to bone health. Women had been informed during the consent process that the pharmacist or nurse would not make a diagnosis.

We enrolled a total of 133 women at five pharmacies in the study. Operation of PIXI was straightforward and convenient. Out of the 133 subjects, only one scan was inadequate, due to incorrect heel positioning. On two occasions, a cable was inadvertently disconnected and the computer had to be rebooted. No other problems were encountered in testing. Many women expressed appreciation that the test results were available so quickly and that they could leave their sock on during the test.

Although client interest in this study was high, the prescreening records retained by two of the five pharmacies indicated that only 55% of women who expressed interest were eligible (see Table 2), according to the study criteria. Although the recruitment notices specified women 65 years of age and older, many younger postmenopausal women asked to be enrolled. Seven women who had had their bone mass measured previously and 16 receiving hormone replacement therapy or osteoporosis treatment were excluded per the study protocol.

Neither the investigators nor the participating pharmacists provided diagnoses to patients, as this is the responsibility of a patient’s primary health care provider. Nevertheless, many
Figure 2. Bone Health Questionnaire

Patient ID # ___________________________________________

Please fill in the following information.

1. What is your current age? ____________________________

2. What is your weight? ________________________________

3. Do you smoke cigarettes? YES  NO

4. How tall are you? (feet & inches) ____________________

5. What is the tallest you ever were? (feet & inches) ____________

6. Have you broken any bones since reaching the age of 40 
   (except for motor vehicle accidents)? YES  NO

7. Have you ever had a serious injury to either leg? YES  NO

8. If answer to 7 was YES, was injury to left leg, right leg, or both? L  R  BOTH

9. Has your mother or father had a hip, spine, or wrist fracture since the age of 50? YES  NO

10. What is your ethnic heritage? (Optional) African American  Asian  Hispanic

                      Native American  White  Other__________________________

11. Have you fallen down within the last year? YES  NO

12. Do you use a wheelchair at least half of the time? YES  NO

13. How many miles per week do you walk outside or 
on a treadmill, or for exercise in a mall? None  < 2 miles  2–5 miles  > 5 miles

14. Aside from walking, how many hours per week do you participate in active indoor or outdoor sports or exercise? _______ hours

15. Please estimate your calcium intake:

Number of servings per day

______ Milk (8 oz)  ______ Yogurt (8 oz)  ______ Cheese (1 oz)

16. Do you take a calcium supplement? YES  NO

What strength tablet (mg)? ____________________________

How many per day? ____________________________

17. Has anyone ever told you that you had osteoporosis? YES  NO

Thank you for answering these questions!

COMMUNITY PHARMACY OSTEOPOROSIS DATABASE PROJECT WITH THE PERIPHERAL INSTANTANEOUS X-RAY IMAGER (PIXI)

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women asked for an interpretation or a diagnosis immediately after the measurement, and several asked repeatedly. Although we did not keep a quantitative record of these requests, it was our impression that at least three-quarters of the women asked for an interpretation of the test results. An overwhelming majority of women agreed to have their results sent to their primary health care providers.

Of the 57 physicians surveyed, 24 (42%) responded. Of these, 20, or 83% (with a 95% CI of 62%–95%), found the information useful (see Table 3). Two of the four physicians who stated that it was not useful preferred hip-and-spine DXA measurements. No physician stated that pharmacy-based bone density testing was inappropriate or should not have been done.

After this study was completed, pharmacists in the project were asked to provide comments. A sampling of their comments follows:

It is crucial to devise methods to obtain reimbursement for bone density screening.

It is important to work out a screening protocol with a physician well before the program is started.

The screening program inspired a sense of professional satisfaction.

Physicians in the community had expressed interest in further pharmacy-based osteoporosis testing.

Finally, one pharmacist stated he had obtained a bone density testing unit and had begun screening using NOF guidelines.

Discussion

In this study, an osteoporosis screening program was pilot-tested in five independent community pharmacies in rural Wisconsin. Client interest was high; our recruitment goal was easily met, BMD measurements were performed efficiently, and physician satisfaction was high.
NOF resources were used in four ways in this project. First, the women tested were at least 65 years old, a key group NOF recommends for testing. Second, NOF criteria, including T-score and other fracture risk factors obtained by questionnaire, were used to identify those meeting NOF treatment criteria (to be described in a subsequent report). Third, subjects were given NOF educational material. Finally, each subject’s health care provider was sent the NOF Physician’s Guide to Osteoporosis, in addition to the bone density test results and a copy of the subject’s Bone Health Questionnaire. While other community pharmacies have carried out bone density testing programs, to our knowledge ours was the first community pharmacy program based on NOF resources and information.

A key objective of this study was to assess whether primary care providers would find the information we provided useful. We asked only whether the provider found the information as a whole useful because we felt that a long questionnaire might lower the response rate. Also, we felt that asking about the Bone Health Questionnaire and bone density test separately would not be practical, because bone density test results are best evaluated in the context of other patient risk factors. A high proportion (83%) of physicians who did respond found the material useful, and none stated that pharmacists should not carry out osteoporosis screening. Our 42% response rate is similar to that reported for other physician surveys. Overall, the positive physician response in this study can be viewed as encouraging to pharmacists considering development of an osteoporosis screening program.

Client interest in osteoporosis was high, as exemplified by the ease of recruitment and the fact that women who clearly did not qualify according to the recruiting notice still wanted to participate in this study. Yet, it may be helpful for pharmacists to bear in mind that, as we found, not all women who initially express interest in the service will participate. Pharmacists should also be familiar with some of the factors that could affect participation, such as scheduling conflicts. Results from the prescreening records kept at two pharmacies (Table 2) show that approximately half of the women who originally expressed interest did not take part in the study.

Peripheral bone mass measurements are useful for initial screening, rather than diagnosis or follow-up of osteoporosis. However, some women whose bone mass had previously been measured requested heel bone density testing. These requests suggest that understanding of osteoporosis monitoring is inadequate in large segments of the target population. Based on our experience, we believe women would be receptive to pharmacy-based osteoporosis screening and pharmacists are well positioned to meet an existing need for information about osteoporosis (see Appendix 1). In this regard, pharmacists providing peripheral measurement must be aware of the phenomenon of bone mass measurement site discordance—peripheral T-scores will sometimes be different from measurements obtained at the spine and hip. An understanding of these differences will help pharmacists in their discussions with both patients and clinicians. Therefore, Appendix 2 provides further information about the relationships among peripheral bone density, spine and hip bone density, and fracture risk.

Each woman was clearly informed before testing, both verbally and in writing, that pharmacists would not provide a diagnosis, and they were encouraged to discuss their results with their physician, who would provide an interpretation or diagnosis. Still, approximately three-quarters of the women tested wanted an interpretation or diagnosis immediately after the test. This observation reinforces the need for pharmacists to formulate a clear-cut plan regarding what information to provide clients. For example, one might argue that a pharmacist informing a client that she has “low bone density” or “osteoporosis” based on a bone density test conducted in a pharmacy has provided a diagnosis (i.e., is practicing medicine).

Ultimately, if pharmacy-based osteoporosis screening is to improve a patient’s skeletal health, the bone mass data must be translated into action. In our study, 92% of women wanted the test results sent to their physicians, and the physicians found the information useful. These findings bode well for pharmacy-based osteoporosis screening. In addition to providing the physician with objective information, the screening may foster discussions about bone health between women and their health care providers.

Comments from pharmacists in the project indicated that there was continued interest in osteoporosis screening on their part and

### Table 2. Results of Screening Log from Two Pharmacies

<table>
<thead>
<tr>
<th>Category</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clients initially expressing interest</td>
<td>137</td>
</tr>
<tr>
<td>Clients enrolled</td>
<td>76</td>
</tr>
<tr>
<td>Clients not enrolled</td>
<td>61</td>
</tr>
<tr>
<td>Wanted bone test, but not to be “in a study”</td>
<td>3 (5)</td>
</tr>
<tr>
<td>Postmenopausal but under age 65</td>
<td>13 (21)</td>
</tr>
<tr>
<td>Had scheduling conflict</td>
<td>4 (7)</td>
</tr>
<tr>
<td>Taking hormone replacement therapy</td>
<td>14 (23)</td>
</tr>
<tr>
<td>Taking calcitonin</td>
<td>1 (2)</td>
</tr>
<tr>
<td>Taking alendronate</td>
<td>1 (2)</td>
</tr>
<tr>
<td>Had previous bone density test</td>
<td>7 (11)</td>
</tr>
<tr>
<td>Changed mind, unspecified, or other</td>
<td>18 (30)</td>
</tr>
</tbody>
</table>

*Results shown are from two pharmacies that kept records for all patients who initially expressed interest in the study.

### Table 3. Results of Primary Health Care Provider Survey

<table>
<thead>
<tr>
<th>Category</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subjects in study</td>
<td>133 (100)</td>
</tr>
<tr>
<td>Wished to have results mailed to primary health care provider</td>
<td>122 (92)</td>
</tr>
<tr>
<td>Primary health care providers surveyed</td>
<td>57 (100)</td>
</tr>
<tr>
<td>Answered survey</td>
<td>24 (42)</td>
</tr>
<tr>
<td>Stated information was useful</td>
<td>20 (83)</td>
</tr>
</tbody>
</table>
on the part of clients and health care providers. Their comments also reflect the fact that much work is necessary to institute a successful screening program, especially where reimbursement issues are concerned.

Based on our experience with this project and our examination of the literature, we developed a set of recommendations for community pharmacists who are interested in becoming further involved in the area of osteoporosis. These are provided in Appendix 3.

Limitations

The generalizability of our findings is limited, because the study used technology that requires substantial investment and, thus, may not be available to many pharmacies. Peripheral bone density instruments cost between $10,000 and $30,000. It may be impractical for one pharmacy to make such a large investment. However, sharing a unit among pharmacies may be a solution, because the units are portable and screening can be offered on a periodic basis.

We did not explore the issues of reimbursement potential, either directly from women or through third party payers.

A nonacademically based community pharmacy screening program may have some advantages over the one described here. Such a program, for example, may not require written informed consent from clients (although a liability waiver might be considered). Additionally, all NOF testing criteria could be followed, thereby broadening the range of clients eligible for screening. Because this was a pilot program, we kept the enrollment criteria simple and enrolled only women aged 65 and older. Our results suggest that, using a simpler form of the Bone Health Questionnaire, community pharmacists could readily assess women for NOF-designated risk factors so that qualified postmenopausal women under 65 could be tested. A final advantage is reimbursement: Pharmacies uninvolved in an academic research project could more readily advertise the service and charge a fee.

Conclusion

Using NOF resources, five community pharmacies in rural Wisconsin carried out a pilot osteoporosis screening program involving 133 rural postmenopausal women and using NOF resources in a number of ways. First, the women tested were 65 years of age and older, a key group NOF recommends for screening. Second, women were provided with NOF literature. Finally, each subject’s primary care provider received her bone mass measurement, the results of a Bone Health Questionnaire including osteoporosis risk factors, and NOF literature. The majority of physicians who provided feedback found the information we provided useful. We conclude that osteoporosis screening carried out by community pharmacists can be well accepted by physicians, and that the recently published NOF guidelines offer community pharmacists a practical tool for osteoporosis screening.

Appendix 1. Recommendations for Pharmacists

Pharmacists can become involved in osteoporosis education in a number of ways, whether or not they carry out bone density screening in their pharmacies.

Suggestions for all pharmacists:

1. Know and recognize risk factors for osteoporosis:
   - Personal history of fracture, loss of height, kyphosis
   - Family history of osteoporosis
   - Slight stature and low body weight
   - Malabsorption or poor diet
   - Immobility or inactivity
   - Inflammatory diseases
   - Hypogonadism
   - Alcohol or tobacco abuse
   - Use of certain medications (e.g., systemic glucocorticoids, antiepileptic drugs) and thyroid oversupplementation.

2. Disseminate NOF public health recommendations to all clients. These recommendations include ensuring adequate intake of calcium (1,200–1,500 mg daily) and vitamin D (400–800 IU daily), getting regular exercise, and avoiding smoking.

3. Provide NOF educational materials (available at www.nof.org) to interested clients.

4. Be prepared to advise clients about whether they may qualify for bone density testing.

5. Advise individuals on the calcium content of foods and supplements.

6. Provide information to prescribers regarding NOF screening and treatment recommendations and on antiresorptive therapy.

7. Ensure that clients receiving antiresorptive therapy understand efficacy, toxicity, and monitoring issues.

Appendix 2. Suggestions for Pharmacists Considering Performing Bone Density Screenings

Learn the basic facts about peripheral bone density testing. Crucial to a good osteoporosis screening program, but often overlooked, are an understanding of the test results, knowledge of the strengths and weaknesses of peripheral bone density measurements, and awareness of the importance of communicating with clients’ primary health care providers. Be aware that peripheral bone densitometry is an evolving area that is still hotly debated among experts.

In choosing a device for osteoporosis screening, pharmacists should think through exactly what they will communicate to physicians and should be prepared to discuss test results with
primary health care providers. Pharmacists should consider the following:

1. Primary care physicians have been shown to have a better understanding of test results and to make more appropriate clinical decisions when radiologists provided them with more complete interpretations of hip and spine DXAs instead of brief reports. Although this is a very different situation from that of a pharmacist carrying out osteoporosis screening, the principle is the same: An explanatory cover letter accompanying the results of the bone density test may make the screening results much more useful to the clinician. Such a letter could include information on the technology used from the published literature and from the manufacturer of the specific device.

2. Be aware of the phenomenon of site discordance, that there is not always a good match between bone density at different skeletal sites. Greenspan et al. examined postmenopausal women with a variety of calcaneal measurement devices and with DXA of the hip and spine. Measurements made with all tested heel measurement devices correlated reasonably well with hip bone density (correlation coefficients 0.70–0.80). The heel bone measurement units also showed a similar ability to discriminate among those individuals who were normal or osteoporotic at the hip. The authors concluded that heel measurements by either X-ray absorptiometry or ultrasound may be valuable for osteoporosis screening. A recent study examined calcaneal measurements made with a heel ultrasound unit (McCue CubaClinical Mk II) and the PIXI in comparison with lumbar spine and hip bone density with the Lunar-DPX-L. The researchers found no difference in the performance of heel units for their ability to discriminate among normal elderly women and those with osteopenia or osteoporosis at the hip. Receiver operator characteristic (ROC) analysis for the identification of osteoporotic subjects was performed. Areas under the ROC curve (95% confidence intervals) for the probability that a subject would be osteoporotic were 0.814 (0.700, 0.928) for calcaneal BMD as measured by PIXI and 0.793 (0.675, 0.911) for the ultrasound unit. Although the discriminatory abilities of calcaneal units are good, the pharmacist should understand that these correlations are not perfect and there are some individuals with normal bone density at the heel and osteoporosis at the hip and vice versa.

3. Be aware that low heel BMD has been shown to be predictive of hip fracture. Based on data from 8,134 ambulatory women in the Study of Osteoporotic Fractures, Cumming et al. concluded that low heel bone density was correlated with hip fracture risk. Other work has shown that ultrasound measurements of the heel are also predictive of hip fracture.

4. Be aware that different instruments using varied technologies and reporting units will have different thresholds or “cut-off” values for what might indicate a risk for osteoporosis at axial sites. For example, a PIXI calcaneal T-score in the −1.2 to −1.6 range has been recommended as a threshold for the physician to consider ordering a spine-and-hip DXA. Before using an instrument for osteoporosis screening, pharmacists should check with the manufacturer and consult the published literature to determine what value is reasonable to use as a threshold. This will help pharmacists prepare for questions from physicians to whom they have sent test results. Be aware that for any practical screening threshold, some patients will exhibit normal bone mass at one site but have low bone mass at other sites.

5. Take note of the comments and suggestions of pharmacists who have been involved in osteoporosis screening.

Appendix 3. Steps in the Development of an Osteoporosis Screening Program

1. Initiate the recommendations listed in Appendix 2.
   a. Become familiar with the basic principles of peripheral bone density testing. Understand the strengths and weaknesses of peripheral bone density measurements for osteoporosis screening.
   b. Check with local or regional authorities regarding the permissibility of nonphysician operation of bone density measurement devices (whether X-ray or ultrasound). State health departments should be able to provide this information.
   c. Communicate with local prescribers before starting the program. Consider asking a physician to review the policies and plans for the program.
   d. Select a unit. Important items to consider are the skeletal site measured (heel, forearm, or other); the technology used (ultrasound versus X-ray), legal requirements for use (some states restrict use of X-ray units), physical specifications that will affect portability and placement of the unit, patient preparation (ultrasound requires a gel or water; DXA does not), duration of the scan (DXA may be 30 seconds, ultrasound can take minutes), cost (usually $10,000 to $30,000), and whether the unit can be used in other settings (DXA may be best in a nursing home setting, easing patient preparation and increasing patient comfort). Finally, a crucial point is interpretation of the test results. Review the published literature and information from the manufacturer regarding how well the peripheral measurement correlates to measurements at other skeletal sites and to fracture risk.
   e. Consider strategies for acquiring a unit: rent, buy, or buy and share the unit among pharmacies.
   f. Decide whom to screen (Table 1).
   g. Formulate a clear strategy for communicating screening results to clients and physicians.

2. Set up and carry out the program.
   a. Draw up a budget. Consider the cost of bone density measurement (unit, service, training costs); transportation costs if a unit is shared; promotion and advertising costs; and...
Osteoporosis Screening

staff time for training, interaction with clients and other health care providers, and carrying out bone density tests.

b. Arrange for acquisition of the unit, either through purchase, shared purchase with other pharmacies, or leasing.

c. Advertise the service.

d. Schedule clients for testing, taking into account pharmacy staffing.

e. Provide information to clients when they are tested (available at www.nof.org).

f. Provide information to clients’ primary health care providers (available at www.nof.org).

3. Evaluate the program.

a. Consider conducting a client satisfaction survey.

b. Consider conducting a physician satisfaction survey.

c. Calculate net loss or gain in revenue.

d. Schedule subsequent screenings for other clients if the program has been successful.

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References


Learning Objectives

After reading this article, the pharmacist should be able to:
Define osteoporosis and T-score.
List risk factors for osteoporosis.
List the recommendations of the National Osteoporosis Foundation for which individuals should be tested for osteoporosis and which individuals should be treated.
Explain the advantages and disadvantages of various methods for measuring bone density.
Explain the advantages and disadvantages of pharmacists’ involvement with bone density determination and osteoporosis screening.

CE Credit

To obtain 2 hours of continuing education credit (0.2 CEU) for completing “Osteoporosis Screening by Community Pharmacists: Use of National Osteoporosis Foundation Resources,” complete the assessment exercise and CE registration form and return them to APhA. A certificate will be awarded to respondents achieving a grade of 70% or better. Individuals completing this exercise successfully by January 31, 2005, can receive credit.

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Assessment Questions

Instructions: For each question, blacken the letter on the answer sheet corresponding to the answer you select as being the correct one. CE answer sheets are located inside the back cover of this issue. Please review all your answers to be sure that you have blackened the proper spaces. There is only one correct answer to each question.

1. Osteoporosis can be considered:
   a. The presence of low bone mass (or low bone density) and associated skeletal fragility.
   b. Having a T-score less than –2.5.
   c. Having a T-score less than –1.0.
   d. Alternatives a and b are both correct.
   e. Alternatives a and c are both correct.

2. A T-score is defined as:
   a. For an individual’s bone density measured at a given site, the number of standard deviations above or below the mean for the healthy young reference population of the same sex.
   b. For an individual’s bone density measured at a given site, the number of standard deviations above or below that of others the same age.
   c. Absolute bone density in gram/cm².
   d. Absolute bone density in gram/cm³.
   e. Alternatives b and d are both correct.

3. Osteoporosis is responsible for:
   a. Approximately 1.3 million fractures per year in the U.S.
   b. Approximately 130 million fractures per year in the U.S.
   c. Approximately 50,000 fractures per year in the U.S.
   d. All fractures in the U.S.

4. Osteoporosis is responsible for approximately ___ in annual health care costs in the U.S.:
   a. $14 billion annually.
   b. $1 billion annually.
   c. $200 billion annually.
   d. $14 million annually.

5. Recommendations for whom should be tested and whom should be treated for osteoporosis were made in 1998 by:
   c. American Society of Endocrinology.

6. Recommendations made in 1998 for which individuals should be tested for bone density include:
   a. Women over 65 years of age.
   b. Postmenopausal women younger than 65 years old if they have one or more specific risk factors.
   c. Men over 65 years of age.
   d. Alternatives a, b, and c are all correct.
   e. Alternatives a and b are both correct.

7. Recommendations made in 1998 for which individuals should be treated for osteoporosis include:
   a. Women with T-scores lower than –2.0.
   b. Women with T-scores lower than –1.5 if they possess one or more specific risk factors.
   c. Men with T-scores lower than –2.0.
   d. Alternatives a, b, and c are all correct.
   e. Alternatives a and b are both correct.
8. Obstacles to adequate testing of individuals at risk for osteoporosis include:
   a. Cost of the bone density testing units.
   b. Lack of convenient access of individuals to testing facilities.
   c. Lack of interest on the part of postmenopausal women.
   d. Alternatives a, b, and c are all correct.
   e. Alternatives a and b are both correct.

9. Site discordance means:
   a. Different individuals have different bone densities at the same skeletal site.
   b. The same individual may have different T-scores at different skeletal sites.
   c. The same individual may have different T-scores when measured by the same type of unit at different physical locations (different pharmacies).
   d. Alternatives a and b are both correct.

10. Mrs. TJ, 73, has no documented health problems and had no complaints during her last visit to her physician. Her dual energy X-ray absorptiometry (DXA) scan showed a T-score of −1.7 at the spine and hip. She does not smoke, has no family history of osteoporosis, no personal history of fractures, and weighs 154 pounds. According to the 1998 NOF guidelines for osteoporosis management, which of the following statements best describes Mrs. TJ?
   a. Postmenopausal woman with osteopenia at the hip and spine.
   b. A patient who clearly qualifies for prescription antiresorptive therapy.
   c. Postmenopausal woman with osteoporosis at the hip and spine.
   d. A patient who is unlikely to need prescription antiresorptive therapy.
   e. Alternatives a and d are both correct.

11. Mrs. AB, 71, has had bilateral hip fractures and is taking alendronate. She uses no dairy products, and her total dietary calcium intake is approximately 300 mg daily. She is taking acetaminophen 650 mg four times daily for arthritis and uses an albuterol inhaler occasionally, but is taking no other medications. What are reasonable recommendations for her?
   a. Two calcium carbonate 500 mg tablets (200 mg elemental) three times daily with meals.
   b. Two calcium carbonate 500 mg tablets (each 200 mg elemental) three times daily with meals, plus two multivitamins containing 800 IU vitamin D.
   c. One calcium citrate 950 mg tablet (each 200 mg elemental) twice a day.
   d. One calcium citrate 950 mg tablet (each 200 mg elemental) twice a day plus two multivitamins containing 800 IU vitamin D.
   e. Vitamin D 50,000 IU daily.

12. Mrs. CD, 73, has had her calcaneal bone density measured at the pharmacy, and has a bone density of 0.4 gram/cm². Mean calcaneal bone density for young healthy women is 0.5 gram/cm², with a standard deviation of 0.1 gram/cm². What is her T-score at the heel?
   a. −1.
   b. −2.
   c. 0.
   d. +1.
   e. +2.

13. Plausible reasons why a pharmacist might choose an ultrasound unit over a peripheral DXA unit for an osteoporosis screening program include:
   a. Uses the same technology as the "gold standard" (hip-and-spine bone measurements).
   b. No gel or water bath required.
   c. Faster than DXA.
   d. All of the above alternatives are correct.
   e. None of the above alternatives is correct.

14. Plausible reasons why a pharmacist might choose a peripheral DXA unit over an ultrasound unit for an osteoporosis screening program include:
   a. No ionizing radiation.
   b. Fewer regulatory problems.
   c. Almost always less expensive than ultrasound.
   d. All of the above alternatives are correct.
   e. None of the above alternatives is correct.

15. Mrs. EF, age 74, has diabetes, high blood pressure, and asthma. She has refused all dietary and lifestyle counseling and has adamantly refused to take medications for these conditions for years. She has a family history of osteoporosis, smokes, and weighs 120 pounds. She has come in to the pharmacy to buy cigarettes and has asked where they are. You would:
   a. Recommend a hip-and-spine DXA.
   b. Recommend a heel ultrasound test.
   c. Recommend a heel DXA.
   d. Not recommend any bone density testing.