The Prevalence of Osteoporosis Risk Factors and Physician Intervention

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To determine the prevalence of osteoporosis risk factors and the probability of physician risk recognition and intervention, the medical records of a cohort of 243 women aged 40 to 65 years were reviewed retrospectively.

A historical cohort design was used. Risk factors present before the start of the study were identified. Osteoporosis risk recognition (discussion, problem list), osteoporosis specific intervention (counseling about risk, or estrogen or calcium supplementation), or nonspecific intervention (dietary, exercise, smoking, or alcohol counseling) were recorded over a 3-year follow-up period.

Seventy-four percent of the women had two or more risk factors. The most common were perimenopausal or postmenopausal status (73%) and absence of estrogen supplementation (ever) (65%). During the period of the study, 46 women (19%) had received an osteoporosis-specific intervention. One hundred eleven women (46%) had received one of the above or a less specific intervention. The medical records of only 25 women (10%) documented an assessment of osteoporosis risk. Only menopausal status predicted osteoporosis intervention, and the probability of intervention decreased as the total number of risk factors increased.

The data identify three groups of women who could benefit from increased risk-reduction strategies: premenopausal women, perimenopausal or postmenopausal women who have never previously taken supplemental estrogens, and women with multiple risk factors. *J Fam Pract 1991; 32:265-271.*

Osteoporosis is the most common metabolic disease of bone. The severity of this public health problem is reflected in its prevalence and its cost in health care dollars. An estimated 24 million Americans are affected, including 50% of women over the age of 45 and 90% of women over the age of 75. Over 1.3 million skeletal fractures occur annually as a result of osteoporosis. Each year 250,000 persons are hospitalized with hip fractures at an annual cost of more than $6 billion. The cumulative lifetime risk of a hip fracture is 15% for white women and 5% for white men. The occurrence of a hip fracture increases an individual's probability of dying within the following year by 5% to 20%.[1,2]

The major risk factors for osteoporosis are well documented. They include female sex, white or Asian ethnicity, positive family history, postmenopausal status, nulliparity, short stature and small bones, leanness, sedentary lifestyle, low calcium intake, smoking, alcohol abuse, and high caffeine, protein, or phosphate intake.[3–6] Endocrine disorders (premature menopause, hyperparathyroidism, hyperthyroidism, or hyperadrenocorticism), gastrointestinal disorders (peptic ulcer disease, malabsorption syndrome, lactase deficiency, or subtotal gastrectomy), and certain medications (corticosteroids, heparin, thyroid hormone, aluminum-containing antacids, furosemide, or anticonvulsants) can also increase risk.[7]

Several therapeutic approaches for replacing lost bone are being actively investigated, including hormonal manipulation (such as administration of low-dose parathyroid hormone or calcitonin) and fluoride administration.[8–11] Encouraging results with the administration of cyclical etidronate have recently been reported.[12,13] For the majority of women, primary prevention and a slowing of the rate of further bone loss by means of risk-factor reduction remain the best strategies.

Although the population prevalence of individual risk factors is known, a review of the literature revealed no reports of the prevalence of composite risk-factor profiles, the incidence of physician recognition of os-

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teoporosis risk, or the rates of physician intervention. These areas need to be addressed in view of the prevalence of the disease, the trend toward an aging population, and current management options.

The purpose of the study reported here was fourfold: (1) to determine the prevalence of osteoporosis risk factors in a family practice setting; (2) to determine the rate of physician recognition of osteoporosis risk; (3) to determine the rate of intervention with a goal of osteoporosis prevention; and (4) to identify risk factors that are associated with the physician's recognition of risk and subsequent intervention.

Methods

The study was conducted using the medical records of a community-based, university-affiliated family medicine program. This program is located in northeast Ohio and has both urban and rural practice sites. It serves a low- to middle-income predominantly white population; staffing is provided by resident and attending physicians.

The study included all women between the ages of 40 and 65 years who were seen at the family practice centers for any reason during the 1985 calendar year. A historical cohort design was used. In this design, a cohort is "... identified from past records and followed forward from that time up to the present ...."[14] Women entered the study cohort at their first office visit in 1985. The follow-up period ended on December 31, 1987. This time period allowed 2 to 3 years of follow-up for osteoporosis risk recognition and intervention.

The data collected from the medical record included the following: the patient's age, race, marital status, payment status, date of cohort entry, date of exit from study (if before the end of follow-up), height, weight, menopausal status, estrogen use, behavioral and medical risk factors for osteoporosis, and use of drugs known to be associated with osteoporosis. The number of office visits during the follow-up period was also recorded.

Independent variables were risk factors associated with an increased probability of osteoporosis. These had to be documented at or before cohort entry. Dependent variables were physician recognition of osteoporosis risk and intervention for risk reduction as recorded in the medical record. The dependent variables had to be documented during the follow-up period.

Data were also collected to document changes in risk-factors status during the follow-up period. Since little change occurred, the presentation of findings will be limited to the relationship between risk factors present at or before the 1985 start of follow-up and risk recognition and intervention that occurred during the follow-up period. This approach allows clear interpretation of the sequence of causality.

The dependent variables were operationalized as follows. Risk recognition included any mention of the woman's osteoporosis risk status in the medical record or any discussion of osteoporosis risk status with the patient. There were two possible levels of physician intervention. Osteoporosis-specific interventions included documented discussion of the risk of osteoporosis with the patient, or supplementation with estrogen or calcium. Nonspecific interventions were the above plus behavioral or medical interventions that might alter the woman's osteoporosis risk status but could have been instituted for another reason. These included dietary, exercise, alcohol, or smoking advice.

The probability of risk recognition and intervention for the individual risk factors, the total number of risk factors, and the total number of office visits was calculated. The chi-square test was used to determine statistical significance. A linear logistic model was used to adjust for the potential confounding effects of age, number of office visits, or other risk factors.[15,16] Where the data are adjusted for the effects of other risk factors, the outcome is expressed as the relative risk (RR) of intervention.

The data were analyzed using a dependent variable measured both as a dichotomy (any intervention as compared with no intervention) and on a ratio scale (cumulative occurrences of intervention). As intervention was rare, only the analysis of the dichotomous dependent variables is reported.

Results

Two hundred forty-three women met the study criteria. Thirteen (5%) were nonwhite women. One hundred eleven women (46%) were aged 40 to 49 years, 87 women (36%) were aged 50 to 59 years, and 45 women (19%) were aged 60 to 65 years. The women were predominantly either married (69%) or widowed (13%) and had private health insurance (88%). Two women died during the follow-up period, and two transferred to a physician outside of the practice.

Recognition of osteoporosis risk status and intervention with osteoporosis-specific preventive measures were rare during the follow-up period. Recognition of osteoporosis risk had been documented in the medical records of 25 women (10%). Forty-six women (19%) had received one or more interventions that would have a direct impact on their osteoporosis risk. For 34 of these women (14%), the intervention was estrogen supplementation, for 21 women (9%), it was calcium supplementation, and for 20 women (8%), it was a discussion

Table 1. Distribution of Osteoporosis Risk Factors and Probability of Intervention According to Risk Status

Risk Factor	Total No. (%)	Type of Intervention: Specific No. (%)	Type of Intervention: Nonspecific No. (%)
Age			
55–65	88 (36)	15 (17)	40 (45)
40–54*	155 (64)	31 (20)	71 (46)
Menopausal status			
Post	129 (53)	31 (24)†	70 (54)†
Peri	48 (20)	14 (29)†	26 (54)†
Pre*	45 (19)	0 (0)	10 (22)
NR	21 (9)		
Estrogen supplementation‡			
Never/NR	115 (65)	23 (20)§	61 (53)
Ever*	62 (35)	22 (35)	35 (56)
Quetelet‖			
≤25 percentile	37 (15)	5 (14)	16 (43)
>25 percentile*	185 (76)	41 (20)	95 (46)
NR	21 (9)		
Smoking			
Ever	82 (34)	14 (17)	47 (57)†
Never/NR*	161 (66)	32 (20)	64 (40)
Alcohol			
Moderate	13 (5)	1 (8)	7 (54)
Rare/none/NR*	230 (95)	45 (20)	104 (45)
Physical activity			
Impaired	11 (5)	1 (9)	7 (64)
Unimpaired/NR*	232 (95)	45 (19)	104 (45)
Predisposing drugs			
Any	53 (22)	9 (17)	25 (47)
None/NR*	190 (78)	37 (19)	86 (45)
Predisposing conditions			
Any	17 (7)	4 (24)	11 (65)
None/NR*	226 (93)	42 (19)	100 (44)

*Referent category.
†$P < .01$.
‡Among perimenopausal or postmenopausal women only.
§$P < .05$.
‖Quetelet score—Weight in kg/(height in m)^2.
NR—Not recorded.

of the risk of developing osteoporosis. There was no documented change in medication that was intended to reduce osteoporosis risk.

Interventions that were less specific to osteoporosis but might alter osteoporosis risk were more common. One hundred eleven women (46%) had received some kind of intervention. The most common nonspecific intervention was dietary advice (63 women), followed by exercise advice (33 women), smoking advice (28 women), and alcohol advice (7 women).

Osteoporosis risk factors were common among the study members. Only 37 women (15%) had no risk factor at the time of cohort entry. Twenty-six women (11%) had one risk factor; 54 women (22%) had two risk factors; 74 women (30%) had three risk factors; and 52 women (21%) had from four to seven risk factors.

Table 1 shows the distribution of risk factors among the study members. The most common risk factors were perimenopausal or postmenopausal status and lack of estrogen supplementation (ever) in conjunction with that status.

Table 1 also shows the probability of intervention in the presence of a risk factor. Both osteoporosis-specific and nonspecific interventions were significantly more likely in perimenopausal or postmenopausal women than in premenopausal women. In contrast, osteoporosis-spe-

Table 2. Distribution of Number of Risk Factors and Relative Risk of Intervention with Increasing Number of Risk Factors

Number of Risk Factors	Total No. (%)	Type of Intervention: Specific No. (%) RR*	Nonspecific No. (%) RR*
0–1†	63 (26)	5 (8) 1.0	18 (29) 1.0
2	54 (22)	20 (37) 0.5	29 (54) 0.8
3	74 (30)	14 (19) 0.2‡	35 (47) 0.4
4–7	52 (21)	7 (13) 0.1§	29 (56) 0.6

**Relative risk adjusted for number of office visits and menopausal status.*
†Referent category.
‡P < .05.
§P < .01.

cific interventions were significantly less frequent among the women who had not previously received supplemental estrogens. Examination of the effect of supplemental estrogens was limited to the women who were perimenopausal or postmenopausal. Nonspecific interventions were more common among women who were current or former smokers.

The following diseases that might predispose a woman to osteoporosis were found in the study group: hyperthyroidism, hyperparathyroidism, adrenocortical hyperactivity, malabsorption syndromes, and diabetes. The following drugs that might predispose a woman to osteoporosis were documented in the medical records of study members: aluminum-containing antacids, thyroid replacement hormones, phenytoin, furosemide, and corticosteroids used chronically. Neither the presence of a predisposing disease nor the use of a predisposing medication was associated with either specific or nonspecific intervention. No single disease or medication was common enough to examine separately.

The data shown in Table 1 were adjusted simultaneously for age and the number of follow-up visits. These adjustments did not substantially change the results, and, for ease of interpretation, only the crude proportions are shown.

Table 2 shows the relationship between a woman's total number of risk factors and the frequency of osteoporosis intervention. The crude data showed a slight increase in intervention as the number of risk factors increased. This was due to a strong positive relationship of total risk factors with both the menopausal status and the number of office visits. After adjustment for these factors, the probability of each type of intervention decreased in the presence of two or more risk factors. For osteoporosis-specific interventions, this decrease was statistically significant (RR = 0.2, $P < .05$ for three risk factors; RR = 0.1, $P < .01$ for four to seven risk factors).

Table 3 shows the cumulative number of office visits during the study period. The number of office visits during the follow-up period, excluding the cohort entry visit, ranged from 0 to 39, with a median of four visits. The relative probability of intervention increased if the woman had made three or more office visits during the follow-up period. The increase in probability of nonspecific interventions was statistically significant, and this probability increased as the number of office visits increased (three to six visits, RR = 3.0, $P < .01$; seven or more visits, RR = 5.6, $P < .01$).

Data on physician recognition of osteoporosis risk factors are not shown in the tables. With the exception of menopausal status, there was no single risk factor that increased the probability of risk recognition. Since there was no documented recognition of osteoporosis risk in the medical record of any premenopausal woman, menopausal status strongly predicted osteoporosis risk recognition. Neither a greater number of risk factors nor more frequent office visits increased the probability of osteoporosis risk recognition by the physician.

There were 82 women in the study who had less than three office visits during the follow-up period, in-

Table 3. Distribution of Number of Office Visits and Relative Risk of Intervention with Increasing Number of Office Visits

Number of Office Visits	Total No. (%)	Type of Intervention: Specific No. (%) RR*	Nonspecific No. (%) RR*
0–2†	82 (34)	7 (9) 1.0	18 (22) 1.0
3–6	89 (37)	21 (24) 2.2	45 (51) 3.0‡
≥7	72 (30)	18 (25) 2.1	48 (67) 5.6‡

**Relative risk adjusted for age and menopausal status.*
†Referent category.
‡P < .01.

cluding 35 whose only office visit was the cohort entry visit. The data from these 82 women were excluded to examine the possibility that a minimum number of office visits are required for any osteoporosis intervention. The results in the remaining subgroup parallel the results from the complete sample.

As menopausal status was strongly associated with intervention, the data analyses were repeated within subgroups consisting of premenopausal, perimenopausal, and postmenopausal women. The effects of the risk factors shown in Tables 1 and 2 for the overall group are representative of the effects in each subgroup. The exception is premenopausal women among whom specific interventions were lacking and could not be analyzed. As in the total sample, postmenopausal women who had never previously been prescribed supplemental estrogens were unlikely (RR = 0.5, $P < .05$) to receive any osteoporosis-specific intervention. Among postmenopausal women, presumably owing to estrogen supplementation after surgical menopause, age was inversely associated with both specific and nonspecific interventions (RR = 0.4 and RR = 0.6, both $P < .01$).

Discussion

This study was limited to women between the ages of 40 and 65 years, since women are at substantially greater osteoporosis risk than men, and since this age range can best benefit from prevention strategies. Maximum bone density occurs between the ages of 20 and 35 years. It declines thereafter because of aging, postmenopausal changes, and sporadic factors. Age-dependent bone loss (primarily cortical bone) begins at age 40 years. This loss progresses at a rate of approximately 0.3% to 0.5% per year over subsequent decades until extreme old age, at which time it slows or ceases. Postmenopausal changes result in additional bone loss (primarily trabecular), which may range from 3% to 10% per year for the next 4 to 8 years before declining exponentially to a steady baseline rate.[4,5,17,18]

Our data demonstrate both the level of osteoporosis risk and the use of strategies for prevention among a group of middle-aged women. More than one half of the women in the study had three or more risk factors. Only 10% had any mention in their medical records of their levels of risk for developing osteoporosis, however, and less than 20% had received any intervention that would have a direct impact on their risk status. Among premenopausal women, there was a complete absence of osteoporosis-specific intervention.

Women to whom supplemental estrogens had not been prescribed before the start of the study were unlikely to have estrogens prescribed during the follow-up period. These may have been women who consistently refused estrogen supplementation or for whom such therapy was judged inappropriate. The reduced likelihood of estrogen supplementation explains the lowered likelihood of osteoporosis-specific intervention seen in Table 1.

Contrary to our expectation, the probability of an osteoporosis-specific intervention decreased as the number of risk factors increased. With the exception of menopausal status, every risk factor showed a slight negative association or no association with osteoporosis-specific intervention. Among women with four or more risk factors, the adjusted probability of intervention was only 10% of the probability among women who had one or no risk factor.

Women with four or more risk factors had the following profile: 98% were perimenopausal or postmenopausal; 76% had never taken supplemental estrogens; 76% were aged 55 years or older; 70% were current or former smokers; and 38% had a Quetelet score in the lowest quartile of the weight distribution of US women between the ages of 40 and 65. Only 13% of the women who had four or more risk factors had received any osteoporosis-specific intervention.

The strong inverse association between osteoporosis risk factors and osteoporosis-specific intervention may have resulted from a concurrence of osteoporosis risk factors with other conditions. The physician may have been involved in active treatment rather than in prevention in cases when the woman had other health problems. We were unable to address this hypothesis directly. Although nonspecific interventions also did not increase with osteoporosis risk factors, they did increase as the number of office visits during the follow-up period increased and did occur more often among current or former smokers.

There may also be a subgroup of healthy women who initiate a discussion of osteoporosis with their physicians. Alternatively, the physician may feel that there is more time for such a discussion with a healthy woman. This may partly explain our finding of relatively more osteoporosis-specific intervention in women with fewer risk factors.

In summary, the data provide no clear explanation for the negative association between the number of osteoporosis risk factors and osteoporosis-specific intervention. Although the medical record frequently documents osteoporosis risk factors, physicians appear to be unlikely to associate them with osteoporosis and to act on them. For example, 53 women had been prescribed medication that increased their risk for osteoporosis, and none had the medication changed by their physician to reduce this risk.

The research suffers from the limitations of data taken from medical records. Often the medical record incompletely documents the activities that occur during an office visit.[19] Counseling and behavioral interventions for risk reduction may be less likely to be recorded than more concrete activities, such as diagnostic procedures. This could partly explain the overall low probability of documented intervention.

In this university-affiliated family practice center, during the period of this study there was an ongoing health promotion–disease prevention teaching program that covered osteoporosis. Consequently, the rates of intervention and documentation in this center may be higher than those found in other settings.

Wasnich and colleagues[20] identify three phases of osteoporosis prevention and treatment. *Primary prevention* refers to "efforts directed at achieving maximal peak bone mass during years of skeletal maturation," for example, making sure that there is adequate dietary calcium during young adulthood. *Secondary prevention* refers to efforts to minimize bone loss due to aging and postmenopausal changes. Secondary prevention may take the form of giving dietary and exercise advice, counseling to change behavior, prescribing estrogen supplementation, and changing medication, as appropriate. *Restorative treatment* refers to treatment of persons who have been diagnosed as having osteoporosis, with the goal of increasing bone density and consequently reducing the rate of fractures.

Based on their risk-factor profiles, a majority of the women in this study may be candidates for secondary prevention. Such activity requires that the physician be aware of risk factors and familiar with intervention options. Based again on the presence of multiple risk factors, some women in the study may be candidates for investigation by bone-density measurement, which is currently recommended for selected high-risk women.[21] Again, physician recognition of women at risk is necessary for appropriate referral.

Although bone-density measurement has been discussed as a screening technique, widespread bone-density screening has yet to be justified in terms of efficacy, safety, and cost. Of three possible techniques for measuring bone density, single or dual photon absorptiometry has been most commonly used. Dual photon absorptiometry is relatively precise, but it involves undesirable radiation exposure and is expensive. Quantitative computerized tomography is also used, but it too is expensive and involves significantly more radiation exposure.[22,23] The recently described use of ultrasound examination of the patella to identify women with osteoporotic fractures suggests a low-risk and less expensive evaluation tool.[24] These techniques, however, identify women in whom substantial bone loss has already occurred.[23] Currently, the determination of risk from patient histories by the primary care physician remains the appropriate option for the majority of women.

Regarding our data, one might speculate that although the physician recognized osteoporosis risk factors, he or she felt that simple, effective, and risk-free preventive or treatment options were unavailable. The data supporting calcium supplementation and weight-bearing exercise have been controversial.[2,4] Although the benefits of estrogen supplementation in preventing fractures, in reducing other postmenopausal changes, and in possibly reducing cardiovascular risk are recognized, estrogen use increases the risk of endometrial cancer and, possibly, breast cancer.[23,25,26] Recently, encouraging treatment results have been reported using cyclical etidronate to increase bone density and reduce vertebral fractures.[12,13] Supplementation with calcium citrate malate has been shown to reduce bone loss in women with low levels of dietary calcium.[27] These advances may create an improved climate for both the treatment and the prevention of osteoporosis.

The prevention of disease, including osteoporosis, should constitute a principle of practice for primary care physicians.[28] Our data suggest that the osteoporosis prevention needs of women at high risk have been unrecognized. We identify three groups of women who are in need of increased intervention. In this study, women with multiple risk factors were very unlikely to receive any intervention. Perimenopausal or postmenopausal women who cannot or will not take supplemental estrogens may be candidates for intensified intervention using other strategies. Premenopausal women, who in this sample received virtually no intervention, are the most appropriate target for lifetime osteoporosis risk reduction.

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