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A randomized study of the effect of five-year and lifetime hip fracture risk information on physician recommendations for management of low bone density

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Abstract

While risk prediction tools providing absolute fracture risk information are currently under development, little is known about U.S. physicians' current thresholds for osteoporosis treatment or the potential effect of fracture risk information upon treatment decisions. To investigate this, a random sample of U.S. primary care physicians was surveyed. Treatment recommendations for four patient scenarios depicting postmenopausal women of varying ages, weights and BMD were elicited. Physicians were randomly assigned to receive all scenarios with either a basic BMD report or an augmented BMD report containing five-year and lifetime absolute hip fracture risk estimates. Over 95% of physicians recommended prescription pharmacologic treatment of a seventy year-old patient with osteoporosis. For three scenarios depicting women with T-scores of -1.01 , treatment recommendations ranged from 30 to 44%. There were no statistically significant differences between physicians who received augmented and basic BMD reports, although those with augmented BMD reports were less likely to recommend prescription treatments. Physician specialty had inconsistent and small effects on recommendations. We conclude that nearly all of a random sample of US primary care physicians recommend pharmacologic treatment of osteoporosis, but a substantial minority also recommend treatment for patients who would not fit current guidelines. A BMD report including absolute hip fracture risk estimates did not change treatment recommendations.

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Keywords

Bone mineral density; postmenopausal osteoporosis; survey research; physician's practice patterns

INTRODUCTION

Decision-support or risk prediction tools have recently been developed to help physicians predict the likelihood of patients' future medical events of many types. Patients at high risk for cardiovascular events, for example, can be identified using information about current smoking, blood pressure, diabetes and cholesterol. Cardiovascular prevention guidelines strongly recommend using such patient-specific risk information for decision-making (1). Risk prediction tools have also been developed and are being refined for fractures (2–4).

There is evidence to suggest that current U.S. osteoporosis care and fracture prevention could be improved. Current osteoporosis treatment decisions do not correlate well with objective measures of patient fracture risk. Specifically, osteoporosis appears to be under-recognized and under-treated in older patients (5, 6), patients with multiple osteoporosis risk factors (7), and patients with prior fractures (8–10). It is not known whether there is widespread treatment of lower-risk patients, but by one estimate nearly 13% of women over 65 are receiving osteoporosis treatment (11). An extended-format bone mineral density (BMD) report has been shown to increase treatment rates, suggesting that providing more information to physicians can affect care (12). It is not known whether the provision of osteoporosis or fracture risk information would improve targeting of osteoporosis care.

In this study, we evaluated U.S. physicians' current osteoporosis management. We also evaluated whether physicians who are presented with quantitative hip fracture risk estimates would use that information in decision-making on postmenopausal osteoporosis prevention or treatment. We examined these questions using a mailed survey of a random sample of primary care physicians in the United States. A randomized design was used to assess the effect of quantitative fracture risk information upon physician recommendations for treatment of low bone density among postmenopausal women. We also assessed the effects of physician characteristics on treatment recommendations.

METHODS

Sample Selection

A random national sample of 736 United States physicians in primary care specialties (family medicine, general practice, internal medicine, and obstetrics/gynecology) was selected from the 2003 American Medical Association (AMA) Masterfile. Sampling was stratified by specialty to reflect specialty prevalence in the U.S. physician population. The AMA database of physicians has information about every physician who entered either a U.S. medical school or residency. Information in the database is collected from primary sources for physician age, sex, and training. Information on current specialty type is collected in a triennial survey to physicians. For survey non-respondents, specialty is

assigned by the AMA based on the last residency or fellowship training recorded by the American Board of Medical Specialties.

All physician respondents were initially eligible for the study. Subjects were then excluded if they reported they spent no time performing general obstetrics and gynecology, primary care internal medicine, or primary care family medicine.

Survey Design and Administration

Physicians were asked to complete a mailed survey between March and May of 2004. The survey was developed following a review of the literature and discussions with osteoporosis experts. It was further refined in response to feedback from pilot testing by two physician small groups, one of general internists and one of geriatricians. To maximize the response rate, survey participants were provided five dollars in cash with an initial mailing of the survey (13), and two subsequent mailings were sent to nonrespondents. Subjects were told that the purpose of the survey was to provide insight into primary care physicians' routine daily practices in osteoporosis care.

Participants were assigned one of two survey versions using a random number table. To address the primary research question of the effect of absolute risk fracture information on treatment of low bone density, the survey included four patient scenarios followed by questions about treatment recommendations for each scenario (table 1). The four scenarios were chosen to reflect several combinations of age, bone density, and the fracture risk factor of low weight (13, 14). All other elements in the scenarios were identical, and in each case included a description of a white postmenopausal woman who was a lifelong nonsmoker and had no personal or family history of fractures. The scenarios then varied by patient's age, weight and bone density. Physicians were randomly assigned to receive either all four clinical scenarios with a basic bone density report (basic version) or an augmented bone density report containing five-year and lifetime absolute hip fracture risk estimates or probabilities (augmented version).

Measures and Variables

Likelihood of Prescription Therapy Recommendations for Clinical Scenarios

—For each of the four patient scenarios, physicians were asked to respond either “yes” or “no” to the following items about treatment decisions; “Would you... a) “treat this patient with calcium” b) “treat this patient with Vitamin D” and c) “prescribe any other medication to prevent fractures”

Basic and Augmented Bone Density Reports—The physicians randomized to the basic bone density report received a report containing the bone density of the scenario patients at the total hip (g/cm²), the T-score (number of standard deviations from the young adult mean), and the Z-score (number of standard deviations from an age and sex-matched control, all as calculated using bone densitometer software (GE Lunar Corp, Madison, WI). The reports also included the World Health Organization bone density criteria for osteoporosis.

The physicians randomized to receive the augmented bone mineral density report received estimates of the lifetime and five-year absolute risk of hip fracture for the scenario patients (table 1). These were calculated based on age, T-score and weight from published sources from the Study of Osteoporotic Fractures (4, 15–17). The U.S. average weight for the patient's age was used (18) for scenarios listed as average weight. Where estimates for five-year hip fracture risk differed slightly between the two published sources, they were reported as a range (eg 0.6–0.9%) and those below 0.5% were reported as <0.5%. The lifetime risk prediction algorithms did not include any predictors other than BMD and age. The single case (case 3) of a patient with a clinical risk factor was therefore described as 17–34%, or a risk between that conferred by a T-score of –1 and –2.5.

The research was conducted with a grant from the Hartford Foundation and the Society of General Internal Medicine. The funding organization did not have any role in the design, collection, analysis, or interpretation of the data. It did not review this manuscript. The study design was reviewed and approved by the institutional review board of the Medical College of Wisconsin.

Statistical Analysis

Respondents were compared to non-respondents with respect to age, sex, and specialty using the Chi square test for categorical variables and t-test for continuous variables. Appropriate descriptive statistics were used for respondents' demographic variables. The percent of physicians reporting that they would treat each scenario patient with calcium, vitamin D and other medications was calculated.

The differences in treatment decisions between the basic and augmented BMD groups were tested using the Chi square test for significance. To evaluate the influence of physician characteristics (age, gender, and specialty) and U.S. census region of residence (Northeast, Midwest, South, West) upon treatment, a logistic regression model which included adjustment for randomization assignment was also developed for each clinical scenario.

RESULTS

Study Population

Of the 736 randomly selected physicians, 19 were found to be ineligible (i.e. no correct address available (n=17) or died (n=2)). Questionnaires were returned by 360 of the remaining 717 physicians for a 50.2% response rate.

Respondents did not differ from nonrespondents by sex or age. Obstetrician-gynecologists were more likely to respond (59%) compared with internal medicine (48%) or family/general practice (46%) ($p=.050$) physicians. Seventy-three physicians reported that they did not practice any primary care medicine, and they were excluded from further analyses. The final study cohort thus included 287 physicians practicing internal medicine, family medicine, and general obstetrics and gynecology (table 2).

Clinical Scenario Treatment Recommendations

Over 96% of physicians reported that they would prescribe calcium and vitamin D for patients in all scenarios. Over 95% of physicians reported that they would prescribe treatment other than calcium/vitamin D to a seventy-year old patient with substantially decreased bone density (T score -2.6) For the other three scenarios, overall treatment recommendations ranged from 30 to 44%.

Physicians who received an augmented BMD report were less likely to prescribe additional treatments other than calcium/vitamin D for all four treatment scenarios (table 3), but these differences did not reach statistical significance. For scenario 2, which depicted a 70-year old patient with a T-score of -1.01 and Z-score of 0.3 and no other risk factors, there was an 11% reduction in treatment recommendations and a statistical trend compared to those who received the basic BMD report ($p=.053$).

Association of Physician Characteristics with Clinical Scenario Treatment Decisions

Because of the very high rate of treatment prescriptions for scenario 1, we did not examine the association of physician characteristics with treatment for this scenario. For the other three scenarios, the association of physician characteristics with treatment recommendations other than calcium or vitamin D was inconsistent across scenarios (table 4). Family medicine physicians were more likely than internists to treat a seventy-year-old woman with a T-score of -1.01 S.D.s and no other risk factors (scenario 2); gynecologists were more likely than internists to treat a similar patient who weighed 124 pounds (scenario 3). Physician gender, physician age, and US census region of practice were not significantly associated with treatment recommendations for any of the scenarios.

DISCUSSION

Over 95% of U.S. primary care physicians surveyed in this study would recommend osteoporosis treatment beyond calcium and vitamin D for a postmenopausal woman with a T-score lower than -2.5 on a hip bone mineral density test. Between one-third and one-half of the physicians also would recommend prescription pharmacologic treatment for postmenopausal women with T-scores of just below -1.0 . There were no statistically significant differences in physician treatment recommendations by randomization to basic bone mineral density results or BMD results augmented with absolute fracture risk estimates.

This study's finding of high rates of treatment recommendations once osteoporosis is diagnosed is consistent with previous studies that directly assessed physician behavior. In a study of over 6,000 patients at one academic medical center, electronic records from a subset of patients with T-scores <-2.5 were examined for pharmacologic treatment (5). Among these 50 patients, (88%) were given some pharmacologic treatment for osteoporosis. A smaller study of An analysis of a large national pharmaceutical database (11) also found both rapidly rising rates of osteoporosis diagnosis and a 97% treatment rate once osteoporosis was diagnosed.

Although differences were not statistically significant, for the three clinical scenarios in our study depicting patients with mildly reduced bone density (osteopenia), physicians receiving augmented bone density reports were less likely to recommend prescription treatment. There was a statistical trend ($p=.053$) toward this reduced treatment for the scenario depicting the lowest-risk older patient. This is similar to the findings of Ettinger et al from another physician survey in a regional HMO(19). In that study, physicians provided with absolute fracture risk estimates were significantly less likely than those given only a clinical scenario and DXA results to treat a low-risk patient. Current guidelines would not recommend treatment for the patients with osteopenia we and Ettinger depicted (20, 21). Although FDA-approved therapies are available for patients like those described in these scenarios, treatment benefits for such patients are small,(22, 23) and probably not cost-effective.(24) The possible overtreatment of some low-risk patients suggested by these two studies is particularly concerning given strong evidence of undertreatment of high-risk patients (25).

Recent proposals to better incorporate additional fracture risk factors into a risk score or algorithm (3) would directly address lack of attention to fracture prevention among higher-risk patients. However, it is not clear how those new treatment recommendations, or the science guiding them, would be communicated to primary care physicians. New recommendations are often described in guidelines, but poor guideline adherence has been documented in many fields of medicine (26). Despite guidelines from the National Osteoporosis Foundation(20) and others (21, 27) that have been disseminated a decade or more, physicians in our study vary greatly in their current assessment of appropriate treatment thresholds. Our study thus suggests that if reducing treatment of patients at low fracture risk is an important societal goal, good communication of recommended treatment thresholds may be particularly important in new guidelines using absolute fracture risk algorithms.

Our study has several limitations. First, we could not examine all combinations of risk factors and bone density results. However, the scenarios studied were chosen to highlight both ends of a spectrum of risk commonly encountered by primary care physicians. Second, because of the morbidity of hip fractures and the lack of data on total overall fractures (total fractures were reported separately as vertebral and nonvertebral fractures) in the prediction rule from the U.S. Study of Osteoporotic Fractures (4), we chose to give hip fracture risk information alone. It is possible that our results would have been different if we had provided total fracture information. We were unable to measure actual physician behavior in our study, and the very high treatment rate for the patient scenario with osteoporosis raises the possibility of a social desirability bias. However, previous studies have shown that clinical scenarios correlate better than chart review with a gold standard of patient reports of preventive care (28). Furthermore, most physicians randomized to a basic bone density report in our study reported high estimates of hip fracture risk, and physicians who estimated the lowest fracture risks were least likely to recommend treatment (data not shown), suggesting that physicians' treatment recommendations and risk perceptions did correspond. It is also possible that physician respondents are more interested in osteoporosis than nonrespondents, although respondents did not differ from nonrespondents by sex or age. Finally, our study can generalize only from the 50% of physicians who responded to our survey. However, in our comparison of respondents to nonrespondents, respondents differed

in their demographic characteristics from nonrespondents only by the increased likelihood of gynecologists to respond.

In conclusion, nearly all primary care physicians in a national sample reported pharmacologic treatment of postmenopausal osteoporosis. A substantial minority reported treatment of patients with only mild reductions in bone density, patients who would not fit current guidelines' treatment thresholds. Prediction tools or algorithms similar to those we examined here are currently being refined to allow clinical assessment of fracture risk based on bone density, age, and other major risk factors for fracture. Future research might build on our and others' results to investigate the effect of fracture risk-based osteoporosis treatment recommendations upon actual treatment, particularly whether guideline adherence improves.

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Table 1

Case Scenario Descriptions

Case Scenario *	T-score	Z-score	Lifetime Hip Fracture Risk (%)	5-year. Hip Fracture Risk (%)
Case 1. Age 70, average wt.	-2.60	-1.3	35	3
Case 2. Age 70, average wt.	-1.01	0.3	17	0.6-0.9
Case 3. Age 70, 124 lb	-1.01	0.6	17-34	2
Case 4. Age 50, average wt.	-1.01	-0.9	16	<0.5

* Case Scenarios provided to primary care physicians surveyed about osteoporosis care. Case scenarios were developed from published studies using the Study of Osteoporotic Fractures. Each case included a description of a white postmenopausal woman who was a lifelong nonsmoker and had no personal or family history of fractures. All physicians received the basic clinical and bone density information including T-scores and Z-scores (unshaded area). One-half of physicians were randomized to also receive augmented information about lifetime and five-year hip fracture risk derived from published algorithms (shaded area).

Table 2

Primary Care Respondent Physicians' Demographics (n=287)

Primary Care Physician Characteristic	
Age (mean years)	47.5 (SD 11.3)
Sex (% male)	72
Specialty (%)	
Family Medicine or General Practice	42
General Internal Medicine	37
General Obstetrics and Gynecology	21

Table 3

Effects of Absolute Fracture Risk Estimates on Physician Prescription Osteoporosis Treatment Recommendations

Scenario Characteristics	% Osteoporosis Treatment by Physicians who Received an Augmented BMD Report (n=138)	% Osteoporosis Treatment by Physicians who Received a Basic BMD Report (n=141)	P value
1. 70 year old T-score -2.5	95	96	0.53
2. 70 yr old T-score -1.01	25	36	0.053
3. 70 yr old low weight, T- score -1.01	44	45	0.89
4. 50 yr old T-score -1.01	38	43	0.37

Table 4

Association of physician characteristics with prescribed osteoporosis treatment

	Adjusted Odds Ratio (95% Confidence Intervals)		
	Case 2	Case 3	Case 4
Physician specialty			
Internal medicine	-	-	-
Gynecology	1.27 (0.60, 2.67)	2.14 (1.08, 4.24)	0.98 (0.50, 1.93)
Family medicine	1.99 (1.02, 3.67)	1.52 (0.87, 2.67)	0.95 (0.55, 1.67)
Physician age			
< 40	-	-	-
40–49	1.15 (0.58, 2.28)	1.33 (0.70, 2.51)	1.35 (0.71, 2.56)
50–59	0.82 (0.37, 1.81)	0.74 (0.35, 1.54)	0.95 (0.46, 1.98)
60	1.18 (0.47, 2.97)	1.47 (0.63, 3.44)	1.75 (0.74, 4.13)
Male Physician	0.88 (0.47, 1.65)	0.70 (0.39, 1.26)	1.08 (0.60, 1.96)
Region			
Northeast	-	-	-
Midwest	0.86 (0.37, 2.01)	0.82 (0.39, 1.75)	1.42 (0.65, 3.08)
South	1.68 (0.79, 3.59)	1.10 (0.55, 2.21)	1.77 (0.86, 3.63)
West	1.07 (0.46, 2.48)	0.85 (0.39, 1.85)	1.41 (0.64, 3.08)
Augmented BMD report	0.62 (0.37, 1.06)	1.00 (0.61, 1.64)	0.80 (0.49, 1.32)

* All odds ratio adjusted for physician specialty, age, gender, US census region and randomization to augmented vs basic BMD reports