

A Postfracture Initiative to Improve Osteoporosis Management in a Community Hospital in Ontario

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Background: Screening programs to manage osteoporosis in fracture clinic environments have had varying success in terms of increasing rates of investigation and initiation of treatment for the disease.

Methods: We determined rates of postfracture investigation and care for osteoporosis in patients screened through a coordinator-based initiative in a community hospital fracture clinic. A coordinator screened outpatients, educated them about osteoporosis, advised them to see their family physician for assessment and/or treatment, and performed follow-up at six months. Men who were fifty years of age or older and women who were forty years of age or older and had a fragility fracture were eligible.

Results: Of 505 patients enrolled at baseline, 332 (66%) returned the follow-up questionnaire; 51% of those patients reported having had a bone mineral density test after screening and 26% had initiated first-line treatment (35% if the patients who had already initiated treatment at baseline were excluded) and an additional 23% were continuing treatment since baseline. After adjustment for demographic and baseline variables, patients who had initiated first-line treatment after screening were 4.15 times more likely to have had a bone mineral density test after screening than patients who had never initiated treatment and 11.67 times more likely to have had a bone mineral density test after screening than patients who had continued treatment since baseline.

Conclusions: A coordinator-based osteoporosis screening program was associated with osteoporosis investigation and treatment. A postfracture bone mineral density test was highly associated with treatment initiation.

Patients often do not undergo an investigation or treatment for osteoporosis after they are seen with a fragility fracture¹⁻⁶. In fifteen of twenty-three international studies of osteoporosis management after a fragility fracture, bone mineral density scans were performed in <15% of patients². A review of Canadian studies showed that 50% to 98% of individuals who sustained a fragility fracture received no diagnosis or diagnostic test and approximately 63% to 95% were not prescribed osteoporosis treatment⁴. That Canadian review may have actually underestimated the gaps in investigation and treatment because it did not report on bone mineral density testing alone and osteoporosis treatment included both pharmacologic and non-pharmacologic means.

Screening programs to manage osteoporosis in a fracture clinic environment have had varying success in terms of increasing the rates of investigation for osteoporosis and initia-

tion of treatment for the disease^{5,7-15}. When screening intervention has been minimal or directed back to the family physician, the reported rates of medication initiation have been low (6% to 17%)^{5,10}. More intensive osteoporosis initiatives appear to lead to higher rates of medication initiation^{7,12-14,16}. One controlled trial consisting of patient education and physician reminders that included treatment guidelines endorsed by opinion leaders resulted in 40% of the patients in the intervention group (compared with 10% of the controls) being prescribed medication¹⁶; at one year postfracture, 82% of the patients in the intervention group reported that they were still filling their prescriptions¹⁷.

Models of postfracture care in which a dedicated coordinator is responsible for identifying, screening, and possibly referring patients for care appear to be particularly successful in initiating and maintaining the use of osteoporosis medica-

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tion^{7,13,15,18}. One intervention in which a clinic nurse identified patients presenting to the emergency department with a fracture, ordered bone mineral density tests, and discussed the test results with the patients resulted in 62% of the patients receiving a bone mineral density test and 37% of those patients being diagnosed with osteoporosis on the basis of the test. Eighty-four percent of the patients who were given advice about drug therapy and referred back to their family physician reported receiving medication for the osteoporosis¹⁵. In a pilot study in which a specialty service facilitated by a nurse manager was developed to coordinate osteoporosis care for patients with a hip fracture, 84% of the patients were adhering to their prescribed medication protocol at twelve months⁷. However, these coordinator-based initiatives included patients who were already taking osteoporosis medication and it is difficult to determine the effect of the intervention on medication initiation.

To date, osteoporosis-screening initiatives have primarily been conducted in urban settings and/or teaching hospitals; little is known about the outcomes of a screening program in a community setting. The purpose of this study was to determine the rates of postfracture investigations and treatment for osteoporosis in patients screened through a coordinator-based initiative in a regional community hospital fracture clinic in Ontario, Canada.

Materials and Methods

The Fracture Clinic Initiative

We conducted a prospective cohort study. At the time of the initiative, our 341-bed hospital was providing tertiary services to a large catchment containing both rural and urban populations. A coordinator screened and identified outpatients with a fragility fracture (sustained from a slip or fall from a standing height or less), educated them about osteoporosis, and then referred them back to their family physician for further assessment and intervention. Eligible patients were men who were fifty years of age or older and women who were forty years of age or older¹⁹ who presented, over a twelve-month period, to an outpatient fracture clinic for follow-up up to two years after a low-energy fracture of the distal part of the radius (wrist), proximal part of the humerus (shoulder), proximal part of the femur (hip), or vertebrae (spine). We did not determine whether the patients had been hospitalized prior to enrollment; the screening coordinator did not have any contact with the patients or their families prior to enrollment. Patients who demonstrated difficulties with the English language or cognitive impairments were not included unless a spouse or friend was present to assist with the completion of the questionnaire.

Eligible patients were approached by the coordinator and given a letter endorsed by a clinic orthopaedic surgeon inviting them to participate in a fracture prevention program. The patients received both verbal and written information concerning bone health and osteoporosis and advice to contact their pharmacist and family physician for further information on vitamin-D and calcium supplementation and their family physician for further investigation and treatment of their bone

health. Patients completed a questionnaire with the coordinator that reviewed demographics, fracture details, previous fracture and family history of fracture, osteoporosis testing and treatment (if any), and general knowledge about osteoporosis. Patients were asked for permission to be recontacted at three and six months after screening in order to reinforce education and to determine their progress with regard to osteoporosis testing and treatment. At three months postfracture, the coordinator contacted the patient by telephone to inquire about his or her adherence to recommendations regarding calcium and vitamin-D supplementation, bone mineral density testing, and osteoporosis medications. Additional education and reinforcement of the recommendations were given at that time, if needed. At six months, a follow-up questionnaire focusing specifically on osteoporosis investigation and treatment was mailed to the patients. This study was approved by the research ethics board of the hospital.

Baseline Questionnaire

Demographics

At baseline, respondents provided information about their age, sex, current marital status (partner or no partner), highest level of education received (less than college or university, or college or university or higher), location of primary residence (urban or rural), and current smoking status (yes or no). Respondents were also asked if their natural mother had ever broken her hip, wrist, shoulder, or spine and whether their natural father had ever broken his hip, wrist, shoulder, or spine (yes, no, or don't know).

Present and Prior Fractures

At baseline, the respondents were asked which bone was currently broken (wrist, hip, shoulder, spine, or other). They were then asked if they had previously broken the wrist, hip, shoulder, or spine as a result of a trip, stumble, slip, or simple fall from a standing height or a similar low-impact injury. The respondents were coded as having a prior fracture if they responded "yes" to the question about breaking any of these bones.

Knowledge and Beliefs About Osteoporosis

At baseline, the respondents completed the Facts on Osteoporosis Quiz (FOOQ), a twenty-item measure assessing knowledge of osteoporosis, including general facts, items related to preventive behaviors, and items on risk factors. Response options were true, false, and don't know, with higher scores (out of 20 points) reflecting greater knowledge. The measure was developed so that it could be understood by someone with a sixth-grade reading level, and it has demonstrated content validity and reliability^{20,21}. The respondents were also asked whether they thought the broken bone could have been caused by osteoporosis (thin or brittle bones) (yes, no, or don't know).

Osteoporosis Status and Care

At baseline, the respondents indicated whether they had ever had a bone mineral density test (yes, no, or don't know). In a

subsequent question, they were asked if they had ever been told by a doctor that they may have a condition called *osteoporosis* (thin or brittle bones) (yes or no). If they responded “yes,” they were asked what medications they were prescribed for the osteoporosis. A list of medications was provided. First-line therapy was defined as any of the following: Actonel (risedronate), Forteo (teriparatide), Fosamax (alendronate), or Evista (raloxifene)¹⁹. The respondents also indicated if they were taking calcium and vitamin D or a multivitamin (containing vitamin D) specifically for the osteoporosis.

Follow-up Questionnaire

At the time of follow-up, the patients were asked if they had had a bone mineral density test in the past six months (yes, no, don’t know). If they responded “yes,” they were asked what the bone mineral density results indicated (osteoporosis, osteopenia, normal bones, or don’t know). The type of bone mineral density measurement utilized and the actual bone mineral density results were not accessible for this study. Although we recognize the inaccuracy of self-reported bone mineral density results, other studies have demonstrated that the self-reported *understanding* of bone mineral density test results is significantly associated with treatment initiation²². At this time, respondents were again asked what medications they were currently taking for the osteoporosis. The same list of medications presented at baseline was provided to patients completing the follow-up questionnaire.

Statistical Analysis

For ease of interpretation, all no/yes categorical variables were coded as 0 or 1 with 0 as “no” and the reference category for the logistic regression analyses²³. We examined the descriptive statistics for each variable at baseline. The Student t test was used to compare the mean age and osteoporosis knowledge score between the patients with and those without six-month follow-up data. Pearson chi-square analyses were used to compare the patients with and those without six-month follow-up data with regard to the remaining variables (sex; education; having a partner; residence; smoking status; mother having a fracture; father having a fracture; hip, wrist, spine, shoulder, or other fracture; prior fracture; previous bone mineral density test; previous diagnosis of osteoporosis; FOOQ score; fracture caused by osteoporosis; first-line therapy at baseline; taking calcium at baseline; and taking vitamin D at baseline).

At the time of follow-up, we divided the patients into two groups according to whether or not they had had a previous diagnosis of osteoporosis at baseline and determined the number and percentage of those who had had a bone mineral density test in the six months between baseline and follow-up, the results of this test (if known), and those taking first-line-therapy medication in each group.

Progression of first-line therapy from baseline to the time of follow-up was calculated for patients with complete baseline and follow-up data. Progression of therapy was categorized as “on-off” (stopped treatment), “on-on” (maintained treatment), “off-off” (never started treatment), and “off-on” (ini-

tiated treatment). “On-off” referred to patients who reported being on first-line therapy at baseline but not at the time of the six-month follow-up. These patients might be a cause of concern because they may have believed that their treatment failed or they may have discontinued treatment secondary to side effects. “On-on” referred to patients who reported being on first-line therapy at baseline and continuing at the time of follow-up. “Off-off” referred to patients who reported not being on first-line therapy at baseline or at the time of follow-up. This group could have been waiting for an investigation or could have been tested and had normal bone density. The group could also include patients who required investigation and treatment but missed the message and were not influenced by the intervention or by their physician, or it could include those whose primary care physician was not apprised of their bone health issues or did not feel comfortable evaluating or treating osteoporosis. “Off-on” referred to patients who were not on first-line therapy at baseline but who were on it at the time of follow-up (the ideal situation when therapy is indicated).

As we were particularly interested in those who had initiated first-line therapy in the period between baseline and the time of follow-up (the “off-on” group), we conducted two logistic regression analyses to examine variables that were potentially associated with treatment initiation after screening. In the first logistic regression analysis, we compared patients who had initiated treatment after screening with patients who had never started treatment to examine the factors associated with a greater likelihood of treatment initiation. In the second logistic regression analysis, we compared patients who had initiated treatment after screening with patients who had maintained treatment from baseline to the time of follow-up to examine the factors associated with treatment initiation compared with those associated with treatment maintenance. In many studies, the investigators excluded patients who were already on treatment^{5,9,10,16,24} and therefore were unable to monitor those who were adhering to therapy at the time of the fracture.

For both logistic regression analyses, potential demographic factors (age, sex, marital status, education, residence, smoking status, mother having a fracture, and father having a fracture) and other baseline variables (fracture location, prior fracture, having had a bone mineral density test, self-report of osteoporosis, fracture caused by osteoporosis, and FOOQ score) were considered if they had been found to be related to the outcome at a level of $p < 0.25$ in bivariate analyses²⁵, had sufficient data (≥ 5) in the cells of each of the two-way tables²⁶, and were not multi-collinear as assessed with Pearson correlations, tolerance, variance inflation factor, and variance proportion statistics²⁷. We excluded the condition of currently taking calcium and vitamin D, as these variables are considered essential adjuncts to osteoporosis treatment (our outcome)¹⁹. After controlling for demographic and baseline variables, we determined whether having had a bone mineral density test within six months after screening contributed to either or both models. The variable “bone mineral density test in the past six months” also had to meet the above eligibility criteria to be

considered. Goodness of fit was assessed with the Hosmer and Lemeshow test²⁵, the area under the receiver operating characteristic (ROC) curve, and R^2 . On the basis of the sample size of our lower outcome category, we had sufficient power to examine a maximum of eight variables in our first (“off-on” versus “off-off”) logistic regression analysis and seven variables in the second (“off-on” versus “on-on”) logistic regression analysis^{28,29}.

Source of Funding

The funding source for this study (Merck Frosst Canada) did not play a role in the investigation.

Results

Figure 1 outlines the flow of patients through the study and the number of these patients who received a bone mineral density test and first-line therapy for osteoporosis. During the twelve-month period, 612 patients were identified by the coordinator as being potentially eligible to participate in the Fracture Prevention Program. Eighty-nine (15%) of these patients were unwilling or unable to participate (thirteen refused, two had difficulties with the English language, three did not complete or return the survey, two were frail and elderly, and sixty-nine presented with cognitive or physical impairments). An additional eighteen respondents (3%) completed the baseline questionnaire but were ineligible for the study as they did not have a fragility fracture. Therefore, at baseline, 505 patients were enrolled in our study. The characteristics of the respondents are shown in a table in the Appendix. The average age in the sample was seventy-five years, wrist fracture was the most common fracture (44%), 417 (83%) of the patients were female, 146 (29%) had had a prior fracture, 197 (39%) reported a previous diagnosis of osteoporosis, and 118 (23%) were taking first-line-therapy medication for osteoporosis. Of the 505 patients, 332 (66%) were successfully followed at six months. Of those who were not followed, eighty-one refused to participate at six months, seventeen had died, seventy-one failed to return the follow-up questionnaire despite four reminder telephone calls, one was too sick, and three could not be located. Compared with the 173 patients without follow-up data, the patients with follow-up data were younger (seventy-four compared with seventy-seven years; $t[503] = 2.80$, $p = 0.005$), more likely to be female (86% compared with 77%; $\chi^2[1] = 5.9$, $p = 0.015$), more likely to report that they had had a bone mineral density test (54% compared with 32%; $\chi^2[2] = 23.4$, $p < 0.001$), more likely to report a prior diagnosis of osteoporosis (44% compared with 31%; $\chi^2[1] = 7.9$, $p = 0.005$), and more likely to present with different fractures ($\chi^2[4] = 9.7$, $p = 0.046$) (see Appendix).

Of the patients with follow-up data ($n = 332$), 144 had been diagnosed with osteoporosis at baseline. Forty-seven of the 144 had a bone mineral density test after screening; thirty-five reported a diagnosis of osteoporosis or osteopenia on the basis of that test, and thirty-eight were receiving first-line therapy. Interestingly, twelve (26%) of the forty-seven patients with follow-up data who reported a previous diagnosis of

osteoporosis at baseline and had undergone a bone mineral density test between baseline and the time of follow-up did *not* report that osteoporosis or osteopenia had been diagnosed on the basis of that bone mineral density test; they either did not know the outcome of the test ($n = 8$) or reported normal results ($n = 4$) (Fig. 1). Of the 188 patients reporting no previous osteoporosis diagnosis at baseline, 121 had a bone mineral density test after screening; seventy-eight of them reported a diagnosis of osteoporosis or osteopenia on the basis of that test, and forty-three were receiving first-line therapy at the time of follow-up.

Within six months after screening, 26% of all 332 patients with follow-up data (35% if patients receiving treatment at baseline were excluded) had initiated first-line treatment. Of those who had initiated treatment ($n = 87$), sixty-four reported having had a bone mineral density test since the screening and fifty-four reported that osteoporosis or osteopenia had been diagnosed on the basis of that test. An additional 23% of all 332 patients with follow-up data had maintained first-line treatment between baseline and the time of follow-up. Of those who had never started treatment ($n = 159$), eighty-five reported having had a bone mineral density test since screening and forty-five reported that osteoporosis or osteopenia had been diagnosed on this test. Within six months after screening, only 3% of the follow-up sample had discontinued first-line therapy (equivalent to 13% of those who had been receiving treatment at baseline). Fifty-one percent (168) of all patients with follow-up data reported having had a bone mineral density test in the six months after osteoporosis screening; 121 of those patients had not been previously diagnosed with osteoporosis.

After adjustment for eligible variables in the first logistic regression model (“off-on” versus “off-off”), patients who had initiated first-line therapy after screening were less likely than those who were not receiving therapy at baseline or follow-up to have had a college or university education (adjusted odds ratio = 0.38; 95% confidence interval = 0.16 to 0.94), were more likely to have self-reported osteoporosis at baseline (adjusted odds ratio = 2.36; 95% confidence interval = 1.04 to 5.32), and were more likely to have reported that they had had a bone mineral density test in the six months after screening (adjusted odds ratio = 4.15; 95% confidence interval = 2.03 to 8.47) (see Appendix).

In our second logistic regression model (“off-on” compared with “on-on”), eight variables met our eligibility criteria; however, we only had power to examine seven variables in this model. We considered a model with and without the FOOQ score and also a model with the FOOQ score alone (strategies recommended by Hosmer and Lemeshow²⁵). The FOOQ coefficient was stable in the model with and without the remaining variables; the coefficient was also not significant in the model (alone or with the other variables as covariates), and the remaining model coefficients were relatively unchanged in value and significance both with the FOOQ score considered and with it not considered. Therefore, we excluded the FOOQ score from the analysis. As age did not meet the assumption of

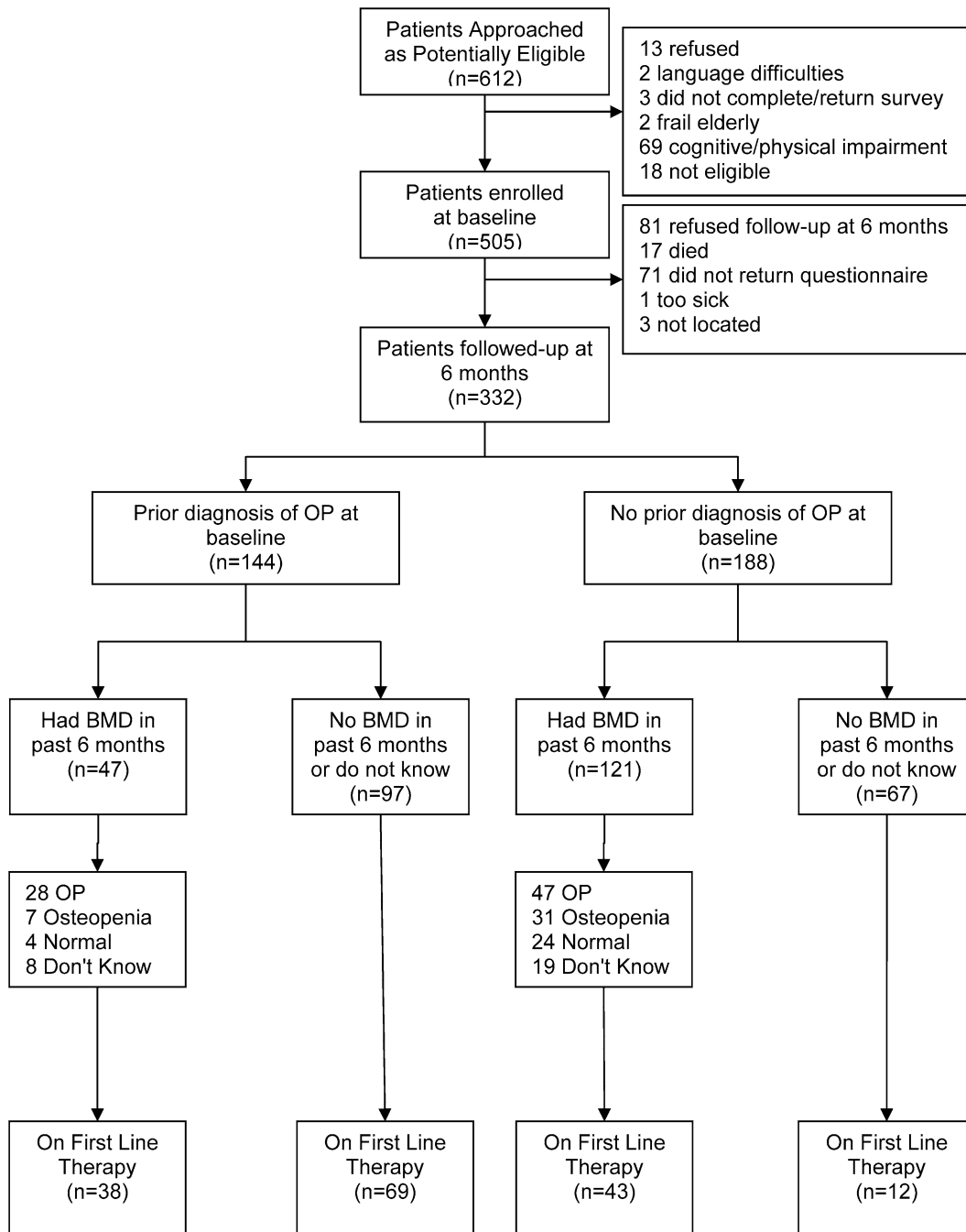


Fig. 1
Flowchart of patients seen through the osteoporosis screening program. OP = osteoporosis, and BMD = bone mineral density testing.

linearity, we categorized age as less than sixty-five years versus sixty-five years or older to reflect the age at which universal-health-care drug benefits are granted to seniors in the province of Ontario. After we adjusted for all seven variables, we found that, compared with those who had maintained therapy from baseline to the time of follow-up, patients who had initiated first-line therapy after screening were less likely to have a college or university education (adjusted odds ratio = 0.13; 95%

confidence interval = 0.04 to 0.49), less likely to have reported a prior fracture at baseline (adjusted odds ratio = 0.28; 95% confidence interval = 0.10 to 0.72), less likely to have had a bone mineral density test at baseline (adjusted odds ratio = 0.24; 95% confidence interval = 0.08 to 0.72), but more likely to have had a bone mineral density test in the six months after screening (adjusted odds ratio = 11.67; 95% confidence interval = 4.52 to 30.19) (see Appendix).

Discussion

We determined the rates of postfracture investigation and treatment for osteoporosis in patients screened through a coordinator-based initiative in a regional community hospital fracture clinic in Ontario. Within six months after screening, 35% of the patients with follow-up data who had been previously untreated had initiated osteoporosis medication. After adjusting for demographic and other baseline variables, we found that patients who initiated first-line treatment after screening were 4.15 times more likely to have had a bone mineral density test after screening than patients who had never initiated treatment and 11.67 times more likely to have had a bone mineral density test after screening than patients who had maintained treatment from baseline to the time of follow-up.

With usual care, the rate of initiation of antiresorptive treatment (by those not previously taking osteoporosis medication) can be expected to be between 11% and 20%^{10,16}. Studies of models of care indicate that initiation of osteoporosis treatment by patients who have sustained a fracture varies widely (from 5% to 40%) after an intervention designed to address postfracture osteoporosis care^{5,10,14,16}. Our postfracture initiative led to a higher proportion of patients initiating osteoporosis medication than the programs cited above, with the exception of the intensive program described by Majumdar et al.¹⁶. Unfortunately, we were not able to determine the rates of treatment initiation associated with other fracture clinic initiatives that also use a coordinator model^{7,13,15,18}.

With the exception of the above coordinator models, other postfracture initiatives excluded patients already receiving osteoporosis treatment^{4,5,9,10,16,24}. We included patients already receiving osteoporosis treatment at baseline because of the risk that they would stop treatment. Evidence of this risk is that approximately 40% to 60% of women newly advised to begin osteoporosis treatment stop taking their medication within six months after initiating therapy^{30,31}. Twenty-three percent of our follow-up sample were taking osteoporosis medication when they entered our program and were still taking the medication six months later; in other words, 87% of the patients who were taking osteoporosis medication when they entered our program were still taking the medication six months later.

The fact that only 3% of our patients stopped treatment (13% of those who were taking medication at baseline) is also encouraging, given that patients may have perceived the fracture as a treatment failure. However, it is possible that the number of patients who stop treatment will increase over time^{30,32,33}.

At baseline, 47% of our sample reported having had a prior bone mineral density test; at the time of follow-up, 51% of *all* patients reported that they had had a bone mineral density test in the six months *after screening*. The majority of these patients reported no previous diagnosis of osteoporosis, suggesting that our intervention succeeded in motivating patients to request, or agree to undergo, a bone mineral density test. It is a matter of concern that a substantial proportion of

the patients (twelve of forty-seven) who reported a previous diagnosis of osteoporosis at baseline did not report, at the time of follow-up, that a subsequent bone mineral density test had demonstrated osteoporosis or osteopenia. It is possible that the subsequent bone mineral density test was conducted with a different machine or was interpreted, or reported, differently by either the patient or the technician, or that some patients believed that the osteoporosis had been cured. It is also possible that the subsequent bone mineral density test result was normal, which would demonstrate the limited ability of bone mineral density testing to accurately reflect microarchitecture as a major component of bone health³⁴.

The results of our first logistic regression analysis (“off-on” versus “off-off”) demonstrated that, compared with patients who were not receiving first-line treatment at baseline or at the time of follow-up, patients who had initiated treatment after screening were less likely to have a college or university education, more likely to have self-reported osteoporosis at baseline, and more likely to have had a bone mineral density test in the six months between baseline and the time of follow-up. The results of our second logistic regression analysis (“off-on” versus “on-on”) demonstrated that, compared with the patients who had maintained first-line treatment from baseline to the time of follow-up, patients who had initiated treatment after screening were less likely to have a college or university education, less likely to have reported a prior fracture at baseline, and less likely to have had a bone mineral density test at baseline but were more likely to have had a bone mineral density test in the six months after screening. The goodness-of-fit summary measures of the second logistic regression model were better than those of our first model; the model explained up to 52% of the variability in the outcome and had excellent discrimination (receiver operating characteristic area = 0.88)²⁵.

In the second logistic regression model (“off-on” versus “on-on”), having had a prior fracture at baseline was not associated with treatment initiation, suggesting that having had a prior fracture is an important variable associated with treatment maintenance. Others have shown that a prior fracture is associated with greater adherence to treatment over time^{32,35,36}. In both logistic regression models, higher education had a negative association with treatment initiation by our patients. This perhaps suggests that higher education is an important predictor of treatment *maintenance*, or doing nothing, rather than treatment *initiation*. Studies that extend beyond six months after an intervention such as ours are needed to further examine the importance of patient education and its association with osteoporosis care.

Having a bone mineral density test after screening was associated with treatment initiation in both models. This finding suggests that patients who were receiving care at baseline did not require an interim bone mineral density test to convince them to continue to receive care. (The previous diagnosis of osteoporosis or the current fracture might have been sufficient to motivate these patients to maintain treatment.) An alternative explanation is that patients who were receiving care at baseline may not have


been taking the medication long enough to warrant a repeat bone mineral density test. However, initiation of first-line therapy during the study period was associated with having had a postscreening bone mineral density test. Previous studies have shown bone mineral density testing to be associated with treatment initiation^{9,14,37-40}. It is of interest that the previous performance of a bone mineral density test at baseline was associated with treatment *maintenance* rather than treatment *initiation* in our second model, again suggesting that the time frame of the bone mineral density test is crucial to its association with treatment initiation by patients following a fracture.

We acknowledge several limitations to our research. Data were self-reported so we cannot comment on the actual osteoporosis status or care of the patients at baseline or the time of follow-up. However, it has been shown that patients are able to accurately report having had a bone mineral density test⁴¹ and taking osteoporosis medication^{16,24,42,43}; patients have less of an ability to report the results of their bone mineral density tests accurately⁴¹. We did not ask patients how much calcium or vitamin D they were taking so it is possible that the amounts did not meet recommended guidelines. We did not collect data on the reasons for discontinuing medication so we cannot comment on whether patients stopped taking medication because of side effects. We also cannot comment on the osteoporosis status and care of those without follow-up data. Indeed, this group differed from the follow-up group at baseline, and these differences might have affected outcomes in these patients at six months. Possible reasons for refusing follow-up or not returning the questionnaire at six months include forgetting about the study, loss of interest in the study, reluctance to participate because of a failure to follow the coordinator's recommendations, caring for a sick spouse, or being too busy. This dropout rate is comparable with that associated with other postfracture interventions^{14,15,31,44-47} and may point to the need for additional public education regarding the impact of osteoporosis. We also did not include a control or comparison group. Finally, we collected data regarding osteoporosis knowledge and beliefs only at baseline; we did not assess whether knowledge and beliefs had changed at the time of the six-month follow-up.

Despite these limitations, we conclude that our osteoporosis intervention program, consisting of education and

instruction to follow-up with the patient's family physician, was associated with 51% of the patients undergoing an investigation for osteoporosis and 26% initiating first-line therapy within six months after the intervention. Given the risk that a fracture could be perceived as a treatment failure, the percentage of patients who discontinued therapy was low. However, the largest group of patients was not receiving first-line therapy at baseline or the time of follow-up, and only 53% of them had a bone mineral density test within six months after screening, indicating that there is still substantial room for improvement in both investigation and treatment for osteoporosis after fractures. We also need to understand why some patients who had been previously diagnosed with osteoporosis did not report having osteoporosis or osteopenia on the basis of their follow-up bone mineral density test. Finally, we demonstrated the importance of the association between having a bone mineral density test within six months after screening and initiation of treatment for osteoporosis.

Appendix

 Tables showing the characteristics of the patients, results of the bone mineral testing, and results of the logistic regression analyses are available with the electronic version of this article on our web site at jbjs.org (go to the article citation and click on "Supporting Data"). ■

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