

Osteoporosis Disease Management: The Role of the Orthopaedic Surgeon

By Richard Dell, MD, Denise Greene, RNP, MS, Steven R. Schelkun, MD, and Kathy Williams, MSG

Introduction

Osteoporosis is a major medical problem affecting 8 million women and 2 million men in the United States. An additional 34 million Americans have low bone mass. Each year, an estimated 1.5 million people in the United States experience a fragility fracture secondary to osteoporosis, resulting in an annual cost of \$18 billion¹. The problem of osteoporosis is now reaching epidemic proportions with the rapidly aging population². One-half of all women and one-third of all men will sustain a fragility fracture in their lifetime³.

There is a huge cost associated with osteoporosis in terms of morbidity, mortality, and the financial impact on society⁴. The most devastating complication of osteoporosis is a hip fracture. According to the most recent statistics published in the 2004 United States Surgeon General's report on osteoporosis, of the 325,000 patients who sustain a hip fracture each year, 24% end up in nursing homes, 50% never reach their previous functional capacity, and 25% die within the first year after the fracture². The first-year mortality rate after a hip fracture is almost twice as high in men as in women (30% compared with 17%)⁵. The mortality rate due to osteoporosis-related fractures is greater than the rates for breast cancer and cervical cancer combined⁶.

Only 20% of patients with a previous hip or other fragility fracture receive treatment for osteoporosis⁷⁻¹². For example, in one study, between 12% and 25% of patients with a hip fracture had testing of bone density, fewer than 25% were given calcium and vitamin-D supplements, and fewer than 10% were treated with effective anti-osteoporosis medications¹³. There are certainly many missed opportunities for fracture prevention. The World Health Organization now has a tool to assess a patient's ten-year absolute fracture risk (called FRAX), and osteoporosis treatment can now be based on a patient's ten-year absolute fracture risk instead of solely on a T-score derived from a bone mineral density study¹⁴. Studies have shown that osteoporosis can be treated cost-effectively while decreasing the hip fracture rate by as much as 50%^{15,16}.

The purpose of the present report was to describe a screening and hip fracture-prevention program in which orthopaedic surgeons play a major role.

Background of the Kaiser Southern California Healthy Bones Program

Kaiser Southern California (Kaiser SCAL) is a health-maintenance organization in Southern California that is made up of eleven medical centers with 3.1 million members. Our members received >95% of their medical care at these centers. Kaiser SCAL has an electronic medical records system that is capable of tracking dual x-ray absorptiometry scans, fragility fractures, and anti-osteoporosis medications. In 1998, several of our medical centers began to independently develop osteoporosis disease-management programs. By 2002, a fully integrated Healthy Bones Program was in place at all eleven Kaiser SCAL medical centers. The Healthy Bones Program was established by having orthopaedic surgeons serve as champions in a large multidisciplinary team made up of healthcare providers from endocrinology, family practice, internal medicine, rheumatology, gynecology, physical therapy, disease/care management, radiology, and nursing education.

Our main goal was to decrease the rate of hip fracture in the Kaiser SCAL healthcare system by 25%. To reach this goal, we set several milestones. The first was to increase the use of dual x-ray absorptiometry scanning by at least 50% among patients considered to be at risk for hip fractures. The second was to increase the rate of treatment with anti-osteoporosis medication by at least 50% among patients diagnosed with osteoporosis on the basis of a dual x-ray absorptiometry scan (as indicated by a T-score of -2.5 or worse) as well as patients with fragility fractures. We also planned to increase awareness of osteoporosis management among our patients and our healthcare providers.

We developed outreach programs in order to target specific patients for dual x-ray absorptiometry scans. These included patients over the age of fifty years who had a history of fragility fractures, all women over the age of sixty-five years,

Disclosure: In support of their research for or preparation of this work, one or more of the authors received, in any one year, outside funding or grants in excess of \$10,000 from Merck. Neither they nor a member of their immediate families received payments or other benefits or a commitment or agreement to provide such benefits from a commercial entity. No commercial entity paid or directed, or agreed to pay or direct, any benefits to any research fund, foundation, division, center, clinical practice, or other charitable or nonprofit organization with which the authors, or a member of their immediate families, are affiliated or associated.

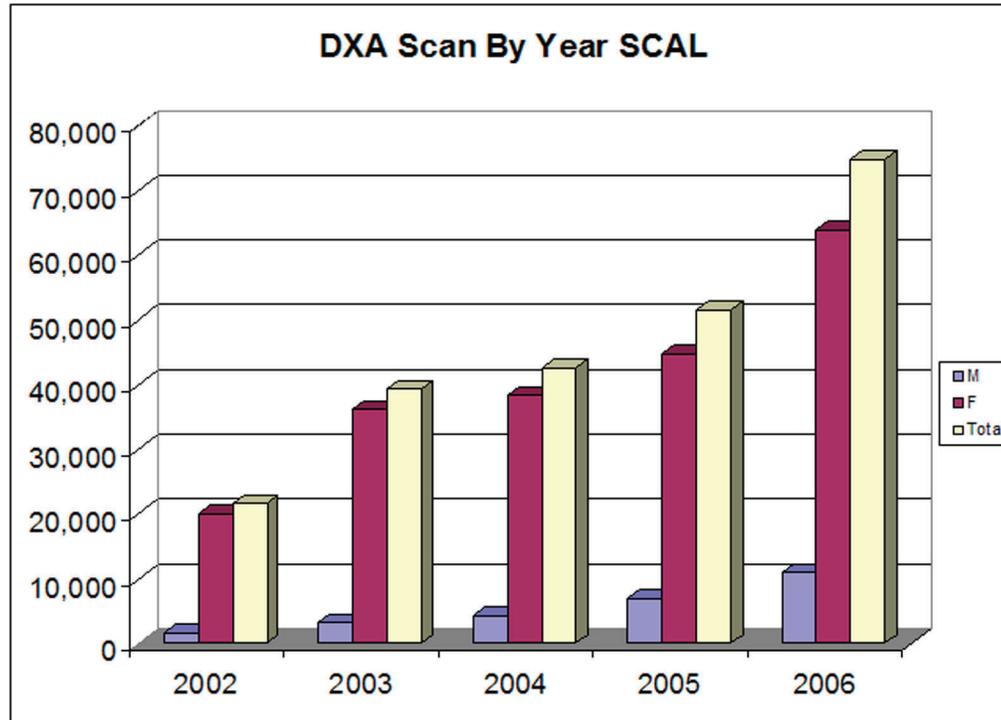


Fig. 1

Bar graph illustrating the annual number of dual x-ray absorptiometry (DXA) scans in the Kaiser SCAL system from 2002 to 2006. The overall increase was 247% (from 21,557 to 74,770), the increase in women was 220% (from 20,008 to 63,929), and the increase in men was 600% (from 1549 to 10,841). M = male, and F = female.

all men over the age of seventy years, and all patients receiving high-dose corticosteroid medication or luteinizing hormone-releasing hormone agonists such as Lupron.

Additionally, the outreach programs targeted patients who have the appropriate indications for osteoporosis treatment, such as patients who have been diagnosed with osteoporosis on the basis of a dual x-ray absorptiometry scan (as indicated by a T-score of -2.5 or worse), patients with a hip fracture, and patients over the age of fifty years with a previous fragility fracture. We instituted a fall-reduction program involving physical therapy and targeted patients with previous fragility fractures, frequent falls, and risk factors for falls such as balance problems or a history of stroke or weakness.

We developed an osteoporosis education program and targeted patients with low T-scores on dual x-ray absorptiometry and previous fragility fractures. After a fragility fracture, a treatment plan that included an osteoporosis care program and a home health program involving home safety checks was instituted.

Patients suspected of having secondary causes of osteoporosis, such as hyperparathyroidism or hypogonadism, were referred for an endocrinology evaluation.

In order to monitor performance, we developed monthly reports that documented the patients who received and required treatment. These reports were available on a secure Kaiser intranet-based web site.

After developing the integrated Healthy Bones Program,

we developed a Kaiser SCAL Osteoporosis Clinical Practice Guideline. Kaiser SCAL then joined forces with the other Kaiser regions nationally and developed a Kaiser National Osteoporosis Clinical Practice Guideline in order to standardize osteoporosis management practices across all of the regions nationwide.

Materials and Methods

We conducted a prospective observational study that evaluated the changes in osteoporosis disease management in the Kaiser SCAL health-maintenance organization for the years 2002 to 2006 inclusively. The Kaiser electronic medical records systems were used to gather data on anti-osteoporotic medications, dual x-ray absorptiometry scans, demographic information, and hip and other fragility fractures. We utilized historical demographic and hip-fracture data from Kaiser SCAL from 1997 to 1999 to determine the rate of fragility hip fracture according to age group. We excluded hip fractures secondary to tumors, periprosthetic fractures, and traumatic high-energy fractures.

More than 620,000 patients were identified for inclusion in the present study. These patients included all patients over the age of sixty years. Also included were all patients over the age of fifty years who had sustained a fragility fracture, who had undergone a dual x-ray absorptiometry scan, or who were receiving an anti-osteoporosis medication. For the present study, we classified bisphosphonates, selective

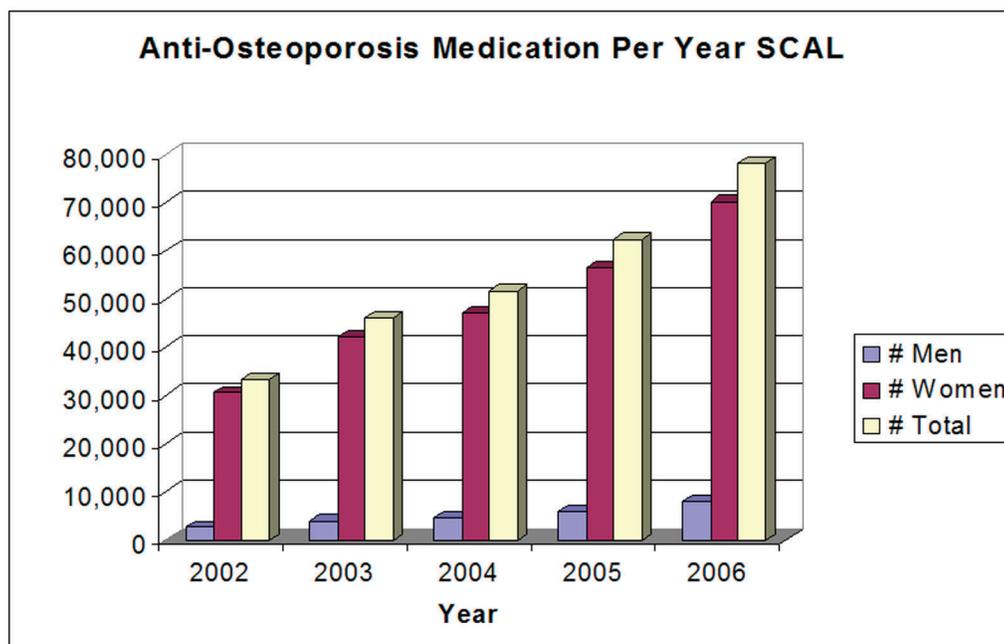


Fig. 2

Bar graph illustrating the annual anti-osteoporosis medication rates for men and women in the Kaiser SCAL system from 2002 to 2006. The overall increase was 135% (from 33,208 to 78,058), the increase in women was 130% (from 30,545 to 70,155), and the increase in men was 197% (from 2663 to 7903).

estrogen-receptor modulators, calcitonin, and parathyroid hormone as anti-osteoporosis medications. We excluded hormonal therapy, calcium, and vitamin D as anti-osteoporosis medications in our analysis, although they do contribute to osteoporosis management.

Results

After the adoption of the Kaiser SCAL Healthy Bones Program at each of the eleven Kaiser SCAL medical centers in 2002, the annual dual x-ray absorptiometry scan utilization rate increased from 21,557 per year in 2002 to 74,770 in 2006,

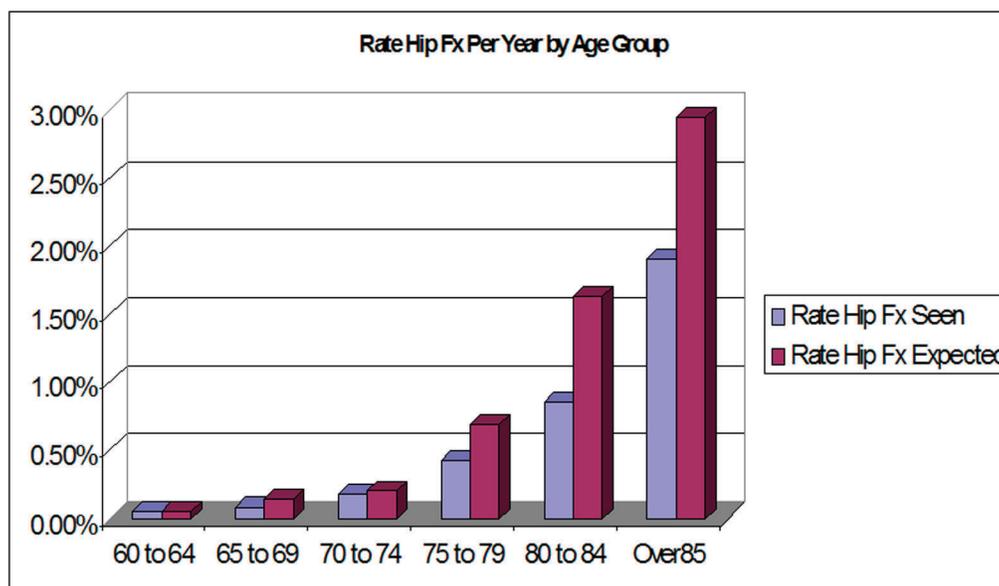


Fig. 3

Bar graph illustrating the expected and actual rates of hip fractures in the Kaiser SCAL system in 2006 according to age group. There was an exponential increase in the hip fracture rate as age increased. Fx = fracture.

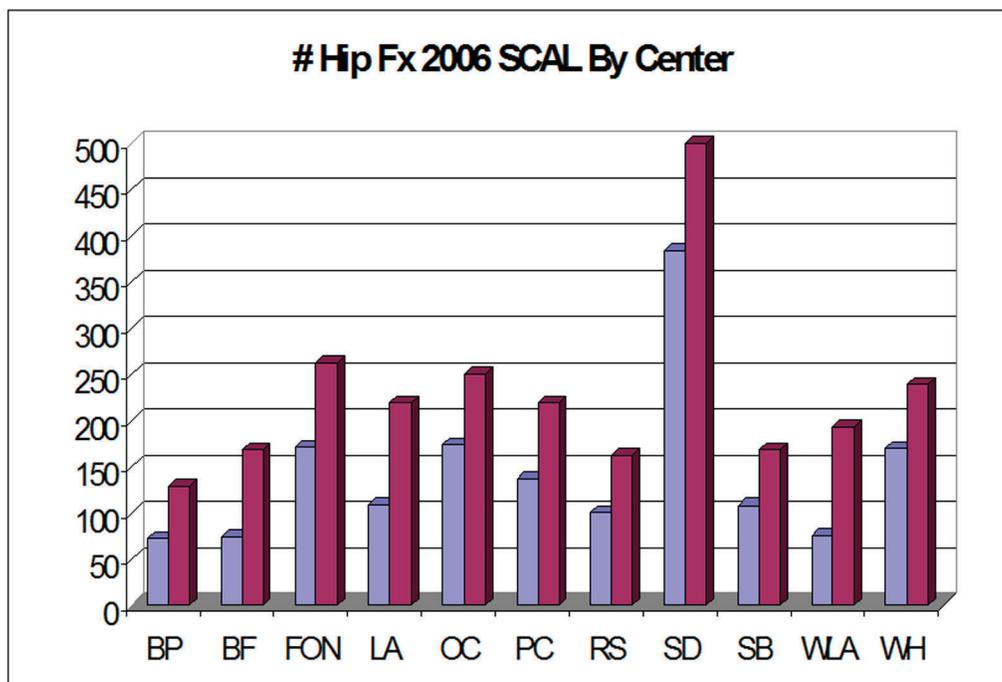


Fig. 4

Bar graph illustrating the expected and actual numbers of hip fractures in the Kaiser SCAL system in 2006. A wide variation can be seen in both the expected number of hip fractures (red bars) and the actual number of hip fractures (blue bars) among the eleven Kaiser SCAL medical centers. BP = Baldwin Park, BF = Bellflower, FON = Fontana, LA = Los Angeles, OC = Orange County, PC = Panorama City, RS = Riverside, SD = San Diego, SB = South Bay, WLA = West Los Angeles, and WH = Woodland Hills.

a 247% increase. In women, the annual dual x-ray absorptiometry scan utilization rate increased from 20,008 per year to 63,929 per year, a 220% increase. In men, the rate increased from 1549 per year to 10,841 per year during the same time interval, a 600% increase. In 2002, 92.8% of all dual x-ray absorptiometry scans were performed for women; by 2006, 85.5% of all such scans were performed for women (Fig. 1).

The annual number of patients managed with medications for osteoporosis increased from 33,208 in 2002 to 78,058 in 2006, a 135% increase (Fig. 2).

We had access to our historical hip fracture data from 1997 to 1999 and, on the basis of these data, we calculated the expected hip fracture rate for each age group. On the basis of the age of each member, the number of members in each age group, and the expected hip fracture rate in each age group, we were able to calculate the expected hip fracture rate in each of the eleven medical centers. There was an exponential increase in the hip fracture rate as our patients aged. We also showed that the decrease in the actual hip fracture rate varied among age groups (Fig. 3).

There is a wide variation in both the number of patients assigned to each of our eleven Kaiser SCAL medical centers and the age distribution of those members at each of the medical centers. While there was a wide variation in the number of both expected and actual hip fractures at each of the eleven medical centers (Fig. 4), there was a reduction in the hip frac-

ture rate at all centers. The reduction varied from 23.1% to 60.7% (Fig. 5). The average reduction in the hip fracture rate from the expected value for all eleven medical centers was 37.2%; in 2006, the expected number of hip fractures was 2510 fractures and the observed number was 1575, representing a reduction of 935 fractures.

Discussion

There remains a widely held misconception among many orthopaedic surgeons that nothing can be done to prevent or treat osteoporosis. The present study should help to dispel that misconception. By aggressively identifying and managing patients who have osteoporosis, we were able to show a 37.2% reduction in the hip fracture rate in the Kaiser SCAL system. That translated to the prevention of 935 hip fractures in the year 2006 (2510 hip fractures were predicted, and 1575 fractures were actually observed). The cost of treating a hip fracture is roughly \$33,000¹⁷. On the basis of this cost, we estimate that we saved more than \$30.8 million for Kaiser SCAL in the year 2006.

The exponential increase in the hip fracture rate as our patients aged is consistent with the findings of previous studies¹⁸. As patients grow older, there is progressive deterioration of bone quality and an increased risk for falling. The Healthy Bones Program aggressively targets older patients because such patients are at the highest risk for hip fractures.

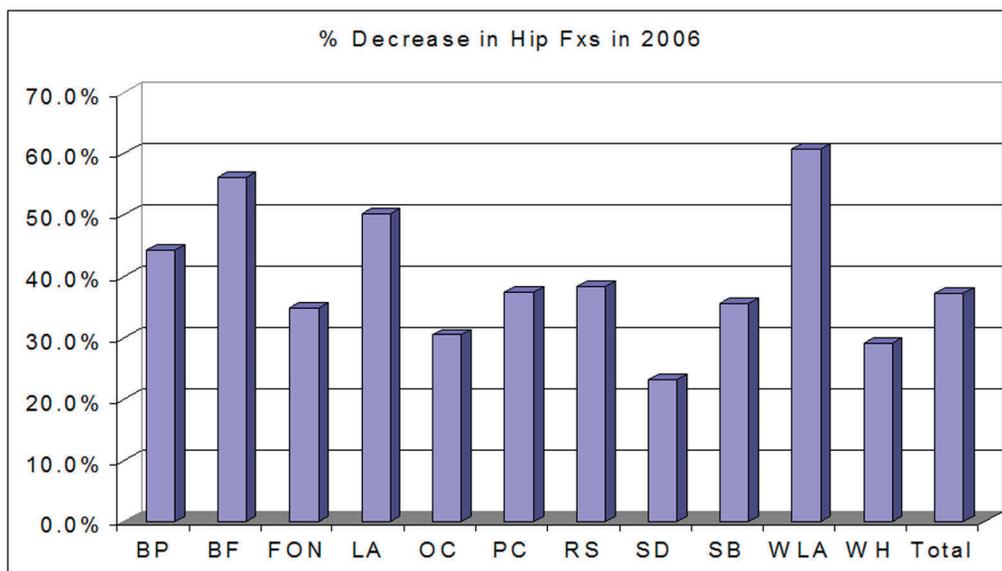


Fig. 5

Bar graph illustrating the percentage decrease from the expected hip fractures in the Kaiser SCAL system in 2006. While there was a wide variation among the medical centers in terms of the percentage decrease in hip fracture rates in 2006, the overall decrease was 37.2%. BP = Baldwin Park, BF = Bellflower, FON = Fontana, LA = Los Angeles, OC = Orange County, PC = Panorama City, RS = Riverside, SD = San Diego, SB = South Bay, WLA = West Los Angeles, and WH = Woodland Hills.

Other disease-management programs also have demonstrated that the greatest cost-savings are achieved by targeting the older age group¹⁷.

There was wide variation in the reduction in the hip fracture rates among medical centers in the Kaiser SCAL system (range, 23.1% to 60.7%). The variation in the reduction of the hip fracture rate may be due to the fact that the effectiveness of the Healthy Bones Program varied among the different medical centers. Some centers have had programs in place since 1998 and manage osteoporosis extremely aggressively, whereas others do not have programs that manage osteoporosis as aggressively, as demonstrated by the variation in the number of dual x-ray absorptiometry scans performed and anti-osteoporosis medications prescribed at various medical centers. We consider the reduction in the hip fracture rate to be the gold standard by which the performance of the Healthy Bones Program should be judged.

The 37.2% reduction in the overall hip fracture rate was above our initial goal of a 25% reduction. However, we now believe that it is possible to achieve a 50% reduction in the hip fracture rate in the Kaiser SCAL system as demonstrated by two of our medical centers. All eleven medical centers in the Kaiser SCAL system are actively sharing best practices in osteoporosis disease management. By better identifying, risk-stratifying, and managing patients who are at risk for osteoporosis and fragility fractures, we hope to achieve the goal of a $\geq 50\%$ reduction in the hip fracture rate.

From 2002 to 2006, the annual number of dual x-ray absorptiometry scans performed in the Kaiser SCAL system increased by 247% (from 21,557 to 74,770). In men, the annual number of dual x-ray absorptiometry scans increased from

1549 to 10,841 during the same time interval, representing a 600% increase. However, in the present study, only 14.5% of the dual x-ray absorptiometry scans in 2006 were performed for men. We are actively involved in obtaining more dual x-ray absorptiometry scans for men.

From 2002 to 2006, the number of patients receiving anti-osteoporotic medication in the Kaiser SCAL system increased by 135% (from 33,208 to 78,058). In 2002, 92% of the patients receiving anti-osteoporotic medication were women and 8% were men; at the time of the present study, that ratio was 90% to 10%. Although anti-osteoporotic treatment in men has increased, it is still far below the treatment rate in women. This finding has similarly been reported in other studies¹⁹. We are actively involved in improving the management of osteoporosis in men.

The increased cost associated with the performance of more dual x-ray absorptiometry scans and having additional patients receiving anti-osteoporosis medications was more than offset by the cost-savings associated with the reduction in hip and other fragility fractures. A detailed cost analysis, however, was beyond the scope of this study.

We realize that Kaiser has a substantial advantage in osteoporosis disease management in that it has an integrated healthcare delivery program with an advanced electronic medical records system that allows for the identification, risk stratification, and tracking of our patients. Kaiser also has the advantage of having care managers that can use our information systems to help to manage patients such as those with osteoporosis.

Most orthopaedic surgeons do not have the advantage of having an integrated healthcare delivery program that can

assist in the identification and risk stratification of their patients. However, that should not stop them from taking steps to improve the care of their patients who are at risk for osteoporosis and fragility fractures.

By more aggressively managing patients who are at risk for osteoporosis, we believe that it is possible to achieve at least a 25% reduction in the hip fracture rate in the United States. The first step must be a more active role by orthopaedic surgeons in osteoporosis disease management.

The following recommendations are based on the ten steps outlined by Laura Tosi, MD, and the American Orthopaedic Association's *Own the Bone* initiative²⁰.

1. Be a Champion—We Own the Bone!

Remember that addressing the problem of fragility fractures is multifaceted and will require a multidisciplinary solution. Identify potential partners in your community.

2. Set a Realistic Goal—Identify High-Risk Patients

Osteoporosis and fractures should not be considered a natural part of aging. A fragility fracture is defined as a fracture resulting from a fall from a standing height or less. The best predictor of a fragility fracture is a previous fragility fracture. The orthopaedic surgeon should focus on fragility fractures in men and women older than fifty years of age.

3. Be Proactive

Get into the habit of ordering dual x-ray absorptiometry scans and initiating anti-osteoporosis treatment for high-risk patients. Do not wait for someone else to do the right thing. Refer complex patients to endocrinology and/or internal medicine as needed. Patients at risk for falls should be referred for fall-reduction classes.

4. Teach Your Patients

About Osteoporosis and Falls

Offer patient-education materials on osteoporosis and fall reduction. Do not try to create your own materials. There are plenty of free educational materials on the Web. Visit www.osteoporosis.org to download materials that you can use, such as "Once is Enough: A Guide to Preventing Future Fractures."

5. Do Not Wait Until Your Patient Has a Fragility Fracture

Develop an outreach program to prevent fractures by following the National Osteoporosis Clinical Practice Guidelines. Perform a dual x-ray absorptiometry scan for all women over the age of sixty-five years and all men over the age of seventy years. Perform a dual x-ray absorptiometry scan for men and women over the age of fifty years who have risk factors such as a previous fragility fracture, a family history of fractures, frailty, a low body mass index, or treatment with medications that increase the risk of osteoporosis.

6. Develop Preprinted Admission Sheets and Orders

Use a check-off sheet listing osteoporosis risk factors. Include

orders for serum calcium, phosphate, and alkaline phosphatase; a complete blood-cell count (CBC); 25 hydroxyl vitamin D, thyroid stimulating hormone (TSH); parathyroid hormone (PTH intact); serum protein electrophoresis (SPEP); and kidney-function tests, including blood urea nitrogen (BUN), creatinine, and glomerular filtration rate (GFR).

7. Develop a Discharge Checklist for Patients with Fragility Fractures

Develop a discharge sheet for patients that discusses osteoporosis and fall reduction. The discharge sheet should include (1) a prescription for calcium (1200 mg daily), (2) a prescription for vitamin D (800 IU daily), (3) a referral to physical medicine or physical therapy for fall-prevention education, (4) a recommendation for a home safety check, and (5) a referral back to the primary-care physician or a specialist for the evaluation of secondary causes of osteoporosis. When appropriate, order dual x-ray absorptiometry scans and/or anti-osteoporosis medications.

8. Improve Your Discharge Documentation

Include the terms "fragility fracture" and "osteoporosis" in the discharge summary, and be sure that your letter to the patient's primary-care physician points out your concern about the risk of future fractures.

9. Measure What You Have Done

It is very important to track how well your program is doing in terms of osteoporosis disease management. It is even more important to compare your results with those of other programs. The Healthcare Effectiveness Data and Information Set (HEDIS) measures are now being used to track the performance of osteoporosis disease programs. The Centers for Medicare and Medicaid Services may soon implement "pay for performance" osteoporosis measures.

10. Look at the New Fracture Risk Assessment Tool (FRAX)

The World Health Organization now has a tool, called FRAX, to assess a patient's ten-year absolute fracture risk. Anti-osteoporosis treatment can now be based on a patient's ten-year absolute fracture risk instead of solely on a T-score derived from a dual x-ray absorptiometry scan. ■

Richard Dell, MD
Denise Greene, RNP, MS
9897 Fonte Road, Cypress, CA 90630. E-mail address for R. Dell:
Richard.M.Dell@kp.org. E-mail address for D. Greene:
DFGreene@ca.rr.com

Steven R. Schelkun, MD
Department of Orthopedics, Kaiser San Diego, 4647 Zion Avenue, San Diego, CA 92120

Kathy Williams, MSG
Department of Orthopedics, Kaiser Fontana, 9985 Sierra Avenue, Fontana, CA 92335

References

1. National Osteoporosis Foundation. America's bone health: the state of osteoporosis and low bone mass in our nation. Washington, DC: National Osteoporosis Foundation; 2002.
2. Office of the Surgeon General, US Department of Health and Human Services. Bone health and osteoporosis: a report of the Surgeon General. Washington, DC: US Department of Health and Human Services; 2004.
3. Cummings SR, Melton LJ. Epidemiology and outcomes of osteoporotic fractures. *Lancet*. 2002;359:1761-7.
4. Burge R, Dawson-Hughes B, Solomon DH, Wong JB, King A, Tosteson A. Incidence and economic burden of osteoporosis-related fractures in the United States, 2005-2025. *J Bone Miner Res*. 2007;22:465-75.
5. Bass E, French DD, Bradham DD, Rubenstein LZ. Risk-adjusted mortality rates of elderly veterans with hip fractures. *Ann Epidemiol*. 2007;17:514-9.
6. Cummings SR, Black DM, Rubin SM. Lifetime risks of hip, Colles', or vertebral fracture and coronary heart disease among white postmenopausal women. *Arch Intern Med*. 1989;149:2445-8.
7. Solomon DH, Finkelstein JS, Katz JN, Mogun H, Avorn J. Underuse of osteoporosis medications in elderly patients with fractures. *Am J Med*. 2003;115:398-400.
8. Andrade SE, Majumdar SR, Chan KA, Buist DS, Go AS, Goodman M, Smith DH, Platt R, Gurwitz JH. Low frequency of treatment of osteoporosis among postmenopausal women following a fracture. *Arch Intern Med*. 2003;163:2052-7.
9. Kiebzak GM, Beinart GA, Perser K, Ambrose CG, Siff SJ, Heggeness MH. Undertreatment of osteoporosis in men with hip fracture. *Arch Intern Med*. 2002;162:2217-22.
10. Kamel HK, Hussain MS, Tariq S, Perry HM, Morley JE. Failure to diagnose and treat osteoporosis in elderly patients hospitalized with hip fracture. *Am J Med*. 2000;109:326-8.
11. Feldstein AC, Nichols GA, Elmer PJ, Smith DH, Aickin M, Herson M. Older women with fractures: patients falling through the cracks of guideline-recommended osteoporosis screening and treatment. *J Bone Joint Surg Am*. 2003;85:2294-302.
12. Freedman KB, Kaplan FS, Bilker WB, Strom BL, Lowe RA. Treatment of osteoporosis: are physicians missing an opportunity? *J Bone Joint Surg Am*. 2000;82:1063-70.
13. Harrington JT, Broy SB, Derosa AM, Licata AA, Shewmon DA. Hip fracture patients are not treated for osteoporosis: a call to action. *Arthritis Rheum*. 2002;47:651-4.
14. Kanis JA, Johnell O, Oden A, Johansson H, McCloskey E. FRAX and the assessment of fracture probability in men and women from the UK. *Osteoporos Int*. 2008;19:385-97.
15. Black DM, Cummings SR, Karpf DB, Cauley JA, Thompson DE, Nevitt MC, Bauer DC, Genant HK, Haskell WL, Marcus R, Ott SM, Torner JC, Quandt SA, Reiss TF, Ensrud KE. Randomised trial of the effect of alendronate on risk of fracture in women with existing vertebral fractures. Fracture Intervention Trial Research Group. *Lancet*. 1996;348:1535-41.
16. Adami S. Bisphosphonate antifracture efficacy. *Bone*. 2007;41:S8-15.
17. Newman ED, Ayoub WT, Starkey RH, Diehl JM, Wood GC. Osteoporosis disease management in a rural health care population: hip fracture reduction and reduced costs in postmenopausal women after 5 years. *Osteoporos Int*. 2003;14:146-51.
18. Melton LJ 3rd. Epidemiology of hip fractures: implications of the exponential increase with age. *Bone*. 1996;18(3 Suppl):121S-5S.
19. Feldstein AC, Nichols G, Orwoll E, Elmer PJ, Smith DH, Herson M, Aickin M. The near absence of osteoporosis treatment in older men with fractures. *Osteoporos Int*. 2005;16:953-62.
20. Tosi LL, Gliklich R, Kannan K, Koval KJ. The American Orthopaedic Association's "own the bone" initiative to prevent secondary fractures. *J Bone Joint Surg Am*. 2008;90:163-73.