


Implementing an Electronic Medical Record Osteoporosis Self-Assessment Tool Score Which Identifies Patients at Risk for Osteoporosis Promotes Osteoporosis Evaluation

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Abstract

Introduction: Osteoporosis affects nearly half of the U.S. population. Screening methods are improving but remain inadequate, leaving the disease underdiagnosed and undertreated. The purpose of this study is to determine the effectiveness of an EMR implemented system that identifies patients at risk for osteoporosis via an OST (osteoporosis screening tool) score in prompting patients toward osteoporosis evaluation. **Methods:** OST scores are generated on every patient 50 years of age and older that is admitted to the Penn State Hershey Medical Center (PSHMC) and recorded in their electronic medical record. An OST score < 2 indicates that a patient has a potential risk for osteoporosis. Information Technology (IT) implemented the EMR OST calculation, which currently generates a daily filtered list of all patients with an OST score < 2; patients with an OST score < 2 are then mailed letters approximately 3 months after their admission informing them of their risk for osteoporosis and suggesting that they schedule a follow-up appointment with a physician for further evaluation. To test the effectiveness of this system in prompting patients toward osteoporosis evaluation, approximately 3 months after letters were mailed, the patients were contacted via telephone and asked a series of questions to determine if the patients had sought osteoporosis evaluation. **Results:** In the intervention group, 67 (58.26%) of 115 did not schedule a follow-up, while the remaining 48 (41.74%) did seek a follow-up. Thus, the patient follow-up response rate improved with letter intervention using the OST score as an indicator ($P < .0001$) compared to historical controls (14.29%). **Conclusion:** Implementing an EMR OST score which identifies patients at risk for osteoporosis, which generates an automatic letter to the patient, significantly promotes patient driven osteoporosis evaluation compared to historical controls.

Keywords

fragility fractures, geriatric medicine, osteoporosis, systems of care, metabolic bone disorders

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Introduction

Osteoporosis, a systemic skeletal disease resulting in the deterioration of the micro architecture of bone tissue, affects an estimated 10.2 million adults in the U.S.,¹ while another 43.4 million adults have low bone mass.^{1,2} The diagnosis of osteoporosis established by the World Health Organization (WHO) is based on the occurrence of adulthood hip or vertebral fragility fracture in the absence of major trauma, or by central Dual-energy X-ray Absorptiometry (DXA) T-score at or below -2.5 ; low bone mass (or osteopenia) is meanwhile defined by T-scores ranging between -1.0 to -2.5 .³ According to guidelines published by the National Osteoporosis Foundation (NOF) and the U.S. Preventative Services Task Force, bone mineral density (BMD) testing should be performed by DXA

for: 1) women age 65 and older and men age 70 and older, 2) postmenopausal women and men above age 50-69, based on risk factor profile, and 3) postmenopausal women and men age 50 and older who have had an adult age fracture, to diagnose and determine the degree of osteoporosis.^{4,5} Screening methods remain inadequate, however, leaving the disease underdiagnosed; a prior report noted only 12% of patients

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receiving a correct diagnosis of osteoporosis after a fracture, leaving the disease grossly underdiagnosed.^{4,6}

There are many barriers to the implementation of care of osteoporosis that involve lack of knowledge from both the physician and the patient.⁷ Some of these include the perception by the orthopedic surgeon that the osteoporosis diagnosis and treatment is not their responsibility,⁷ low rates of referral to an appropriate osteoporosis service,⁸ the cost of therapy, side effects of medication, poor patient follow up, non-adherence to medication regimen, patient's fear of treatment side effects,⁹ and multiple medical comorbidities.⁷ Due to these barriers, the quality of life of these patients suffers. In addition, there is a high cost of treatment and management of fragility fracture that occurs due to osteoporosis. As an example, in 2005, the direct cost of fragility fractures alone were US\$17 billion.¹⁰ Annually, there are about 1.5-2 million fractures in the US. Worldwide, osteoporosis causes more than 8.9 million fractures annually, resulting in an osteoporotic fracture every 3 seconds.¹¹ This number is expected to rise as the WHO estimates that 6 million hip fractures alone will occur each year worldwide by the year 2050, when 1 in every 5 individuals will be over 50.^{10,12}

One osteoporosis screening method available is the Osteoporosis Self-Assessment Tool (OST) which has demonstrated good predictive values in terms of sensitivity and specificity in multiple populations.¹³ OST was first developed using data of postmenopausal women from 8 Asian countries. The final algorithm only selected age and body weight as the predictors, creating the formula: OSTA score = (body weight in kg – age in years) × 0.2.¹⁴ It was developed for Asian women and later validated for European and North American white women and men.^{13,15,16}

We propose that an automated osteoporosis intervention program using an OST score as an identifier and generating a letter to the patient can address this care gap in an efficient, automated fashion to reduce health care costs and improve patient quality of life. Using the OST score as an identifier of high risk patients, we can advise high-risk patients to schedule a follow-up with a health care professional in order to ascertain if a bone measurement test is necessary. The US Preventive Services Task Force (USPSTF) agrees that bone measurement tests are accurate for detecting osteoporosis and predicting osteoporotic fractures in women and men.^{16,17} Using a mailed letter system, we will reach more patients that are at risk for osteoporosis, prompting them to seek osteoporosis evaluation.

The purpose of this study is to determine the effectiveness of an electronic medical record (EMR) implemented system that identifies patients at risk for osteoporosis (OST (osteoporosis screening tool) score) in prompting patients toward osteoporosis evaluation.

Materials and Methods

This was a prospective study that was reviewed by our international review board committee and qualified for exemption. OST scores are generated on every patient 50 years of age and older that is admitted to the Penn State Hershey Medical Center

(PSHMC) and recorded in their electronic medical record. The patient list and the corresponding OST scores are already collected as a part of routine quality practice. The OST formula is (body weight in kilograms – age in years) × 0.2. An OST score < 2 indicates that a patient has a potential risk for osteoporosis. Information Technology (prod00631) currently generates a report daily on all inpatients with an OST score. Patients with an OST score < 2 are mailed letters approximately three months after their admission informing them of their risk for osteoporosis and suggesting that they schedule a follow-up appointment with a physician for further evaluation (Appendix A Figure 1). Approximately 3 months after these letters are mailed, the patients were contacted via telephone and asked a series of questions to determine if patients have sought further follow-up. A developed phone script was used in this process, and patients were subsequently telephoned by a research associate 3 months after receiving the letter, and each was asked about his or her response to the letter and current plan for follow-up (Appendix A: Form 1).

One hundred and fifteen patients provided consent for participation and qualified for the study with OST score < 2 had phone screenings completed and were included in the analyses. 47% of the patients were female.

For the control group, our previously published historical control was used (Varacallo, 2013): 645 billing records spanning 275 days (July 18, 2010-April 19, 2011) were reviewed. In all, 234 candidates were identified, and the final control group after screening was comprised of 98 patients.¹⁸ In order to keep the time to phone call consistent between the 2 groups, these individuals were contacted via telephone approximately 6 months after their departure from the ED to determine whether or not they had any current or future follow-up planned after being treated for their fracture (Appendix A: Form 2).

Patients were excluded if they were deceased, a repeat in the database (ie, multiple hospital admissions), or unable to be contacted for various reasons (phone disconnected/out of service, patient admitted to nursing home, or having dementia).

We defined osteoporosis follow-up as a patient actively scheduling an appointment with one of his or her health care providers to address the risk of osteoporosis. The percentage response for both the control group and intervention group were calculated, and we employed the chi-square test in order to assess the effectiveness of our automated intervention program.

Results

In the control group, 84 (85.71%) individuals of the total 98 did not have any osteoporosis follow-up evaluation after being treated for their fracture, but the remaining 14 (14.29%) had osteoporosis follow-up evaluation. Similarly, in the intervention group, 67 (58.26%) of 115 did not schedule a follow-up, while the remaining 48 (41.74%) did seek an osteoporosis follow-up. Thus, the patient osteoporosis follow-up response rate improved with letter intervention using the OST score as an indicator ($P < .0001$).

Of note, there is a significant association between gender and follow-up based on receiving the letter ($p = 0.029$):

females have a higher percentage of follow-up than males do (83.33% vs. 58.97%).

Discussion

Osteoporosis impacts millions of individuals annually and creates a large burden on society and the health care system.^{3,7,8,19-31} Various types of intervention programs have demonstrated a successful range of increases in osteoporosis follow-up in high-risk patients.^{3,7,8,19-30} Many of these programs lack standardization and automation. While nonautomated systems are subject to human error and could result in failure to identify certain high-risk patients, it has been shown that an automated screening process is effective and negates this human error that would result in the failure to guide this population.¹⁸

Simple letter intervention has already been shown to be an effective method. Leslie et al conducted a randomized-controlled trial (RCT) and found that patients more than 50 years of age sustaining a major fracture without prior BMD testing or treatment for osteoporosis experienced an improved follow-up rate via letter notification to the patient and/or his or her physician. The reported absolute increase for the combined end point of bone mineral density testing or pharmacologic treatment was 14.9%, and the number needed to notify to change patient care was 7.²⁸ Additionally, a study by Sugi et al demonstrated improvement in follow-up rates via basic telephone intervention following automated fragility fracture identification using ICD-9 codes.²⁰

We did experience some limitations in our study. There was a slight time lag in patient contact (ie, telephone intervention). However, the time frame for screening and contacting patients did not exceed 3 months after receiving the computer-generated letter. Thus, all patients in the intervention group received the letter up to 3 months after hospital admission, and


all patients in the intervention group were contacted up to 3 months after receiving the letter (ie, approximately 6 months after hospital admission). This was consistent with our control group telephone contact period, which was set at approximately 6 months after fracture treatment.

It is also worth highlighting that given the nature of our intervention protocol, some individuals with dementia were unable to be contacted to determine their response to the letter. In some cases, family members or individuals familiar with that specific patient's care were able to respond on his or her behalf. Patients with dementia pose additional issues such as polypharmacy, medication noncompliance, multiple medical comorbidities, increased risk of side effects, and increased fall risk; these factors hinder follow-up rates and increase the morbidity, mortality, and financial burden for the patient as well as the entire health care system. The need to reduce the incidence of repeat fragility fractures in patients with dementia³² must be balanced with the dangers of placing these older patients on osteoporosis medications.³³

Although there are many barriers to implementing effective osteoporosis care, these barriers must be addressed to guarantee long-term success. Effective screening methods will decrease the burden of osteoporosis on society being identifying high-risk patients early and improve the quality of life of those at risk of developing osteoporosis. Furthermore, osteoporosis screening with an automated EMR OST score upon hospital admission with a subsequent letter intervention, as we have outlined, effectively prompts patients at risk for osteoporosis to seek further osteoporosis workup from a health care professional. OST score screening should be considered an effective tool in identifying patients at risk for osteoporosis and prompting patients toward osteoporosis evaluation in the community.

Appendix A

Figure 1 (Letter)

<p>ADULT BONE AND JOINT Mail Code EC140 30 Hope Drive, Bldg. B Hershey, PA 17033 717-531-5638 717-531-0983 Fax</p> <p>Adult Reconstruction Bone and Joint Infection Foot & Ankle Hand Metabolic Bone Disease Musculoskeletal Oncology Podiatry/Diabetic Foot Primary Care Sports Medicine Shoulder & Elbow Spine Sports Medicine Orthopaedic Trauma</p> <hr/> <p>PEDIATRIC BONE AND JOINT Mail Code EC020 30 Hope Drive, Bldg. B Hershey, PA 17033 717-531-7123 717-531-0385 Fax</p> <hr/> <p>STATE COLLEGE LOCATION 1850 E. Park Avenue, Suite 112 State College, PA 16803 814-865-3566 814-863-7803 Fax</p> <p>General Orthopaedics Hand Orthopaedic Sports Medicine Pediatric Orthopaedics Primary Care Sports Medicine Physical Medicine Physical Therapy</p> <hr/> <p>RADIOLOGY / IMAGING SERVICES 717-531-3799 717-531-0381 Fax</p> <hr/> <p>THERAPY SERVICES Mail Code EC130 30 Hope Drive, Bldg. B Hershey, PA 17033 717-531-8070 717-531-4558</p>	<p>Dear Patient:</p> <p>Our records show that you have had a recent general admission and/or fracture evaluation at the Hershey Medical Center, and that you meet criteria for being at-risk for osteoporosis. Osteoporosis is a skeletal disease characterized by weak bones that are prone to break.</p> <p>The good news is that with early diagnosis and proper treatment, patients can lead full and active lives. I encourage you to pursue further evaluation to see if you indeed have osteoporosis by either making an appointment with your primary care physician, or with us in the Penn State Hershey Bone and Joint Institute. You can make an appointment to see me in our convenient East Health Campus (on the east end of the Medical Center grounds) by calling 717-531-5638.</p> <p>It is never too late or too early to start intervention for this silent disease. Please give us a call.</p> <p>**If you are already being treated for osteoporosis, there is no need to act on this letter. However, if it has been more than 2 years since your last DEXA scan, please see your ordering physician about getting an updated DEXA scan. **</p> <p>Sincerely,</p>  <p>Edward J. Fox, M.D. Professor Department of Orthopaedics</p> <p>P.S. You can learn more about osteoporosis by visiting www.pennstatehershey.org/osteoporosis</p>
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Form 1 (intervention group phone script):

“Hello Mrs./Mr. _____, my name is _____ from Hershey Medical center. I’m calling regarding your last admission to the medical center.”

“How are you?” “May I talk to you?”

If no – “May I ask why?” Not interested, no time, other _____

“I’m calling you on behalf of the Dept of Orthopaedics to talk about our Osteoporosis Initiative. You were recently mailed a letter after your admission to the hospital from Dr. Ed Fox here at the Medical Center. The letter indicated that you might be at risk for osteoporosis. It further advised you to reach out to your primary care physician to further discuss this and it included a pamphlet with some further information about osteoporosis.

Do you recall receiving this letter?

If yes No

Std Osteoporosis Script

“Did you do anything?”

Yes No

“What?” “Why?”

_____ Didn’t understand letter, cost, time, physical issue,

Std Osteo Script Other _____

Standard Osteoporosis Script

1. "Prior to your last admission to the medical center, were you ever dx'd with osteoporosis or brittle bones?" Y/N
2. "Did you know you were at risk for osteoporosis?" Y/N
 - a. If no, skip to III
 - b. If yes, "Have you ever been treated previously for osteoporosis?" Y/N
 - i. If no: "Why did you not get treated for osteoporosis?" _____
 - ii. If yes:
 1. "Did you take Calcium/Vit D or a Bone Drug such as Fosamax/Reclast/Boniva/Actonel/Miacalcin/Estrogen/Forteo or other?" _____
3. "Have you ever been seen a doctor about a bone fracture?"
 - a. "When?" _____
4. "Are you:
 - a. A non-smoker
 - b. A smoker
 - c. An ex-smoker"
 - i. If yes, "How many _____ ppd x _____ years", Quit _____
5. "Do you have any relatives with osteoporosis?"
 - a. If yes, "Who?" _____
6. If female, "Are you post-Menopausal?"
 - a. If yes:
 - i. "At what age?" _____
 - ii. "Were you started on HRT?" _____

Form 2 (Control group phone script):

“Hello , may I speak with **(patient name)**? My name is _____ from the Penn State Hershey Medical Center. How are you?

“I’m calling you on behalf of the Dept of Orthopaedics to talk about our Osteoporosis Initiative. You were recently mailed a letter after your admission to the hospital from Dr. Ed Fox here at the Medical Center. The letter indicated that you might be at risk for osteoporosis. It further advised you to reach out to your primary care physician to further discuss this and it included a pamphlet with some further information about osteoporosis.

May I talk to you? I have just a few brief questions.

If **NO**, why? (i.e. not interested, no time, etc.) Would there be a better time?

If **YES**,

1. **Prior** to this visit, were you evaluated for osteoporosis? **Yes or No**
2. **Prior** to this visit, were you diagnosed with either osteoporosis/penia? **Yes or No**
3. **Prior** to this visit, were you treated for either osteoporosis/penia?

Yes or No (This does not include Vit D/Calcium)

4. **Prior** to this visit, did you ever take Vitamin D? **Yes or No**
5. **Prior** to this visit, did you ever take Calcium? **Yes or No**
6. **After** this visit, were you evaluated for osteoporosis? **Yes or No**
7. **After** this visit, were you diagnosed with either osteoporosis/penia? **Yes or No**
8. **After** this visit, were you treated for either osteoporosis/penia?

Yes or No (This does not include Vit D/Calcium)

9. **After** this visit, did you ever take Vitamin D? **Yes or No**

After this visit, did you ever take Calcium? **Yes or No**


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