Minimizing Disparities in Osteoporosis Care of Minorities With an Electronic Medical Record Care Plan

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Abstract

Background Ethnic disparities in care have been documented with a number of musculoskeletal disorders including osteoporosis. We suggest a systems approach for ensuring osteoporosis care can minimize potential ethnic disparities in care.

Questions/purposes We evaluated variations in osteoporosis treatment by age, sex, and race/ethnicity by (1) measuring the rates of patients after a fragility fracture who had been evaluated by dual-energy xray absorptiometry and/or in whom antiosteoporosis treatment had been initiated and (2) determining the rates of osteoporosis treatment in patients who subsequently had a hip fracture.

Patients and Methods We implemented an integrated osteoporosis prevention program in a large health plan. Continuous screening of electronic medical records identified patients who met the criteria for screening for osteoporosis, were diagnosed with osteoporosis, or sustained a fragility fracture. At-risk patients were referred to care managers and providers to complete practice

guidelines to close care gaps. Race/ethnicity was self-reported. Treatment rates after fragility fracture or osteoporosis treatment failures with later hip fracture were calculated. Data for the years 2008 to 2009 were stratified by age, sex, and race/ethnicity.

Results Women (92.1%) were treated more often than men (75.2%) after index fragility fracture. The treatment rate after fragility fracture was similar among race/ethnic groups in either sex (women 87.4%–93.4% and men 69.3%–76.7%). Osteoporotic treatment before hip fracture was more likely in white men and women and Hispanic men than other race/ethnic and gender groups.

Conclusions Racial variation in osteoporosis care after fragility fracture in race/ethnic groups in this healthcare system was low when using the electronic medical record identifying care gaps, with continued reminders to osteoporosis disease management care managers and providers until those care gaps were closed.

Each author certifies that he or she has no commercial associations (eg, consultancies, stock ownership, equity interest, patent/licensing arrangements, etc) that might pose a conflict of interest in connection with the submitted article.

Each author certifies that his or her institution approved the human protocol for this investigation, that all investigations were conducted in conformity with ethical principles of research, and that informed consent for participation in the study was obtained.

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Introduction

Ethnic and racial disparities in care have been documented in many treatment realms [5–7, 11]. Epstein et al. [7] found ethnic minorities were less likely to be treated by high-volume surgeons at high-volume hospitals, with African Americans operated on by low-volume surgeons in low-volume hospitals in nine of 10 procedures across the surgical spectrum studied at New York City area hospitals. Ethnic disparities in care have been recently documented in osteoporosis care [1, 2, 10, 12, 14]. Neuner et al. [10] reported African American and Hispanic women were less likely to undergo bone density testing before index hip fracture compared to white women and this phenomenon

remained after hip fracture occurred in these two ethnic groups. However, differences in testing between ethnic groups were not observed when using zip code as a surrogate for socioeconomic characteristics, since bone density testing rates after hip fracture were similar in low- and high-income groups [10].

In fact, there is a disparity in how ethnic data are collected by physician groups [13]. Although the Institute of Medicine and recent health reform proposals encourage the collection of data on race, ethnicity, socioeconomic status, and primary language spoken in the home, it is clear there is variance as to how this is done in physician practices [13]. All physician practices can and should use accurate data on their patients' race and ethnic group for population-based activities such as detecting disparities and optimizing the effectiveness of quality improvement interventions [13].

Kaiser Permanente is an integrated healthcare system where hospitals, health plans, and medical groups coexist collaboratively in nine states and Washington, DC. The system is fully integrated and owns dual-energy xray absorptiometry (DXA) scanners, pharmacies, and hospitals. This setting allows our osteoporosis treatment program to be tracked more accurately and completely than in a fragmented and partitioned medical system. Osteoporosis treatment regimens are encouraged and supported in the system because preventative medicine drives higher quality, such as reduction in hip fractures, which can also reduce costs. We leverage information technology in the form of our electronic medical record (EMR) and registries to provide actionable information to care managers who, through care management guidelines, identify osteoporosis care gaps in patients and correct any deficiencies in care without creating disparities in race or ethnicity [4].

In this observational study, we evaluated whether there was any variation in osteoporosis treatment by age, sex, and race/ethnicity by (1) measuring the rates of patients after a fragility fracture who had been evaluated by DXA and/or in whom antiosteoporosis treatment had been initiated (this is a way to evaluate how effective our program is in identifying and treating patients after fragility fracture) and (2) determining the rates of osteoporosis treatment in patients who later went on to hip fracture.

Patients and Methods

We conducted a study including all Kaiser Permanente Southern California (KPSC) enrollees who were aged 60 years or older as of January 1, 2008. KPSC is a not-for-profit community service healthcare organization. Outcomes were ascertained during the years 2008 to 2009. There were more than 3.3 million members in the health plan and more than 570,000 members were 60 years or

older as of 2008. The study included 13,412 fragility fractures (2008) and 1496 hip fractures (2009). Age was classified into subsets (60–64, 65–69, 70–74, 75–79, 80–84, and 85 years or older) and data were divided by male and female sexes. Race and ethnicity was self-reported as Asian, African American, Hispanic, or white. Among women, 10% of the KPSC population age 60 years or older (in the time period studied) reported an Asian background, 11.9% reported an African American background, 14.0% reported a Hispanic background, and 64% reported a white background. Among men, 9.8% reported an Asian background, 9.6% reported an African American background, 16.6% reported a Hispanic background, and 64% reported a white background. No patients were lost to followup. No patients were recalled specifically for this study; all data were obtained from medical records and radiographs. This study was reviewed and approved by the KPSC Institutional Review Board.

In 2000, the KPSC region implemented the Healthy Bones Model of Care (HBMO) [4], an interdisciplinary osteoporosis prevention and management program. This program seeks to identify health plan members who are at increased risk for developing osteoporosis and fragility fractures (a fracture occurring spontaneously or following a minor trauma, such as a fall from standing height) and provides proactive screening, prevention, and treatment options. Members selected for enhanced screening are (1) women aged 65 years or older; (2) men aged 70 years or older; and (3) all patients aged 50 years or older who have a personal history of fragility fracture since age 50 years, glucocorticoid use of 3 months or more at doses of 5 mg or more, parental history of hip fracture, rheumatoid arthritis, high alcohol use (≥ 3 ounces/day), cigarette smoking, and/or other causes of secondary osteoporosis. Members identified as being at increased risk are screened by DXA scan. Prevention and treatment options include screening for vitamin D deficiency, encouragement of exercise and smoking cessation, safety-proofing homes, vitamin and mineral supplementation, and use of evidence-based pharmacologic interventions.

Inreach programs, such as our Proactive Office Encounter, exist to capture patients in clinic visits unrelated to osteoporosis and refer them for DXA scans and/or treatment. Outreach programs exist where care managers utilize computer-generated lists of patients to contact for DXA scans and/or treatment, as well as "Just in Time" clinics after the DXA to evaluate the DXA results and initiate treatment.

For each series member, we collected from electronic administrative and clinical data sources the following: (1) demographic information, including age, sex, and race/ethnicity; (2) enrollment information; (3) inpatient and outpatient encounter information, including diagnosis and

procedure codes for each encounter; (4) claims information from outside providers; (5) referrals information; and (6) radiology records. We were able to ascertain osteoporosis status, osteoporosis screening status, and history of prior fragility fractures from inpatient and outpatient encounter data.

Osteoporosis treatment rates initiated after a 2008 fragility fracture were identified, measured, and examined by ethnic subset populations. Osteoporosis treatment rates where a later hip fracture occurred in 2009 as identified by the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) discharge diagnosis codes 820.xx (hip fracture) were also measured and subdivided by ethnic subset populations. The 733.xx hip fracture code and the hip and femur fracture Current Procedural Terminology (CPT) codes were also used in case finding, and all hip fractures had a chart review and when needed a radiographic review by the senior author (RD).

Fragility fractures that occurred in 2008 were screened and treated for osteoporosis in accordance with the Healthy Bones Model [4]. One study suggests it takes 6 months or longer to see a substantial drop in the hip fracture rate [4]. Based on this finding, we followed the fracture cohort for at least 6 months after fracture/intervention to see the effectiveness of that intervention. We then saw how effective this was in the year 2009 with respect to eventual hip fracture. The study was performed entirely after introduction of our EMR, which began in 2005 and was rolled out to all facilities by 2007.

The KPSC osteoporosis management program aims to screen for osteoporosis and to provide pharmacologic intervention for osteoporosis. The patients were considered screened for osteoporosis if they had a bone mineral density (BMD) test performed during the study period, regardless of the BMD test results. Pharmacologic intervention for osteoporosis was obtained from the pharmacy records of prescriptions for bisphosphonates, calcitonin, estrogens, selective estrogen receptor modulators (SERMs), miscellaneous hormones, and sex hormone combinations. If the patient was prescribed any of the above medications 6 months or longer before the incident of a hip fracture, the patient was labeled having received intervention. Otherwise, the patient was labeled as not receiving intervention [4].

Treatment rates after (1) identified fragility fracture and (2) osteoporosis treatment failures with later hip fracture were used as proxy measures for all treated. Not all patients treated will have had a prior fragility fracture and not all treated with osteoporosis medications go on to have a hip fracture. These rate data in patients 60 years or older for the years 2008 (after fragility fracture treatment period) and 2009 (hip fracture as end point period) were then stratified by age, sex, and race/ethnicity.

Diagnosis of osteoporosis was identified through ambulatory encounters and hospital discharge data. Using the administrative databases, a patient was classified as having osteoporosis if they had an ICD-9-CM diagnosis recorded with codes 733.0x (osteoporosis) or had a BMD test score indicating osteoporosis or low bone mass requiring treatment (women's t score < -2.0 ; men's t score < -2.5) any time during the study period.

We determined differences in rates of patients who had been evaluated by DXA and/or in whom antiosteoporosis treatment had been initiated after a fragility fracture between sex and the four race/ethnicity designations using the chi square test of proportions. We also determined differences in the rates of osteoporosis treatment in patients who later went on to hip fracture between sex and the four race/ethnicity designations using the chi square test of proportions. We used IBM SPSS Statistical Software for all statistical tests (Somers, NY).

Results

In the fragility fracture group, we observed no discernible disparity in osteoporosis treatment rates after fragility fracture across ethnic groups for either women ($p = 0.52$) (Table 1) or men ($p = 0.48$) (Table 2). The rate of patients after a fragility fracture who had been evaluated by DXA and/or in whom antiosteoporosis treatment had been initiated was higher ($p < 0.001$) in all women (92.1%) than in all men (75.2%). The population rate of fragility fracture (number of fragility fractures specific to that sex and ethnic/race subset over that subset sex and ethnic/race population) was less in Asians and African Americans and more likely to occur in Hispanics and whites (women: $p < 0.001$ [Table 1]; men: $p < 0.001$ [Table 2]). Most of the fragility fractures occurred among white participants.

We observed notable differences in treatment rates among ethnic groups in both women ($p = 0.001$) (Table 3)

Table 1. Female fragility fracture data in 2008

Variable	Asian	African American	Hispanic	White	p Value
Treatment rate (%)	89.9	87.4	89.3	93.4	0.52
Population rate (%)	1.8	1.7	3.8	3.5	< 0.001

Table 2. Male fragility fracture data in 2008

Variable	Asian	African American	Hispanic	White	p Value
Treatment rate (%)	75.7	72.2	69.3	76.7	0.48
Population rate (%)	0.9	1.0	1.6	1.8	< 0.001

Table 3. Female hip fracture data in 2009

Variable	Asian	African American	Hispanic	White	p Value
Treatment rate (%)	63.9	54.9	72.0	75.6	0.001
Population rate (%)	0.12	0.20	0.26	0.44	< 0.001

Table 4. Male hip fracture data in 2009

Variable	Asian	African American	Hispanic	White	p Value
Treatment rate (%)	13.3	11.1	22.5	35.0	0.007
Population rate (%)	0.062	0.113	0.171	0.203	< 0.001

and men ($p = 0.007$) (Table 4). The rate of osteoporosis treatment in patients who had a hip fracture was higher ($p < 0.001$) in women (73.5%) than in men (30.7%). The population rate of hip fracture (number of hip fractures specific to that sex and ethnic/race subset over that subset sex and ethnic/race population) was more likely in Hispanic male populations and all white patients (women: $p < 0.001$ [Table 3]; men: $p < 0.001$ [Table 4]). Most of the hip fractures occurred among white participants.

Discussion

Ethnic disparities in care occur with a number of musculoskeletal disorders including osteoporosis care. We presumed a systems-based approach coupled with our proactive EMR-based system would minimize any ethnic disparity in osteoporosis care as our medical providers and care managers are motivated by predetermined practice guidelines to close care gaps without concern for race or ethnicity. Our data are fundamentally different from much of the published work in the literature on this topic as we are able to capture both the specific fracture rate in each sex, race/ethnic, and age group, as well as the overall subpopulation in each sex, race/ethnicity, and age group stratification. We therefore assessed whether our EMR-based proactive care plan for osteoporosis care would minimize ethnic disparities in a group of patients who had osteoporosis care and treatment after fragility fractures and in a group of patients who went on to hip fracture after osteoporosis treatment was initiated.

We note several limitations to our study. First, because we used proxy measures to determine rates of patients treated, not all patients treated will have had a prior fragility fracture and not all treated with osteoporosis medications go on to have a hip fracture after fragility fracture so this may underestimate the treatment after fragility fracture and the treatment before hip fracture. From

the perspective of measurement, it creates a metric harder to attain so that we may be in fact performing better than the results show. Second, the simple classification of four race/ethnic groups may miss many race/ethnic subtypes and mixed-race categories. At the time of the study, we only collected data in the construct as follows: Asians, African Americans, Hispanics, and whites. The Institute of Medicine (IOM) recommends the US Office of Management and Budget race categories (black or African American, white, Asian, American Indian or Alaska Native, and Native Hawaiian or other Pacific Islander) and the ethnicity choice of Hispanic (yes/no) be used a minimum for data collection. Our designations, while not perfect, are better than no designations. Our systems are being improved to provide the detail the IOM suggests in the future [8]. Third, patients can be noncompliant with DXA and pharmacy orders made by medical providers (and that is what we are measuring) after being identified via screening and after fragility fracture. All systems must deal with this patient compliance issue. Fourth, we lacked a control group from before the implementation of our EMR and integrated osteoporosis prevention program. We could have retrospectively created such a control group, but it would have required substantial effort to do so. Therefore, we cannot ensure the relatively high rates of treatment (compared to the literature) are due only to the implementation.

When controlling for sex, the screening and treatment rates by race/ethnicity after fragility fracture were similar between the four ethnic groups. In this case, our hypothesis that ethnic disparities in care would be minimized by our internal mechanisms aimed at closing care gaps was supported. Racial variation in osteoporosis care after fragility fracture of ethnic groups in this healthcare system is minimized by the EMR identifying care gaps, with continued reminders to care managers and providers until those care gaps are closed. This is in contradistinction to a study by Mikuls et al. [9], who found black women with a positive fracture history were less likely to receive a DXA scan or receive an osteoporosis prevention medicine than white women with a positive fracture history. Wei et al. [12] also showed pharmacologic osteoporosis treatment (calcium supplements and antiresorptive drugs) was more likely in white than black women. Curtis et al. [3] found a substantial gap existed between 2008 National Osteoporosis Foundation treatment guidelines based on fracture risk and the receipt of prescription osteoporosis medications. This gap was particularly notable for African Americans and men [3].

We found a racial variation in the osteoporosis treatment in patients who eventually went on to a hip fracture. Among both sexes, African Americans and Asians had lower screening and treatment rates when compared with whites and Hispanics in the period before hip fracture. Both

male and female race/ethnic treatment disparities were statistically significant. The reasons are unclear. While we are doing well at getting patients screened and treated after a fragility fracture, our treatment rates are not as good in the population that goes on to a hip fracture.

In women, 73.5% of all hip fractures were treated before hip fracture and, in men, 30.7% of hip fractures were treated before hip fracture. These rates of osteoporosis screening and treatment in patients who go on to hip fracture are still very good. These patients may be harder to encounter before hip fracture as the numbers of actual patients are small. The goal would be to have 100% of patients on treatment before their hip fracture. These treatments are not 100% effective so theoretically only an approximately 50% reduction in the hip fracture rate can be expected in the best scenario of all indicated patients screened/treated. A review of the literature revealed no studies where hip fracture rates in patients on prior osteoporosis medications could be examined by race/ethnicity so no comparisons could be made. The male disparity in care, as well as the two ethnic subset disparities described, represents a call to arms for our regional orthopaedic group. There is a mechanism whereby these results are disseminated back to orthopaedic chiefs at each medical center in the KPSC system. They can then notify frontline orthopaedists of these findings so that, where the doctor can influence screening and treatment, action can be taken. Care managers are also involved in enhanced screening of high-risk groups. We continue to improve in identifying, risk stratifying, treating, and then tracking our patients at risk for osteoporosis and fractures. Our systematic approach to closing care gaps should drive continued process improvement and change management to reduce ethnic disparities in the treatment of osteoporosis.

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References

1. Cauley JA, Wu L, Wampler NS, Barnhart JM, Allison M, Chen Z, Jackson R, Robbins J. Clinical risk factors for fractures in multi-ethnic women: the Women's Health Initiative. *J Bone Miner Res.* 2007;22:1816–1826.
2. Cheng H, Gary LC, Curtis JR, Saag KG, Kilgore ML, Morrissey MA, Matthews R, Smith W, Yun H, Delzell E. Estimated prevalence and patterns of presumed osteoporosis among older Americans based on Medicare data. *Osteoporos Int.* 2009;20:1507–1515.
3. Curtis JR, McClure LA, Delzell E, Howard VJ, Orwoll E, Saag KG, Safford M, Howard G. Population-based fracture risk assessment and osteoporosis treatment disparities by race and gender. *J Gen Intern Med.* 2009;24:956–962.
4. Dell RM, Greene D, Anderson D, Williams K. Osteoporosis disease management: what every orthopaedic surgeon should know. *J Bone Joint Surg Am.* 2009;91(Suppl 6):79–86.
5. Dunlop DD, Manheim LM, Song J, Sohn MW, Feinglass JM, Chang HJ, Chang RW. Age and racial/ethnic disparities in arthritis-related hip and knee surgeries. *Med Care.* 2008;46:200–208.
6. Emejuiwe N, Jones AC, Ibrahim SA, Kwok CK. Disparities in joint replacement utilization: a quality of care issue. *Clin Exp Rheumatol.* 2007;25:44–49.
7. Epstein AJ, Gray BH, Schlesinger M. Racial and ethnic differences in the use of high-volume hospitals and surgeons. *Arch Surg.* 2010;145:179–186.
8. Institute of Medicine. Race, ethnicity, and language data: standardization for health care quality improvement. Washington, DC: National Academies Press; 2009. Available at: <http://www.iom.edu/~media/Files/Report%20Files/2009/RaceEthnicityData/Race%20Ethnicity%20report%20brief%20FINAL%20for%20web.pdf>. Accessed February 23, 2011.
9. Mikuls TR, Saag KG, George V, Mudano AS, Banerjee S. Racial disparities in the receipt of osteoporosis related healthcare among community-dwelling older women with arthritis and previous fracture. *J Rheumatol.* 2005;32:870–875.
10. Neuner JM, Zhang X, Sparapani R, Laud PW, Nattinger AB. Racial and socioeconomic disparities in bone density testing before and after hip fracture. *J Gen Intern Med.* 2007;22:1239–1245.
11. Skinner J, Weinstein JN, Sporer SM, Wennberg JE. Racial, ethnic, and geographic disparities in rates of knee arthroplasty among Medicare patients. *N Engl J Med.* 2003;349:1350–1359.
12. Wei GS, Jackson JL, Herbers JE Jr. Ethnic disparity in the treatment of women with established low bone mass. *J Am Med Womens Assoc.* 2003;58:173–177.
13. Wynia MK, Ivey SL, Hasnain-Wynia R. Collection of data on patients' race and ethnic group by physician practices. *N Engl J Med.* 2010;362:846–850.
14. Zingmond DS, Melton LJ 3rd, Silverman SL. Increasing hip fracture incidence in California Hispanics, 1983 to 2000. *Osteoporos Int.* 2004;15:603–610.