Improving Quality of Care in Osteoporosis: Opportunities and Challenges

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Osteoporosis is a chronic disease with a projected escalation in fracture prevalence and costs as the population ages. Osteoporosis care aims to prevent fractures and ultimately improve health-related quality of life. Despite significant evidence-based advances in testing and treatment, a large proportion of patients with fragility fracture or other osteoporosis risk factors are never evaluated with bone mineral density measurement testing and never receive therapy. This suboptimal quality of care can be attributed to barriers at the patient, provider, and health system levels. In addition, significant disparities in care exist across age, ethnicity, and gender. Recent studies have indicated that restructuring care at the system level is more likely to be successful, dependable, and durable than traditional quality improvement interventions focusing predominantly on physicians.

Introduction

Osteoporosis is associated with significant morbidity and mortality, and its public health burden is increasing as the population ages [1•]. Recognizing this growing problem, various organizations have made osteoporosis a global health priority [2–4]. However, a substantial gap exists between current evidence for best practices and its translation into optimal care of osteoporosis. As with many asymptomatic chronic diseases, prevention and diagnosis is often neglected until a sentinel event such as a fragility fracture occurs. Fractures provide an ideal opportunity for the initiation of secondary osteoporosis intervention, yet abundant evidence reveals low rates of osteoporosis evaluation following fractures [5–11]. Moreover, even fewer of these patients receive appropriate prescription antiosteoporosis therapy. This article reviews the literature regarding the challenges and opportunities related to improving the quality of osteoporosis care.

Defining and Measuring Quality of Care in Osteoporosis

Quality of care refers to the levels of excellence that characterize the health services or health care provided based on accepted standards of quality. Figure 1, adapted from the Donabedian model [12], illustrates the relevant components and measures of the quality of osteoporosis care through process and structure leading to outcome. A quality measure is a mechanism to quantify quality of care by comparison to a criterion. It incorporates a clinical performance measure, which is a mechanism for assessing the degree to which a provider competently and safely delivers appropriate clinical services in the optimal time period. The domains of clinical performance measure include process of care (a health care service appropriately provided to a patient based on scientific evidence of efficacy or effectiveness), structure of care (a feature of a health care organization or clinician relevant to its capacity to provide health care), and outcome of care (a patient's health state resulting from health care).

The setting in which care is delivered is also important. Factors such as the availability of bone mineral density (BMD) testing may differ among inpatient, outpatient, or long-term care settings. The process measures of BMD measurement and prescription osteoporosis therapy are most relevant because they are actionable and evidence based, which is a relatively unique feature in musculoskeletal diseases.

Using these and similar process measures for osteoporosis, some groups have undertaken efforts to measure health plan, hospital, and physician performance and

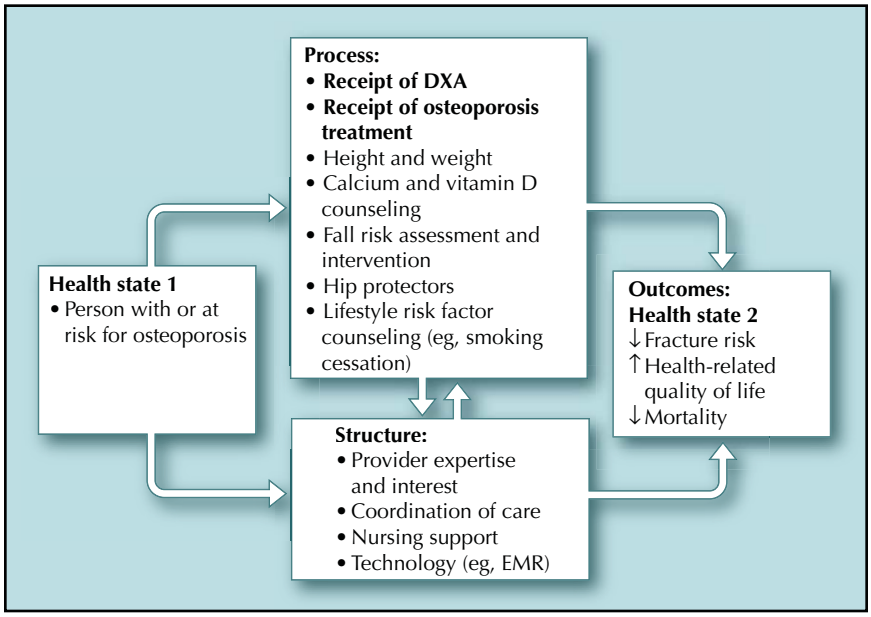

Figure 1. Schematic of interactions among the domains and measures of quality of care in osteoporosis. Improvements in the process and structure of the health care result in a favorable transition of health care from a preliminary health state (health state 1) to the outcome (health state 2). The two primary osteoporosis process measures are in bold. DXA—dual energy X-ray absorptiometry; EMR—electronic medical record.

link financial incentives with high performance. In 2004, osteoporosis management after a fracture became a National Committee on Quality Assurance Healthcare Effectiveness Data and Information Set (HEDIS) quality measure [13]. More than 90% of American's health plans use this tool to evaluate the provision of osteoporosis care by assessing the percentage of women 67 years old and older with a new fracture who received either a BMD test or prescription treatment for osteoporosis within 6 months of their fracture. Regrettably, the HEDIS rates remained stagnant at approximately 20% between 2004 and 2006 [5]. This figure is especially discouraging compared with the 94% of patients who received β-blocker therapy after a myocardial infarction and 88% of patients with coronary artery disease who received low-density lipoprotein cholesterol screening in 2006, as examples of other successful HEDIS measures [5].

Other performance measures used by investigators and stakeholders such as the Joint Commission on the Accreditation of Healthcare Organizations assess other facets in the continuum of care of osteoporosis. These include evaluation for secondary osteoporosis, education regarding calcium and vitamin D supplementation, physical activity and fall risk assessment, continuity of care, monitoring, and pharmacotherapy [14].

The US Centers for Medicare and Medicaid Services (CMS) began requiring all Medicare-participating health plans to collect and report the HEDIS performance measures as a basis for pay-for-performance in Medicare. At this point, hospitals and physicians are not mandated to report quality measures to CMS, and osteoporosis management is not yet required in the Hospital Quality Alliance and Ambulatory Care Quality Alliance starter sets. However, at a physician level, voluntary reporting of quality measures can result in up to a 1.5% bonus for Medicare part B billings through the CMS Physician Quality Reporting Initiative, which includes three of the four osteoporosis performance measures developed by the American Medical Association Physician Consortium for Performance Improvement.

In the absence of a fragility fracture, BMD traditionally has been used to diagnose osteoporosis and is one of the strongest predictors of fracture risk. Clinical trials evaluating the efficacy of therapeutic agents have selected patients based on low BMD for inclusion and use BMD as a surrogate for fracture reduction to indicate the effectiveness of a given therapeutic intervention. Although BMD is a useful process measure, most fractures occur in patients with low BMD (ie, osteopenia) who do not meet the BMD definition of osteoporosis (ie, T score ≤ –2.5) [15,16]. Because the primary goal (outcome measure) in osteoporosis care is fracture prevention, sole reliance on BMD neglects a considerable population in need of therapy. Other factors such as age and previous fragility fracture are also important risk factors. Different strategies may be necessary to assess fracture risks in high-risk patients and the general population. Population-based studies have shown that absolute fracture risk assessment can be determined using clinical risk factors alone or in combination with BMD [12,14,17–19], including those based on the Study of Osteoporotic Fractures (SOF) [20] and the National Osteoporosis Risk Assessment (NORA) [12]. Treatment intervention thresholds will vary depending on health care resources and priorities in each country. The upcoming World Health Organization initiative of integrated absolute fracture risk assessment may help identify persons who will benefit most from treatment; however, current quality indicators and treatment guidelines do not yet integrate multiple risk factors and are based solely on BMD testing results, fracture history, and certain very strong risk factors such as glucocorticoid use.

Gaps in Osteoporosis Quality of Care

United States performance results on the osteoporosis HEDIS measure indicate underdiagnosis and undertreatment of osteoporosis in high-risk patients [5]. Despite the availability of effective therapies, studies in US and international populations consistently document low rates of BMD screening (approximately 20%) and treatment in at-risk patients, even among those who have already sustained fractures [5–11]. In a recent systematic literature review of 35 studies of osteoporosis management following fragility fracture, 1% to 45% of postfracture patients reported an osteoporosis diagnosis, 1% to 49% had laboratory tests ordered, and 1% to 32% had bone density scans [21]. Calcium/vitamin D and pharmacologic therapy was reported in 2% to 62% and 1% to 65% of patients, respectively. Fall assessments were often not reported, but when they were reported, performance frequency was low. Care delivery was better in subacute than acute settings.

Beyond appropriate testing or initiation of therapy, suboptimal compliance and persistence with treatment, particularly in asymptomatic disease, further compromises the effectiveness of osteoporosis treatment. In a recent systematic review of 14 reports from 14 databases, the proportion of patients persisting with bisphosphonates for osteoporosis for 1 year ranged from 18% to 78% (mostly < 50%) and the mean medication possession ratio (MPR), a compliance measure defined as the number of days' supply of medication received divided by the length of the follow-up period, was 0.58 to 0.76 for weekly therapy [22••]. Although it is difficult to compare across studies, the compliance with bisphosphonates was somewhat lower than that observed with treatments for dyslipidemia [23]. The impact of poor adherence with bisphosphonates has been measured in several studies. A large cohort study of 35,537 women reported a fracture risk reduction of 21% in those with MPR of 80% of greater over 2 years compared with those with an MPR less than 80% [24]. A nested case control study showed that 1-year persistence (refill gap < 50% previous prescription length) was associated with a 26% reduced risk of fracture ($P < 0.05$), and persistence for 2 years was associated with a 32% reduced risk ($P < 0.05$) [25]. Understanding the causes for treatment cessation is critical to addressing this important issue of poor compliance.

In addition to underuse of appropriate testing and treatment strategies, overuse and misuse can also create quality of care problems. High-quality care must be delivered safely with minimal waste. Sometimes, the World Health Organization criteria for diagnosis of osteoporosis in postmenopausal women are overgeneralized to premenopausal women, resulting in inappropriate use of osteoporosis treatment in low-risk populations [26]. Approximately 0.5% of healthy women between ages 30 and 40 years have T scores of –2.5 or less [27]. In the absence of fragility fractures or other significant osteoporosis risk factors, low BMD in younger women typically reflects low peak bone mass and is associated with a very low 5-year and even 10-year absolute fracture risk compared with that in postmenopausal women [26]. In premenopausal women, BMD testing and treatment should be undertaken only in the presence of approved indications such as chronic glucocorticoid therapy [28–30], in which efficacy has been proven.

Although renal toxicity and osteonecrosis of the jaw are more prevalent in the oncologic literature than for osteoporosis patients [31], inappropriate or overzealous use of oral and/or intravenous bisphosphonates in osteoporosis management could further exacerbate renal, gastrointestinal, and even cardiac side effects.

Barriers at the patient, provider, and health care system levels account for these gaps in osteoporosis care quality, as summarized in Table 1.

Osteoporosis Health Care Disparities

Despite great opportunity for treatment and prevention of osteoporosis, certain populations receive suboptimal care. Disparities in osteoporosis awareness, diagnosis, treatment, and outcomes exist across gender, age, and ethnic lines [21,32]. Elderly residents of nursing homes, home health care patients, older patients with high comorbidities, and chronic glucocorticoid users represent particularly vulnerable high-risk populations [33–36]. In subgroup analysis of a recent study, older patients and those with higher disease burden were less likely to receive a BMD measurement than younger, healthier patients [36], which was a consistent finding in a systematic review [21].

Due to higher peak bone mass, the incidence of osteoporosis is generally lower in African American women than in Caucasian women; however, fractures in African American women are associated with higher morbidity and mortality [37,38]. Several studies have shown that postmenopausal black women are much less likely than their white counterparts to receive BMD testing or prescription therapy [39–41]. This finding held true even among those who had a previous fracture or diagnosis of osteoporosis by dual energy X-ray absorptiometry [41,42•].

The prevalence of osteoporotic fractures is higher in women, but men have a higher rate of fracture-associated mortality with a greater economic impact [43••]. The incidence of osteoporosis in men is often underestimated, and some uncertainty exists regarding the BMD cut-off point to define male osteoporosis. In a large Canadian study, diagnosis and treatment in men with clinical fragility fractures were numerically much lower compared with other studies including only women: at baseline, 20% of men had a prevalent fracture, but only 2.3% reported a diagnosis of osteoporosis, which increased to only 10.3% 5 years later [44••]. At baseline, less than 1% of men with a fragility fracture were taking a bisphosphonate; by year 5, the treatment rate for any fragility fracture was 9.5% [44••]. In Medicare beneficiaries at least 65 years old, 30% of women had been screened with dual energy X-ray absorpti-

Table 1. Barriers to high-quality osteoporosis care

Health system factors*
Static nature of traditional health care processes
Lack of system-wide standard orders
Insufficient coordination of care between subspecialty and primary care providers
Unwillingness of physicians to assume responsibility for preventive care
Fragmented financing for preventive care
Provider factors†
Lack of recognition of fragility fracture events as osteoporosis-defining events
Low prioritization of osteoporosis among patients' multiple comorbidities
Resistance to change
Lack of awareness of the morbidity, mortality, and health care costs associated with osteoporosis
Patient factors‡
Denial of osteoporosis diagnosis and risk factors
Lack of awareness of osteoporosis treatment and prevention therapies and their efficacy
Lack of understanding of the potential morbidity and mortality of untreated osteoporosis
Poor adherence and persistence to treatment

*Data from Solomon et al. [72,73].
†Data from Elliot-Gibson et al. [8] and Juby and De Geus-Wenceslau [74].
‡Data from Harrington and Deal [67] and Caro et al. [75].
(*Adapted from* Warriner et al. [76].)

ometry at any time over a 7-year period compared with less than 5% of men [45]. Osteoporosis care improvement in non-white populations and men represents an even greater challenge and will require substantial attention and effort.

Strategies to Improve Quality of Care

Quality improvement programs have been designed to target provider, patient, and health system barriers to optimal osteoporosis care (Table 1). These strategies work best when they are multidisciplinary, multifaceted, and aimed at influencing different components of the health care system. Strategies to improve quality ultimately must be generalizable and cost-effective if they are to be adopted. Of highest relevance, intervention immediately postfracture may represent the best window of opportunity for preventing future fractures.

Provider level

Medical education of physicians, including providing recommended care guidelines, real-time reminders at the point of patient care, and individualized audit and feedback of physicians' treatment patterns, are examples of some current methods for quality of care improvement. Several controlled studies have shown increased rates of BMD measurement and osteoporosis therapy when interventions target primary care physicians after a patient has sustained a fracture [11,36,46]. Patient-specific prompts to the health care providers through electronic medical record reminders resulted in 51.5% of postfracture patients receiving a BMD measurement or osteoporosis treatment in the 6 months postfracture as compared with 6% in the usual care [36].

Past attempts to use financial incentives for providers have not met with much success in changing care [47]. In a recent longitudinal study, the osteoporosis management outcome defined by the HEDIS measure rates were assessed in primary care clinics every 2 months during an initial phase of an outreach program. The program consisted of electronic messages and clinical guidelines followed by a phase of financial incentives to the staff and clinicians. These incentives provided no additional significant improvement in osteoporosis management; however, osteoporosis management increased from the baseline level of 13.4% to 44% (95% CI, 40%–48%) 20 months after both phases, suggesting the benefit of the outreach program [48]. Currently, many primary care physicians, who are overloaded by administrative and reporting duties, are resisting these programs at their current levels of reimbursement. Although some controversy surrounds the benefits of pay-for-performance [49–51], better alignment of physician payment with quality indicators is hoped to improve osteoporosis care.

In addition to postmenopausal women and persons with prior fractures, glucocorticoid users represent another subgroup in which early aggressive osteoporosis prevention and treatment are needed. In a recent study targeting primary care physicians of elderly Medicare beneficiaries at risk for osteoporosis (women ≥ 65 years old, men and women ≥ 65 years old with a prior fracture, or patients who had used oral glucocorticoids for ≥ 30 days), brief educational interventions did not work to improve rates of BMD testing or medication initiation [52•]. However, a similar study by the same authors in a younger population (age ≥ 45 years with prior fracture or glucocorticoid use) showed a 4% absolute increase in BMD testing or filling a prescription for osteoporosis treatment, yet only 14% of patients were tested or treated compared with 10% of the control group [53•].

In a randomized trial of physicians participating in a large health maintenance organization, a Web-based intervention incorporating performance audit and feedback and case-based continuing medical education had no significant impact on osteoporosis management quality for long-term glucocorticoid users [54•]. Employing similar methods, including academic detailing and efforts directed at the medical and nursing staff at nursing homes, researchers observed a small and nonsignificant improvement in prescribing osteoporosis therapies [55]. In a recent cluster randomized trial

involving 230 residential and nursing care homes (5637 residents) in England and Wales, specialist osteoporosis nurses trained home nursing staff regarding the importance of fractures, recognition of high-risk residents, and fall prevention using fracture risk assessment tools. The specialist nurses then calculated the fracture and fall risks and reported the high-risk individuals and falls to general practitioners with treatment recommendations. The intervention significantly increased the prescription of bisphosphonates and calcium/vitamin D, but it did not affect the rate of falls or fractures or the use of hip protectors [56]. Other methods that can effectively change physician practice patterns and impact fracture rates are greatly needed.

Heath system and hospital level

Overall, approaches to health system improvements seem more effective than provider-directed interventions. One example of success was seen in a closed health system that implemented an osteoporosis disease management program, providing clinical practice guidelines, physician and allied health care provider education, community education, and a bone density testing program [57]. Over the course of 5 years, the program led to a decrease in the age-adjusted incidence of hip fractures among the clinic's patients and an overall reduction in health care costs of $7.8 million, compared with the estimated costs if no intervention had been undertaken [57].

Compared with primary prevention of fractures, secondary prevention may be somewhat easier. In an osteoporosis care service provided by a nurse and physician in a health system using a guideline-based care algorithm, telephone follow-up, and task management software, 61% of 1019 patients with prior orthopedic fragility fractures underwent osteoporosis evaluation and treatment [58••]. In another model, specialized fracture clinics improved BMD assessment twofold, but the results on receipt of osteoporosis treatment were mixed [59–61]. Standard hospital orders such as automatic osteoporosis or other liaison consults for patients hospitalized for a fracture have been beneficial. One study showed a significant increase in the percentage of patients treated for osteoporosis following an automatic rheumatology consult compared with those without a consultation (97.6% vs 2.4%, $P < 0.0001$) [62,63]. Similarly, a case manager intervention during hospitalization for hip fracture led to a significantly higher frequency of appropriate care versus a control group at a moderate cost [58••,64]. Therefore, integrating services across specialty lines and involving allied health professionals (eg, nurse coordinators or case managers) may be critical to the success of osteoporosis care programs. In developing a new clinical process, poorly organized health systems, limited resources, and provider resistance to change are common [65]. For a process to become effective and standard care in the health system, it takes the Plan-Do-Study-Act cycle of innovation, implementation, outcome evaluation, and improvement [66,67], which requires years of work and perseverance.

Patient level

Empowering patients to seek out their physicians and initiate testing or treatment is another strategy that has been minimally effective in improving osteoporosis quality of care [53•,60,68,69]. Following an osteoporotic fracture, letters including an offer for a free BMD test were associated with a significantly higher testing rate than a personalized letter alone (OR 8.5, 95% CI, 3.1–24.5), but this intervention did not affect osteoporosis treatment rates [60]. Another study showed that a patient education and physician alert system for persons with a recent wrist fracture resulted in 3.8 times more BMD testing compared to no intervention, but treatment rates were not assessed [68]. Nonetheless, shared decision making is an essential component of high-quality care. New tailored patient activation strategies and better public education are necessary to increase awareness that a fragility fracture begets more fractures and that osteoporosis can be prevented [70,71].

Conclusions

Osteoporosis quality care deficits exist at many levels, and opportunities for improvement are abundant. However, no single solution has been proven to better the quality of care in osteoporosis in all populations. Early identification of patients at risk of fracture followed by effective therapeutic intervention with long-term adherence can substantially improve patient outcomes. BMD testing and comprehensive risk assessment are crucial for deciding when to initiate osteoporosis management. System-wide interventions have the most promise to overcome barriers to quality care. However, a significant effort must be made to educate patients and those physicians most likely to encounter high-risk patients or patients presenting with new fragility fractures (eg, orthopedists, emergency doctors, primary care physicians, gynecologists, and medical subspecialists). A movement toward redesigning clinical processes by incorporating allied health professionals and evidence-based algorithms or pathways describing appropriate management into osteoporosis health care delivery is compelling. Future research should refine and test interventions that maximize the effectiveness of individual dependable components in the care path.

Disclosures

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The other authors have reported no potential conflicts of interest relevant to this article.

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