6-19-2019

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Recommended Citation

Dhital, R., Lynn, T., Tachamo, N., & Poudel, D. (2019). The trend of osteoporosis and osteoporotic fragility fractures in inpatients: results from a national database.. *J Community Hosp Intern Med Perspect, 9* (3), 211-214. https://doi.org/10.1080/20009666.2019.1618660

JOURNAL OF COMMUNITY HOSPITAL INTERNAL MEDICINE PERSPECTIVES
2019, VOL. 9, NO. 3, 211–214
https://doi.org/10.1080/20009666.2019.1618660

The trend of osteoporosis and osteoporotic fragility fractures in inpatients: results from a national database

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ABSTRACT

Osteoporosis is associated with an increased risk of pathologic fractures; however, most patients do not receive diagnosis and adequate treatment. The aim of our study was to compare the yearly trends of osteoporosis and osteoporotic fragility fractures in the USA (US) inpatients.

We used National (Nationwide) Inpatient Sample database to identify adults ≥18 years with diagnoses of osteoporosis and pathologic fractures and excluded pathologic fractures due to other etiologies. We then studied the annual trends, in terms of annual percentage change (APC), of osteoporosis and osteoporotic fractures.

Among overall hospitalizations, osteoporosis was noted to have an increasing trend from 2000 to 2009 (APC = 5.81, p < 0.05) with a decline thereafter (APC = – 3.88, $p < 0.05$). In contrast, osteoporotic fracture showed an initial downward trend from 2000 to 2010 (APC = –7.31, $p < 0.05$), followed by a slowly rising trend (APC = 2.0, p = NS).

The initially increasing trend of osteoporosis was followed by a decreasing trend thereafter. In contrast, there was a halt in a previously declining trend of osteoporotic fracture. Potential explanations include inadequate screening and treatment per guidelines along with decreasing patient compliance. In conclusion, primary and secondary prevention measures for osteoporosis have been underutilized by both physicians and patients alike.

ARTICLE HISTORY
Received 9 April 2019
Accepted 9 May 2019

KEYWORDS
Osteoporosis; osteoporotic fractures; fragility fractures; association

1. Background

Osteoporosis is a systemic bone disease characterized by low bone mass and skeletal fragility. Osteoporosis patients are at a risk of subsequent pathologic fractures leading to morbidity, mortality, and poor life quality. Osteoporosis prevalence continues to increase among older Americans and is a major cause of disability. Despite all the available treatment options, most patients do not receive early diagnosis and adequate treatment [1, 2]. The aim of our study was to assess the prevalence of osteoporosis and osteoporotic fragility fractures among inpatients.

2. Methods

We used National (Nationwide) Inpatient Sample (NIS) database for years 2000–2014 to select adult hospitalizations (≥18 years of age). Information on *T*-scores was not available in the database, and the diagnoses of osteoporosis and pathologic fractures were based on ICD-9 codes 733.0x and 733.1x, respectively. We excluded pathologic fractures associated with diagnoses other than osteoporosis, including osteomyelitis (acute, chronic, and unspecified), periostitis, poliomyelitis, other bone infections, all neoplasms, osteitis deformans, renal osteodystrophy, rickets, and osteomalacia, all of which were also identified based on ICD-9 codes used for billing purposes.

We studied the trend of osteoporosis and osteoporotic fractures in inpatients. Differences in annual trends were analyzed in terms of annual percentage change (APC), calculated using the Joinpoint regression analysis statistical software. APC is a way to characterize disease trends over a specified time interval in which the disease rates are assumed to change at a constant percentage of the rate of the previous year. The Joinpoint software takes trend data, and based on the maximum number of joinpoints supplied by the user, fits the data into segments, enabling the users to assess if the apparent change in trend is statistically significant [3].

3. Results

A sample of 2,975,120 (weighted national estimate, N = 14,245,268) osteoporosis and 175,383 (weighted, N = 838,977) osteoporotic fragility fractures were identified from the years 2000–2014. Among overall hospitalizations, osteoporosis was noted to have an increasing trend from 2000 to 2009 (APC = 5.81,

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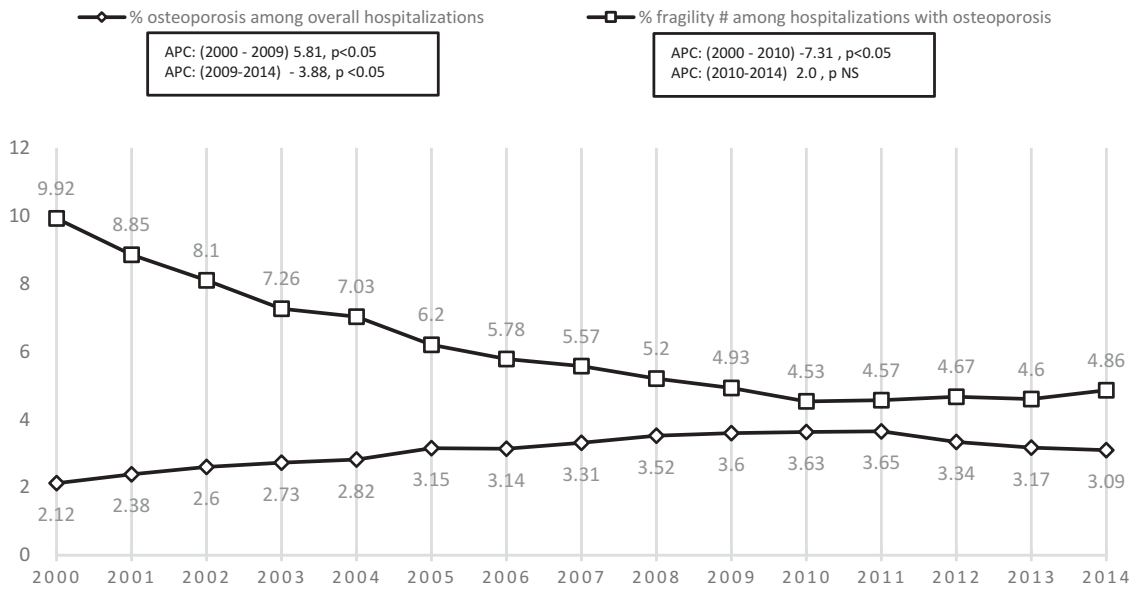

Figure 1. Trends of Osteoporosis and Fragility Fracture Hospitalizations (2000-2014)

$p < 0.05$) with a decline thereafter (APC = – 3.88, $p < 0.05$) (Figure 1). In contrast, osteoporotic fragility fractures among overall hospitalizations showed an initial downward trend from 2000 to 2010 (APC = −7.31, $p < 0.05$), followed by a nonsignificant but a slowly rising trend thereafter (APC = 2.0, p = NS) (Figure 1).

4. Discussion and conclusion

In our study of hospitalized patients, the initially increasing trend of osteoporosis prevalence was followed by a decreasing trend thereafter. On the other hand, there was a halt in previously declining osteoporotic fragility fractures. It is important to note that, in the latter half of the study period, while osteoporosis prevalence was noted to be decreasing, the prevalence of fragility fractures was increasing inversely. Whether the noted decrease in osteoporosis represents a true decline due to better prevention, or simply a decline in screening and subsequent detection, is not certain. However, if the decreased osteoporosis prevalence was a result of better preventative measures, one would expect the number of osteoporotic fragility fractures to decrease as well. Another study by Lewiecki et al. to assess the hip fracture rates using Medicare claims data from 2002 to 2015 also noted that hip fracture rates declined from 2002 to 2012 and then plateaued at higher than projected levels from 2013 onward, with resultant increase in over 11,000 hip fractures [4].

A study by King et al. noted plateauing of dual-energy x-ray absorptiometry (DEXA) testing in 2007–2009 and suggested that the noted trend could partly be attributed to lowering of Medicare reimbursement for DEXA scans starting in 2007, resulting in fewer patients being screened and treated for osteoporosis [5]. A similar phenomenon might explain our study results, with the noted decrease in osteoporosis actually being related to decreased detection rates rather than a true decrease in prevalence, subsequently leading to increasing fracture trend.

Another explanation for noted results could be that the physicians are not adequately screening and treating for osteoporosis per guidelines. Current standard screening recommendations for osteoporosis, per the USA Preventive Services Task Force (USPSTF), include all women >65 and younger women with risk factors, using bone density screening [6]. The National Osteoporosis Foundation (NOF) makes the above recommendations as well, but also includes the recommendation for screening men over 70 years, men 50–69 years with risk factors, and all patients with fragility fractures above 50 years [7]. Although we have these clear guidelines for screening for osteoporosis with DEXA, only about 26.3% and 16.4% women aged 65–79 years and 80+ years, respectively, were found to receive their screening DEXA prior to their first hip fracture [8]. Even lesser percentage of patients (~23%) had recommended screening for secondary prevention following a fragility fracture, even when over 80% of them had an office visit within 12 months postfracture [8–11]. Additionally, most women who have fractures do not receive treatment for osteoporosis [8,12,13]. A study by Freedman et al. showed that only about 24% of postmenopausal women who sustained a distal radial fracture underwent either diagnosis or a treatment of osteoporosis. Also, only a 3% increase in antiosteoporotic medication prescribing in the periods before and after fracture was noted, suggesting that physicians may have overlooked fractures as sentinel events for osteoporosis detection [12,14].

The other major hindrance to treatment is patient compliance, with a majority of patients breaking from therapy, with only a quarter of patients achieving

an year without breaking osteoporosis therapy [15–17]. A study noted that the treatment rates for osteoporosis decreased steadily and significantly over time: from 23.8% (2001–2002) to 15.9% (2007–2009) for women and from 10.6% (2001–2002) to 8.5% (2007–2009) for men [10]. Zoledronic acid, oral bisphosphonates, denosumab, teriparatide, and raloxifene have all been shown to significantly lower fracture rates [18]. However, there was a significant decline in the number of prescriptions written for oral bisphosphonates beginning in 2007–2008 and IV bisphosphonates from 2010, coinciding with a spike in internet search for alendronates between 2006 and 2007 following media reports of safety concerns [19,20]. However, it could as well have been from the availability of alternate treatment options. While some studies suggest that the rise in fragility fracture trend could be related to decreased use of hormone replacement therapy after the Women's Health Initiative trial was published [21], the noted increase of fractures among men makes this a less likely explanation [22].

Hence, it would not be unreasonable to state that the primary and secondary prevention measures for osteoporosis have been underutilized by both physicians and patients, although several possibilities exist for prevention. More so, bone fragility is thought of only after the onset of fragility fractures, and even then, the management is often suboptimal. Awareness of this will help increase physician prescribing practices and patient compliance.

5. Strengths and limitations

The major strength of our study is a large sample size provided by the national database. However, a major limitation is that the database used only provides data for inpatients. The actual rate of osteoporosis is likely higher than that found in this study as it does not account for the outpatient setting. Also, the data we observed were only until 2014. The newer medications such as teriparatide and denosumab were not approved for osteoporosis by the FDA until 2009/2010 and perhaps the effect of the newer agents is yet to be seen. Further studies need to be done in order to determine the cause of the slowly rising trend of osteoporotic fragility fractures to best determine appropriate methods for prevention.

Disclosure statement

No potential conflict of interest was reported by the authors.

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