Cost effectiveness analysis of osteoporosis treatment using FRAX index at the Hospital San Juan de Dios of Costa Rica

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Abstract

Objectives: to determine the cost effectiveness of osteoporosis treatment at the Hospital San Juan de Dios in Costa Rica

Materials and methods: this is a prospective case series study where 105 randomly selected osteoporotic patients were evaluated. These patients were selected from the outpatient clinic of the Endocrinology Department during April and May 2008 at the Hospital San Juan de Dios in San José, Costa Rica. Cost-effectiveness was assessed using the WHO FRAX index.

Results: 96.2% women, average age is 61.5 years. 11.4% of patients had a 10 year probability of major osteoporotic fracture (PMF) over 20% and 17% had a 10 year probability of hip fracture (PHF) over 3%. Age was the main predictor of fracture probability; patients below 70 years had a very low probability of having a PMF over 20% and PHF over 3%. Combining age and BMI may improve the sensibility and specificity of reaching the PMF or the PHF threshold. A cutoff point of 70 years and a BMI below 25 kg/m² will have a sensibility of 58.3% and specificity of 94.6% for a PMF over 20% and a sensibility of 75% and specificity of 90.3% for PHF over 3%.

Conclusions: Treatment in most of the patients is not cost-effective assessed by FRAX tool. T scores in BMD are not a good parameter by itself to predict a 10 year probability of major osteoporotic fracture neither 10 year probability of hip fracture. In patients older than 69 years with low or normal weight, treatment is cost-effective independently of other fracture risk factors.

Background

Osteoporosis is the most common metabolic bone disease. Its treatment either with antiresorptives or anabolic agents have shown a reduction in the fracture rate. However, it has long been recognized that there are other factor that influence the risk of fractures in each patient, such as age, body mass index, previous fractures, and family history of fractures.

At this moment, international guidelines recommend treatment for those patients with postmenopausal osteoporosis regardless of age.

If we follow these guidelines, there would be a group of patients, specially young patients, where their fracture risk is not so high so their absolute risk reduction would be low. For these patients, the treatment may confer benefits on the long term but absolute risk reduction would be low, so treatment may not be cost-effective.

The World Health Organization developed the FRAX index. This index addresses these issues, and calculates the absolute fracture risk for the patient. The variables that are used in the FRAX index are age, gender, weight, height, previous fracture, parent hip fracture, current smoking, current use of glucocorticoids, rheumatoid arthritis, secondary osteoporosis, alcohol consumption, femoral neck BMD. WHO states that treatment is cost-effective if the absolute 10 year probability of major osteoporotic fracture (PMF) is over 20% and probability of hip fracture (PHF) is over 3%.

Updated National Osteoporosis Foundation guidelines endorses these WHO recommendations for pharmacologic treatment. Their current indications for osteoporosis treatment are:
- a hip or vertebral fracture
- T score ≤ -2.5 at femoral neck or spine
- low bone mass (T score between -1.0 and -2.5 at the femoral neck or spine) and a 10 year probability of hip fracture > 3% or a 10 year probability of a major osteoporosis related fracture ≥20%

95% of Costa Ricans are covered by our social security system. Therefore most of the patients are treated in public hospitals, where resources are limited. FRAX index may be useful to help choose which patients will benefit most of osteoporosis treatment.

Objectives

To determine the cost effectiveness of osteoporosis treatment in a group of patients treated at the Hospital San Juan de Dios

Materials and methods

This is prospective case series study where 105 randomly selected patients that attended the outpatient clinic for osteoporosis treatment at the Endocrinology Department of the San Juan de Dios Hospital were assessed. Every patient was receiving osteoporosis treatment, most of them with biphosphonates plus calcium and vitamin D. All variables that are used in the FRAX index were collected and this index was calculated using the original pre-treatment DEXA scan. We used the FRAX calculation tool for US Hispanics.

Statistical analysis was performed using SPSS 15.0

Results

105 patients were included in the study during April and May 2008. 96.2% are women. Average age is 61.5 ±8.54 years. Average T score at the lumbar spine was -2.97 ± 1.01, total hip -1.70 ± 0.95 and femoral neck -2.14 ± 0.83.

11.4 of patients had a PMF over 20% and 17% had a PHF over 3%.

Table 1. Percentage of patients with probability of major osteoporotic fracture over 20%

	Osteopenia	Osteo-porosis	P
Femoral neck	2.9% (2/68)	30.3% (10/33)	<0.001
Total hip	4.8% (4/84)	42.1% (8/19)	<0.001
Vertebral	10.3% (3/29)	12% (9/75)	.911
Any site	8.7% (2/23)	12.5% (10/80)	.772

Table 2. Percentage of patients with probability of hip fracture greater than 3%

	Osteopenia	Osteo-porosis	P
Femoral neck	0% (0/68)	51.5% (17/33)	<0.001
Total hip	7.1% (6/84)	63.2% (12/19)	<0.001
Vertebral	6.9% (2/29)	20% (15/75)	0.25
Any site	0% (0/23)	22.5% (18/80)	.034

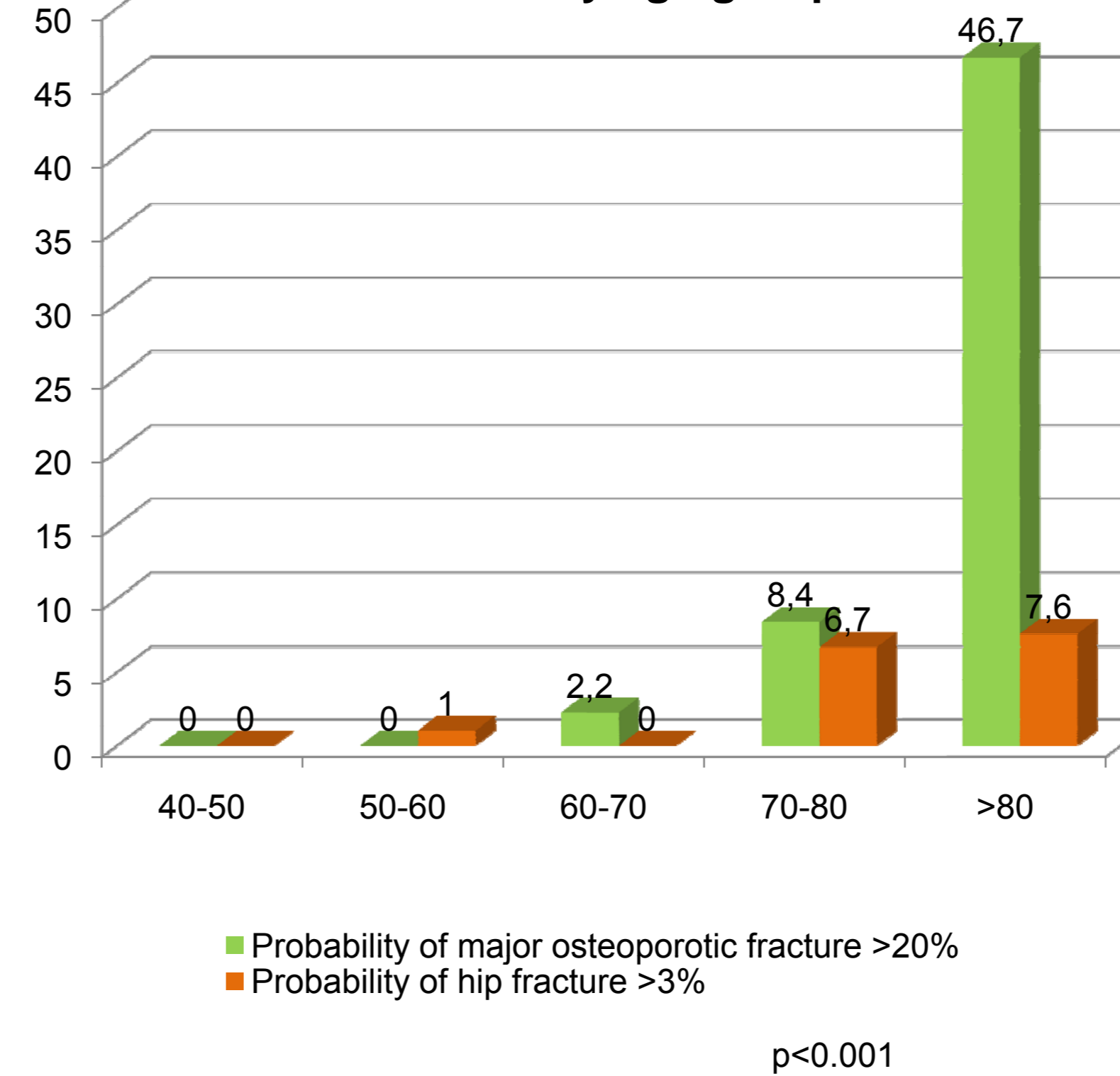Graph 1. Percentage of patients with PMF >20% and PHF >3% by age group

Probability of major osteoporotic fracture >20%
Probability of hip fracture >3%

p<0.001

Table 3. Percentage of patients with a PMF over 20% distributed by age and BMI

BMI	<18.5	18.5-24.9	>25	Total
<50 years	0 (0/1)	0 (0/4)	0 (0/1)	0 (0/6)
50-60 years	0 (0/1)	0 (0/14)	3.3 (1/30)	2.2 (1/45)
60-70 years	0 (0/1)	22.2 (2/9)	3.8 (1/26)	8.3 (3/36)
70-80 years	0 (0/1)	75 (6/8)	16.7 (1/6)	46.7 (7/15)
>90 years	---	50 (1/2)	---	50 (1/2)
Total	0 (0/4)	24.3 (9/37)*	4.68 (3/64)	11.4 (12/105)

Table 4. Percentage of patients with a PHF over 3% distributed by age and BMI

BMI	<18.5	18.5-24.9	>25	Total
<50 years	100 (1/1)*	0 (0/4)	0 (0/1)	16.6 (1/6)
50-60 years	0 (0/1)	0 (0/14)	0 (0/30)	0 (1/45)
60-70 years	100 (1/1)	55.6 (5/9)	3.8 (1/26)*	19.4 (7/36)
70-80 years	0 (0/1)	75 (6/8)	33.3 (2/6)	53.3 (8/15)
>90 years	---	100 (2/2)	---	100 (2/2)
Total	50 (2/4)	35.1 (13/37)*	4.68 (3/64)	17.1 (18/105)

Table 5. Sensibility and specificity for PMF >20% and PHF >3% using a cutoff point of age over 70 years and BMI <25 kg/m2

	Sensibility	Speciificity
PMF >20%	58.3%	94.6%
PHF >3%	75%	90.3%

Discussion

BMD alone is a poor predictor of fracture risk. This study shows that in most of osteoporotic patients, treatment is not cost effective. Overall, only 17% of patients have a FRAX score high enough that would render the treatment-cost effective.

FRAX has shown to be a good predictor of cost effectiveness of osteoporosis treatment in the United States (Tosteson et al 2008). However, medication and fracture treatment costs are very different in Latin America so we do not know if this model may apply. On the other hand, there are multiple versions (not necessarily generic) of the different pharmacologic treatments available, with unknown bioequivalence and unknown clinical effectiveness. In Costa Rica, where most patients are treated on the Social Security, our only drug available is a generic version of alendronate of unknown effectiveness. These different factor may limit the applicability of the FRAX model in our countries. Borgström et al have also shown that intervention thresholds that render osteoporosis treatment cost depends on the economic reality of each country, and this analysis have not been performed in Costa Rica yet.

Our analysis shows that age is the main risk predictor. No other assessed variable had enough significance to predict fracture risk. Most of the patients below 70 years of age will not have a significant fracture risk if assessed by FRAX. On the other hand, patients with age older than 80 years, 46% had a PMF >20%. If age and BMI are combined, a cutoff point of 70 years and BMI lower than 25 kg/m2 will have a high sensibility and specificity. These two factors have also shown to predict BMD.

Hans et al. have found also that a model that includes stiffness index on heel ultrasound plus six clinical risk factors such as BMI, history and fracture, current smoking, fall in he past year, failed chair test and diabetes mellitus, predicts fracture risk. In this model, age increased the risk slightly although not as significant as these other risk factors. This study was performed in two cohorts of French and Swiss women, so results may not be extrapolated to Latin American women where we may have different fracture risk.

On the other hand, other models have found the same risk factors for hip fractures, such as age, self reported health, weight, height, race, self reported physical activity, history of fracture after age 54 years, parental hp fracture, smoking, current corticosteroid use and treated diabetes (Robbins J 2007).

Osteoporosis treatment threshold should not rely solely on BMD. Other risk factors must be taken into account so resources are oriented to those patients with a higher fracture risk.

Conclusions

Treatment in most of the patients is not cost-effective assessed by FRAX tool. T scores in BMD are not a good parameter by itself to predict a 10 year probability of major osteoporotic fracture neither 10 year probability of hip fracture. In patients older than 69 years with low or normal weight, treatment is cost-effective independently of other fracture risk factors.

References

1. Tosteson AN et al. Cost –effective osteoporosis treatment thresholds; the United States perspective. Osteoporosis Int. 2008;19(4):437-447.
2. Borgström et al. At what hip fracture risk is it cost-effective to treat? International intervention thresholds for the treatment of osteoporosis. Osteoporosis Int. 2006;17(10);1459-1471.
3. Hans D. et al. Assessment of the 10 year probability of osteoporotic hip fracture combining clinical risk factors and heel bone ultrasound: the EPISEM prospective cohort of 12958 elderly women. J Bone and Miner Res. 2008;23:1045-1051.
4. Robbins J. Factors associated with 5 years risk of hip fracture of postmenopausal women. JAMA: 2007;298/(20):2389-2398.