Available online at www.sciencedirect.com

SciVerse ScienceDirect

journal homepage: www.elsevier.com/locate/jval

Evidence to Inform Decision Makers in Thailand: A Cost-Effectiveness Analysis of Screening and Treatment Strategies for Postmenopausal Osteoporosis

Pritaporn Kingkaew, BPharm, MSc[1,], Usawadee Maleewong, BPharm, PhD[1,2], Chardpraorn Ngarmukos, MD[3], Yot Teerawattananon, MD, PhD[1]*

[1]*Health Intervention and Technology Assessment Program, Nonthaburi, Thailand;* [2]*Faculty of Pharmacy, Mahasarakham University, Mahasarakham, Thailand;* [3]*Faculty of Medicine, Ramathibodi Hospital, Bangkok, Thailand*

A B S T R A C T

Objectives: To assess value for money of providing systematic screening for osteoporosis among postmenopausal women and medical treatments for those diagnosed with osteoporosis as evidence-based decision making for the revision of the National List of Essential Medicines. **Methods:** Decision analytic models were constructed, using a societal perspective, to assess the cost per quality-adjusted life-years (QALYs) gained from systematic screening using the Osteoporosis Self-Assessment Tool and dual-energy X-ray absorptiometry or dual-energy X-ray absorptiometry alone compared with no screening. Alendronate, risedronate, raloxifene, and nasal calcitonin were economically evaluated to determine a treatment of choice for the prevention of osteoporosis-related fractures. Most input parameters were obtained from literature reviews, and systematic reviews and meta-analyses, if available. The service costs and related household expenses were based on the Thai setting. Probabilistic and one-way sensitivity analyses were used to incorporate the impact of parameter uncertainty. **Results:** The Osteoporosis Self-Assessment Tool and sequential dual-energy X-ray absorptiometry provided better value for money for osteoporosis screening among young age groups (<60 years old). Although there was no significant difference in cost per QALY for older age groups, alendronate provided the lowest incremental cost-effectiveness ratio while nasal calcitonin presented the highest incremental cost-effectiveness ratio. It was shown that providing medication for a secondary prevention yielded a much higher cost per QALY gained compared with providing medication for a primary prevention. **Conclusions:** Given the benchmark set at 100,000 Thai baht per QALY gained, providing systematic screening and treatment for osteoporosis was cost-ineffective in the Thai setting.

Keywords: cost-utility analysis, decision analysis model, postmenopausal osteoporosis, screening, treatment.

Background

Osteoporosis is one of the most significant factors contributing to fractures in postmenopausal women worldwide. It is caused by an imbalance between bone formation and bone resorption, often defined by a reduction in bone mineral density (BMD). BMD reaches its maximum at the age of 20 to 30 years, and then declines over time [1,2]. It has been estimated that one-fifth of women aged between 40 and 80 years in Thailand live with osteoporosis, resulting in approximately 126,000 hip fractures annually [3,4]. The mortality rate among those with major fractures is high. This, in turn, leads to a significant economic burden on society as well as a reduction in quality of life for those individuals who survive [1,5–7].

At present, dual-energy X-ray absorptiometry (DXA) is a gold standard for measuring BMD and is used for the diagnosis and monitoring of osteoporosis [8]. DXA, however, is relatively expensive, and there is also a lack of information concerning whom to examine, the potential risks and benefits of undertaking the test, and ultimately, whether it is worth offering this service under the public health insurance scheme. As a result, DXA has rarely been used by Thai women. The Osteoporosis Self-Assessment Tool (OST), a risk assessment instrument, was first developed and validated in Asian postmenopausal women [9]. It is a simple tool that requires only age and weight parameters; however, it is not appropriate to be used as a stand-alone method for the diagnosis of osteoporosis because it has a high sensitivity but low specificity. A previous study conducted in Thailand showed that screening with OST and sequential DXA for those identified at high risk for osteoporosis from OST is the most cost-effective option compared with other screening modalities [10]. Therefore, OST in conjunction with DXA is considered to have the potential to be used for osteoporosis screening at the national level.

Various medications are currently available in the market to reduce the risk of fractures among osteoporosis patients. In Thailand, alendronate has been reported to be the most prescribed drug (39%), followed by raloxifene (26%), nasal calci-

Conflicts of interest: The authors have indicated that they have no conflicts of interest with regard to the content of this article.

* *Address correspondence to:* Pritaporn Kingkaew, Health Intervention and Technology Assessment Program, Department of Health, Ministry of Public Health, 6th floor, 6th Building, Tiwanon Road, Nonthaburi 11000, Thailand.

E-mail: pritaporn.k@hitap.net.

1098-3015/$36.00 – see front matter Copyright © 2012, International Society for Pharmacoeconomics and Outcomes Research (ISPOR). Published by Elsevier Inc.

doi:10.1016/j.jval.2011.11.015

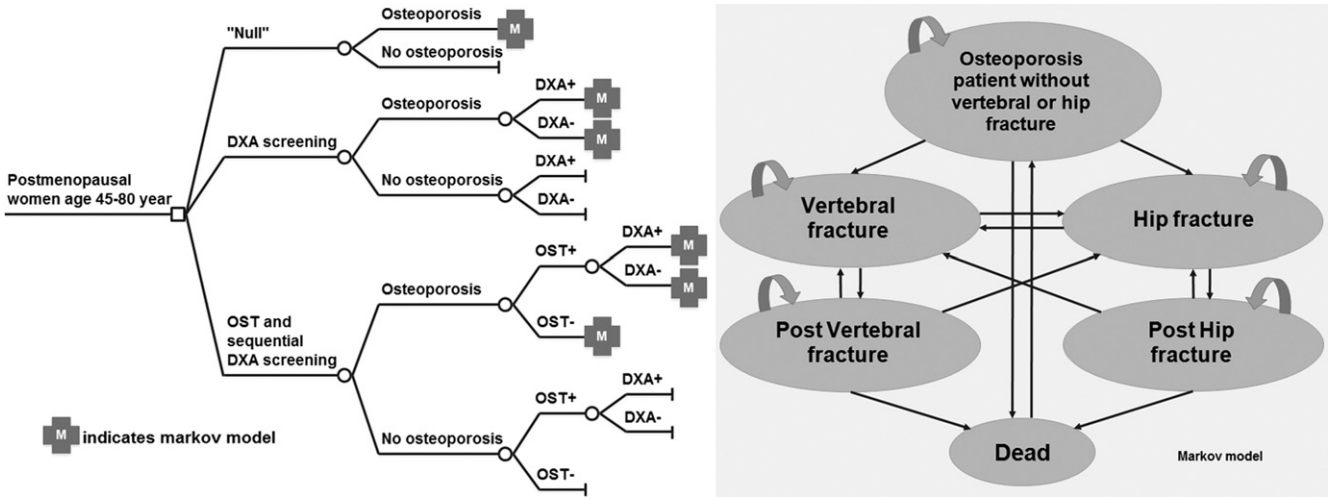

Fig. 1 – Decision tree illustrating two systematic screening compare to 'Null' scenario, followed by Markov model representing a disease partway once postmenopausal women are diagnosed with osteoporosis.

tonin (13%), and risedronate (2%) [11]. At present, there have been no economic evaluation studies conducted in developing settings. These drugs are not included in the National List of Essential Medicines (NLEM) in Thailand; thus, a majority of Thai patients need to pay for the cost of their prescription themselves. This has resulted in only a minority of osteoporosis patients currently receiving treatment.

This present study was conducted as a result of a request from the Subcommittee for Development of the NLEM to provide information on the long-term effectiveness and cost-effectiveness of the screening of osteoporosis and its medical management. This information was then used to inform the Subcommittee regarding the selection of osteoporosis drugs for public reimbursement nationwide [12]. It is expected that the findings from this study will be useful to decision makers in other developing countries, where health resources and infrastructure are constraints and the screening and treatment of osteoporosis are underutilized.

Methods

Analyses and model

The hybrid model consisting of a decision tree and a Markov model (Fig. 1) was constructed to compare the short- and long-term costs and outcomes of systematic screening for osteoporosis among postmenopausal women and offering medical management to those diagnosed with osteoporosis. Quality-adjusted life-years (QALYs) were used as an outcome measure in the analysis because they contain both longevity and quality of life, allowing comparisons across different diseases and treatment modalities. The study was conducted in regard to the Thai context by using the societal viewpoint, with a hypothetical cohort of postmenopausal women aged between 45 and 80 years. The lifetime time horizon was used as the base case, with both costs and outcomes discounted at 3%, as recommended by the guideline of economic evaluation in Thailand [13]. All analyses were performed in Microsoft Excel® 2003 (Microsoft).

To identify the number of people who are diagnosed with osteoporosis, a decision tree was then developed by comparing the costs and consequences of three screening strategies, namely, 1) "null" scenario, 2) a systematic screening using DXA, and 3) a systematic screening using OST and sequential DXA. For the null scenario, no screening and no treatment was offered besides calcium and vitamin D supplements. Only those who were confirmed with DXA to have low BMD received medical management. The Markov model was, then, used to compare the long-term cost and outcome of treating osteoporosis based on the nature of the disease's progression (presented as "M" signs at the end of the decision tree). All hypothetic cohorts of those who had been diagnosed with osteoporosis received either calcium and vitamin D supplements, null, or four choices of treatment: alendronate, risedronate, raloxifine, or nasal calcitonin for both the primary prevention—prevention of fragility fractures in women with osteoporosis—and the secondary prevention—prevention of new fractures in women with osteoporosis and a previous history of fragility fractures. All the four drugs are widely available and commonly used under the Thai health-care setting for averting osteoporosis-related fractures [11]. The comparators were also approved as appropriate alternatives for the treatment of osteoporosis in Thailand by Thai experts (a senior orthopedist, endocrinologists, and a gynecologist) (see details in the "Acknowledgment" section). Consequences only from hip and vertebral fractures were considered in the Markov model because a number of studies had indicated a nonsignificant difference in mortality and morbidity among patients with wrist fractures and among the general population [5–7]. This model was then validated by the same group of experts. The model worksheet is freely available online at www.hitap.net/projects_detail_en.php?p_id=90.

Model inputs

Key parameters used in the decision models are summarized in Table 1. Because the aim of this analysis was to inform decision makers in Thailand, we identified the parameters from sources that were most relevant to the Thai context [3,11,16,19], and if not applicable, international publications [7,14,15,17,18,20] were retrieved. The effectiveness, in terms of relative risk reduction of vertebral and hip fractures, of each drug was derived from literature searches and meta-analysis by using a Bayesian mixed treatment comparison. The justification of each parameter and details of systematic review and meta-analysis are available in the Supplemental Materials found at doi:10.1016/j.jval.2011.11.015. For intercountry comparisons, costs can be converted into US dollars by using the purchase power parity exchange rate of US$1 = 12.615 THB (Thai baht) [21]. All costs were adjusted to 2007 values by using the general consumer price index [22].