

Cost-effectiveness analysis of annual dose of Zoledronic acid versus orally administered bisphosphonates in prevention of osteoporotic fractures in Czech post-menopausal women

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ABSTRACT

Objectives » Markov model was constructed and first-order microsimulation was run in order to compare long term health-economic impact of treatments with Zoledronic acid (ZA) and oral bisphosphonates (OB) in Czech patients. The model considered real-life effectiveness of both treatments associated with medication compliance.

Results » Systematically improved effectiveness for ZA was reported as QALY gained throughout the life expectancy. The ICER for ZA reached € 25,856 per QALY gained in 50 years old. The major decrease of the ICER value was reported in patients between 60 and 65 years at the onset of the therapy. From 76 years on, the ZA strategy turns cost-saving.

Conclusion » From the age 65 on, patients should be preferentially treated (1st line treatment) with Zoledronic acid rather than oral bisphosphonates.

INTRODUCTION

Background » Annual dose of Zoledronic acid significantly decreased risk of fractures (Black 2007, Lyles 2007) as compared to placebo. This makes Zoledronic acid an alternative to oral bisphosphonates with more convenient dosing regimen and full compliance over one year after administration.

Objective » Herein we evaluated cost-effectiveness of the Zoledronic acid as an alternative to generic alendronate in the life-time model of osteoporotic patients within Czech health care setup.

| Description | Price | Source |
|---|----------|---|
| Annual reimbursement for oral alendronate | € 261 | Seznam SUKL (Price list of the State Institute for Drug Control of the Czech Republic) valid from Sep.1th, 2008 |
| Annual reimbursement for Zoledronic acid | € 397 | Claimed reimbursement level from public health insurance |
| Cost of hip fracture | € 4,872 | Kudrna K, Kraska Z. Rozbor nakladu na lecbu zlomenin horniho konce stehenni kosti. Rozhl. Chir. 2005; 84 (12): 631-634 |
| Cost of vertebral fracture | € 1,110 | Expert opinion: 20% of Hip fracture costs |
| Annual reimbursement of nursing home | € 11,845 | Fiala P. Pacienti urceni k likvidaci. Analysis of nursing home costs published at www.acm.cz, web portal of the Association of Czech and Maravian Hospitals |

Table 1. Modeled costs for resources utilized

RESULTS

QALY gained » Compared to oral bisphosphonates the treatment with Zoledronic acid showed systematically improved effectiveness expressed as QALY gained throughout the life expectancy (Figure 1, Table 2). The QALY gained for patients aged 50 was 0.1, reaching maximum 0.16 for the 75 years old.

ICER » The incremental cost-effectiveness of the Zoledronic acid is for patients aged 50 and above ≤ € 25,856 per QALY gained and decreases sharply for patients between 60 and 65 years, resulting in distinctly improved incremental cost-effectiveness ratio below € 7,405 per QALY gained (Figure 2, Table 2).

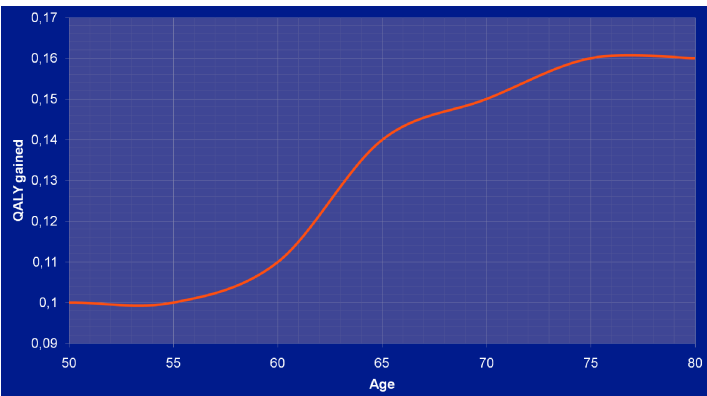


Figure 1. Development of incremental utility of Zoledronic acid versus oral bisphosphonates by the age of patient at the treatment onset.

| Age at onset | Strategy | Cost | Incr Cost | Eff | Incr Eff | C/E | Incr C/E (ICER) |
|--------------|----------|-------|-----------|-------|----------|-----|-----------------|
| 50 | OB | 5,690 | | 16.80 | | 339 | |
| | ZA | 8,276 | 2,586 | 16.90 | 0.10 | 490 | 25,856 |
| 55 | OB | 5,374 | | 14.95 | | 359 | |
| | ZA | 7,562 | 2,188 | 15.05 | 0.10 | 502 | 21,880 |
| 60 | OB | 5,029 | | 12.92 | | 389 | |
| | ZA | 6,732 | 1,703 | 13.03 | 0.11 | 517 | 15,479 |
| 65 | OB | 4,718 | | 10.78 | | 438 | |
| | ZA | 5,754 | 1,037 | 10.92 | 0.14 | 527 | 7,405 |
| 70 | OB | 4,323 | | 8.55 | | 506 | |
| | ZA | 4,856 | 532 | 8.70 | 0.15 | 558 | 3,549 |
| 75 | OB | 3,825 | | 6.40 | | 598 | |
| | ZA | 3,910 | 84 | 6.56 | 0.16 | 596 | 526 |
| 76 | OB | 3,780 | | 6.01 | | 629 | |
| | ZA | 3,751 | -29 | 6.16 | 0.15 | 609 | -192 |
| 80 | OB | 3,433 | | 4.52 | | 760 | |
| | ZA | 3,023 | -410 | 4.68 | 0.16 | 646 | -2,559 |

Table 2. Development of cost-effectiveness and ICER

METHODS

Model type » Markov models (Figures 1 and 2) were constructed for both strategies and first-order microsimulation was run.

Stages » The model consist of these stages; Compliant, Non-compliant, Nursing home and Dead. Rather than clinical efficacy, the model considered real-life effectiveness of both treatments associated with medication compliance (Siris, et al, 2006). Compliance was defined by Medical Possession Ratio (MPR). The MPR was calculated as the sum of days' supply divided by the follow-up time. Patients use to be classified as refill compliant if their MPR was 0.8 or higher. The stage non-compliant was not included in the Zoledronic acid model as the treatment is administered only once per year. For the ZA model the effect of the decreasing year-to-year persistence was driven from included with the efficacy data from the intent-to-treat set of the clinical study HORIZON (Black, 2007).

Probabilities » Model is populated with probabilities of fractures (Siris, 2006; Black 2007) and probabilities of death and transition to nursing home after hip fracture (Stevenson 2005). The probabilities of staying compliant vs. non-compliant were taken from Seeman (2007). Compliance was assumed for the first year following a fracture.

Costs » Costs were obtained from public sources specific for the Czech Republic and from interviewed experts (Table 1.). Costs were discounted with annual rate 3%.

Utilities » Healthy stage and fractures were associated with utilities. In addition ,the stage in nursing home was assigned utility. All utilities were obtained from published sources. Utilities were discounted with yearly annual rate 3%.

Perspective » The payer's perspective was analyzed only, hence only direct cost were considered.

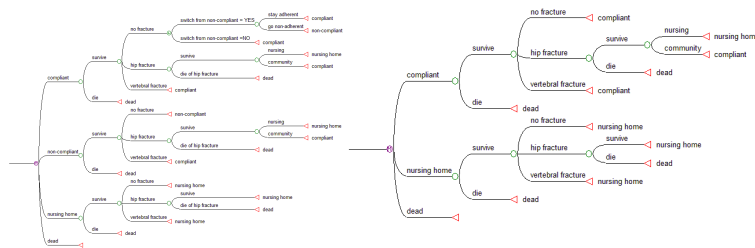


Figure 3. Model tree of oral bisphosphonates

Figure 4. Model tree of Zoledronic acid



Figure 2. Development of incremental cost effectiveness (ICER) in € per QALY by the age of patient at the treatment onset.

CONCLUSION

Zoledronic acid provides a cost-effective treatment for the prevention of fractures in postmenopausal women aged 50+ years compared to orally administered bisphosphonates. This incremental cost-effectiveness ratio (ICER < € 25,856 per gained QALY) decreases sharply with the patient age at treatment onset and turns cost-saving from the age 76+ years. From the age 65 on, patients should be preferentially treated with Zoledronic acid rather than oral bisphosphonates.