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COST-EFFECTIVENESS ANALYSIS OF ATORVASTATIN COMPARED TO SIMVASTATIN IN THE PREVENTION OF CARDIOVASCULAR DISEASES IN THE CZECH REPUBLIC

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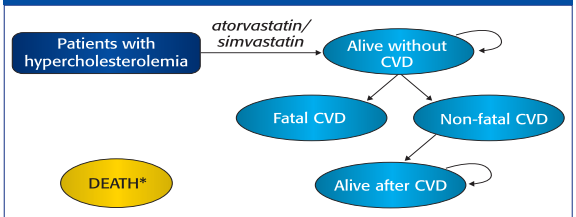
OBJECTIVE

To assess the impact of atorvastatin compared to simvastatin use in the Czech Republic on cardiovascular diseases (CVD), Life-Years Gained (LYG) and Quality-Adjusted Life Years (QALY), based on the real proportional consumption of both statins in particular strengths (10 mg, 20 mg, 40 mg) based on the life-time Markov cohort model. We also simulated the health impact in the situation of no statin therapy. The finding were also translated into population level based on the real number of patients treated with particular statin (i.e. atorvastatin or simvastatin) in prevention of CVD.

Figure 1. Structure of the Markov model



*Death – patients can die from each health state

Table 1. One-Year cost of particular item (non/fatal CVD are presented as one-off)

Cost item	Cost (€)
Ator 10	59.7
Ator 20	119.3
Ator 40	183.6
Simva 10	27.1
Simva 20	54.3
Simva 40	108.5
fatal CVD (one off)	1,410
non-fatal CVD (one off)	1,460
Follow-up non-fatal CVD	580

METHODS

Life-time (35 years) cost-effectiveness Markov cohort model was developed with 1 year cycle length and 5 health sates, i.e. Alive without CVD, Alive with experience of CVD, Non-fatal CVD, Fatal CVD and Death (see **Figure 1**).

Patients enter the model with the baseline characteristics/ risk factors that were derived from the cohort studies/registers [1, 2], i.e. mean age (63.7 years), percentage of male (65%), percentage of smokers (27%), percentage of diabetics (22%), base-line HDL cholesterol level (55 mg/dl), base-line total cholesterol level (252 mg/dl) and base-line systolic blood pressure (141 mmHg).

The probability of transition among health states were derived from Framingham equations [3] and from SCORE equations [4] for probability of the first non-fatal CVD and from SCORE equations for probability of the first fatal CVD. The background mortality was derived from the Czech life-tables. [5] Probability of subsequent CVD was derived from the international cohort studies [6].

The efficacy data for particular statin and its strength were derived from latest meta-analyses [7]. We calculated drug acquisition costs of atorvastatin 10 mg and 20 mg which were 10% higher compared to simvastatin 20 mg and 40 mg. We also calculated the costs of fatal, non-fatal CVD and one-year follow-up after CVD, the costs inputs are presented in **Table 1**. The proportional consumption of particular statin (atorvastatin – ATOR and simvastatin – SIMVA) and their strengths were derived from real consumption in the Czech Republic, i.e. ATOR 10 mg, 20 mg and 40 mg tablets in year 2012 and 2013 occurred in 33%, 58% and 9%, respectively of all ATOR consumption. Whereas SIMVA 10 mg, 20 mg and 40 mg tablets in year 2012 and 2013 occurred in 21%, 69% and 10%, respectively of all SIMVA consumption.

The utility (Quality of life) data were derived from the literature [8], i.e. patients alive without CVD (0.727), patients alive after previous CVD (0.671) and patients who experienced CVD at this/that year (0.616).

We used discount rate for cost and outcomes at 3% for each.

Probabilistic sensitivity analysis (PSA) using a willingness to pay (WTP) threshold equal to 1 GDP per capita in the Czech Republic (i.e.14,000 €) was applied.

Table 2. Results of the cost-effectiveness analysis in the life-time horizon

	Without statin therapy	Atorvastatin – proportion in CZE	Simvastatin – proportion in CZE	Difference (ATOR – SIMVA)
Costs (€), Total	2,377	3,025	2,557	468
Statin	0	1,142	581	262
Fatal CVD	415	338	353	–15
Non-fatal CVD	741	591	619	–29
Follow-up non-fatal CVD	1,221	954	1,004	–50
Occurence of non-fatal CVD (life-time)	68.47%	56.02%	58.44%	–2.42%
Occurence of fatal CVD (life-time)	41.78%	34.90%	36.27%	–1.37%
Total QALY	7.333	7.768	7.686	0.082
Total LYG	10.297	10.850	10.746	0.105
ICER (€/QALY)				5,693
ICER (€/LYG)				4,475

RESULTS

Over a life-time horizon, the highest costs are attributed to atorvastatin cohort (3,025 €), however this cohort also revealed the highest LYG and QALY gained, simultaneously with the highest proportion of non/fatal CVD averted. Compared to simvastatin ATOR provides 7.77 QALYs vs. 7.69 QALYs, 10.85 LYG vs. 10.75 LYG, 56.02% vs. 58.44% of non-fatal CVD (RRR is 4.14%) and 34.9% vs. 36.27% of fatal CVD (RRR is 3.78%). See **Table 2** for the cost-effectiveness results of each intervention and **Figure 2**, where the cumulative number of fatal and non-fatal CVD of each intervention is presented within time from diagnosis (treatment onset).

ATOR compared to SIMVA provides increment total costs of 468 €, which provides ICER for atorvastatin vs. simvastatin 5,693 €/QALY and 4,475 €/LYG.

The results of the PSA are presented in **Figure 3** and **Figure 4**, where it is apparent that despite the 10% higher acquisition costs of ATOR compared to SIMVA (at doses granted to be "equipotent"), ATOR is still cost--effective. There is a 98.9% probability of atorvastatin being cost-effective at the selected WTP threshold (1 GDP/capita in the Czech Republic = 14,000 €).

The limitation of our analysis could be the fact, that the efficacy of the statin therapy was applied on the whole cohort in terms of the mean/ average percentage efficacy on HDL and total cholesterol level without respecting the fact that even lower doses of particular statin could lead to target levels of cholesterol in some patients (i.e. target to treat approach). However, according to the consumption of particular strength of each statin (ATOR, SIMVA), it seems that physicians prefer the 20 mg tablets without differentiating the potency of particular statin. Hence, we rather think that the implications into health gain in relation to the cost (cost-effectiveness) of particular intervention in the Czech Republic from our analysis are rather relevant.

Figure 2. Cumulative number of fatal and non-fatal CVD of each intervention. The percentage is proportion of patients free from particular complication, i.e. fatal, non-fatal CVD.

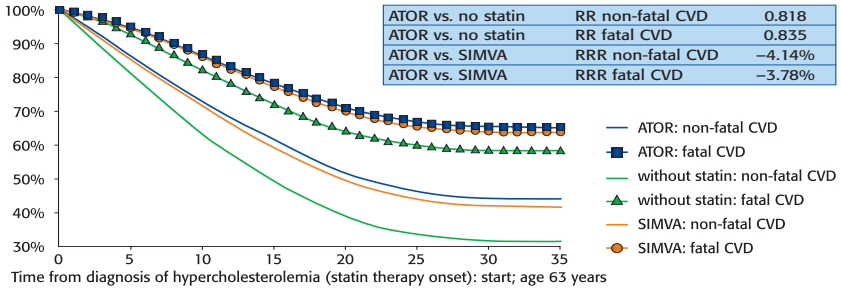


Figure 4. Results of the PSA; Cost-effectiveness acceptability curve of ATOR vs. SIMVA

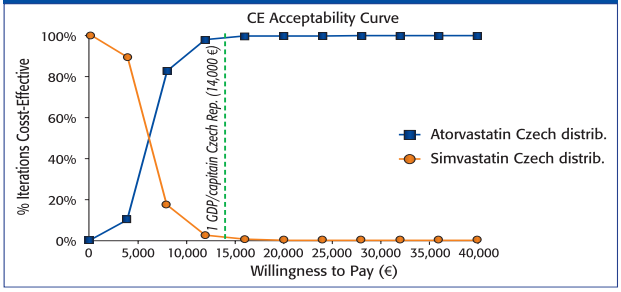
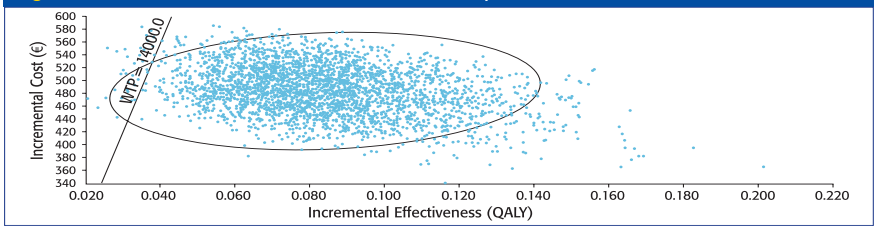


Figure 3. Results of the PSA; Cost-effectiveness scatter plot of ATOR vs. SIMVA



CONCLUSIONS

Over a life-time horizon (from the statin treatment initiation to the end of life), in a cohort of 100 patients atorvastatin compared to simvastatin provides 776.8 QALYs vs. 768.6 QALYs (incremental gain of 8.22 QALYs), 1085.0 LYGs vs. 1074.6 LYGs (incremental gain of 10.40 LYGs). On the population level, if all patients currently on simvastatin (165 thousand patients in the Czech Republic) were treated with atorvastatin, there would be a gain of 17,160 life-years, or 13,563 QALYs from the statin treatment initiation to the end of life. Hence, these values represent the loss of health in the population of the Czech Republic.

References

1 **Svilaas A**, McGrath C, van Campenhout H, et al. A descriptive study of cardiovascular risk management and statin therapy in Belgian and Norwegian general practice. ATHEROSCLEROSIS SUPPLEMENTS. 2010, 11(2), 59-60. • 2 **Cífková R**, Škodová Z, Bruthans J, et al. Longitudinal trends in major cardiovascular risk factors in the Czech population between 1985 and 2007/8. Czech MONICA and Czech post-MONICA. Atherosclerosis. 2010, 211(2), 676-81. • 3 **Anderson KM**, Odell PM, Wilson PWF, Kannel WB. Cardiovascular risk profiles. Am Heart J. 1990, 121, 293-8. • 4 **Conroy RM**, Pyörälä K, Fitzgerald AP et al. Estimation of ten-year risk of fatal cardiovascular disease in Europe: the SCORE project. Eur Heart J. 2003, 24, 987–1003. • 5 *Czech Statistical office: Life-tables* [on line]. Accessed on: http://www.czso.cz/csu/2012edicniplan.nsf/p/4002-12. • 6 **Steg PG**, Bhatt DL, Wilson PWF, et al. One-year cardiovascular event rates in outpatients with atherothrombosis. JAMA. 2007, 297, 1197-206. • 7 **Rogers SL**, Magliano DJ, Levison DB, et al. A dose-specific meta-analysis of lipid changes in randomized controlled trials of atorvastatin and simvastatin. Clin Ther. 2007, 29, 242-52. • 8 **Sullivan P**, Slejko J, Sculpher M, Ghushchyan V. Catalogue of EQ-5D scores for the United Kingdom. Med Decis Making. 2011, 31, 800-804.

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