

# COST-MINIMIZATION ANALYSIS OF MULTIFOCAL AND MONOFOCAL INTRAOCULAR LENSES IN CATARACT SURGERY IN THE CZECH REPUBLIC

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## OBJECTIVE

Crystalline lens is opacified during the aging and it results in deterioration of visual function. The surgery of cataract is the only possibility of treatment where opacified crystalline lens is replaced by artificial lens. Traditional monofocal intraocular lens (monoIOL) allows acute vision only on one distance (e.g. near vision) and there after its implantation most patients need spectacles. Multifocal intraocular lens (MIOL) may ensure accurate vision on all distance and liberate patient from spectacles after undergoing cataract surgery with this lens.

The object of this analysis was to model the lifetime cost attributed to intraocular lenses (multifocal vs. monofocal) implantation during cataract surgery from patient's perspective.

## METHODS

The Markov model was developed using TreeAge Pro 2012 with 28-day cycle length projecting life-time costs of patients undergoing cataract surgery of both eyes at 65 years, on average.

Patients move among four health states which occur after cataract surgery, see **Figure 1**. Patients become independent on the spectacles or need them after cataract surgery with probabilities derived from Lafuma et al. [1], Laurendeau et al. [2]. **Table 1** shows probabilities of dependence on spectacles after cataract surgery, especially dependence on particular type of spectacles. In the model, we assume on the base of expert panel that new glasses are bought by patients (who wear glasses after surgery) every three years, approximately one third of patients buy new spectacles every year, which equal to 1 month probability of 0.0328. Patient may die from each health state with probability derived from Czech life-tables. There was no difference in mortality specific for particular intraocular lenses. We also did not distinguish patients' quality of life based on not/dependence on spectacles, hence no difference was captured by our model and cost-minimization approach was admitted.

Resource utilization was obtained by expert panel and unit costs were derived from the current pricing lists. Costs of cataract surgery with multifocal and monofocal lenses implantation were 1,200 € and 9.9 €, respectively. This means that monofocal lens surgery is full reimbursed, in contradistinction to high patients' co-payments in multifocal surgery, i.e. for multifocal lens itself. Mean costs of purchasing spectacles after the intervention of implanting multifocal (42.9 €) and monofocal (82.5 €) lenses were derived from unit cost on particular type of spectacles and probabilities of wearing those particular types (reading, distance, bifocal and multifocal spectacles). Monthly costs of ophthalmologist visit, maintenance and service of spectacles were calculated to 0.4 €. **Table 2** shows details of costs' inputs.

Discount rate of 3% was applied for both costs and outcomes (life years gained). One-Way Sensitivity Analysis (OWSA) was performed.

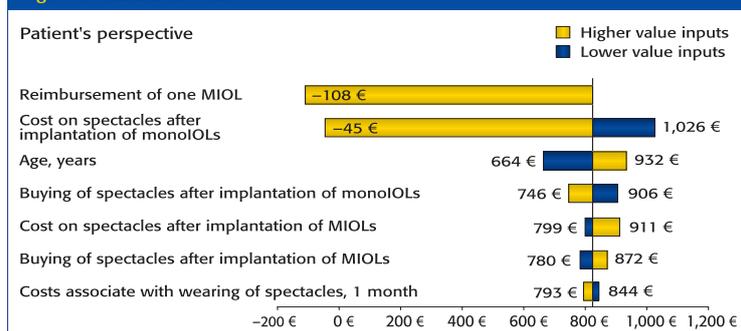
**Table 3. Results of deterministic analysis (discounted)**

Patient's perspective (discounted, 3 %)	MIOLs	monoIOLs	Increment MIOLs – monoIOLs
Cost on cataract surgery	1,200 €	10 €	1,190 €
Costs associate with buying of spectacles	49 €	378 €	-329 €
Costs associate with wearing of spectacles	12 €	47 €	-35 €
<b>TOTAL costs</b>	<b>1,261 €</b>	<b>435 €</b>	<b>826 €</b>

**Table 4. Input parameters to OWSA**

Parameters of OWSA	Base-case, value	Range, value	
Age, years	65	40	75
Reimbursement of one MIOL	117 €	-	584 €
Cost of spectacles after implantation of MIOLs	43 €	19 €	117 €
Cost of spectacles after implantation of monoIOLs	82 €	39 €	273 €
Buying of spectacles after implantation of MIOLs	20 %	5 %	35 %
Buying of spectacles after implantation of monoIOLs	80 %	65 %	95 %
Costs associate with wearing of spectacles, 1 month	0.4 €	0.2 €	0.8 €

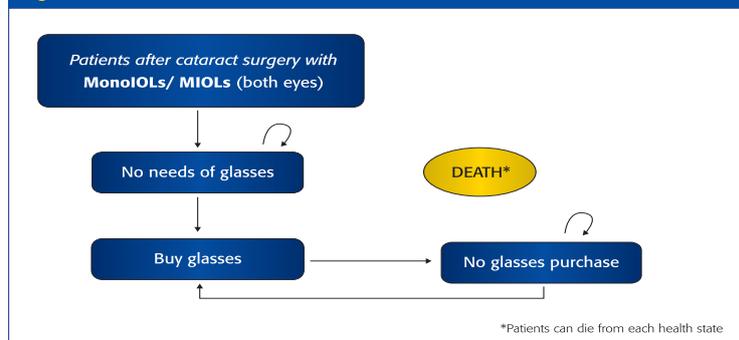
**Figure 2. Results of OWSA**



## References

- Antoine Lafuma, Gilles Berdeaux; Modelling lifetime cost consequences of ReSTOR® in cataract surgery in four European countries; *BMC Ophthalmology* 2008, 8:12 doi:10.1186/1471-2415-8-12
- Laurendeau C, Lafuma A, Berdeaux G. Modelling lifetime cost consequences of toric compared with standard IOLs in cataract surgery of astigmatic patients in four European countries. *J Med Econ* 2009 Sep;12(3):230-7. doi: 10.3111/13696990903257439.

**Figure 1. Structure of Markov cohort model**



**Table 1. Probability inputs of the model**

Probabilities of	MIOLs	MonoIOLs
dependence on spectacles after cataract surgery [1]	20.0%	80.0%
dependence on particular type of spectacles [2]		
reading spectacles	74.3%	30.8%
distance spectacles	0.0%	8.0%
reading & distance spectacles	0.0%	16.1%
bifocal spectacles	17.1%	12.5%
multifocal spectacles	8.6%	32.7%
buying new spectacles [expert panel]	3.3%	3.3%

**Table 2. Cost inputs of the model**

Type of costs	Value
Cataract surgery & subsequent care (MIOLs)	1,200 €
Cataract surgery & subsequent care (monoIOLs)	9.9 €
Spectacles after implantation of MIOLs	42.9 €
Spectacles after implantation of monoIOLs	82.5 €
reading spectacles	23.4 €
distance spectacles	25.1 €
bifocal spectacles	60.1 €
multifocal spectacles	177.5 €
Ophthalmologist visit, maintenance and service of spectacles	0.4 €

## RESULTS

After cataract surgery with multifocal lenses implantation, patients purchase on average by 4.4 spectacles less compared to patients undergoing monofocal intraocular lenses implantation (i.e. 5.9).

The initial patient's investment of 1,190 € into multifocal IOLs is partially offset by saving of 364 € attributed to lower number of new spectacles purchased and their maintenance in the lifetime horizon. However, from the patient's perspective, the intervention of MIOLs surgery is still by 826 € more expensive compare to standard monoIOLs, see **Table 3**.

Inputs to OWSA are presented in **Table 4**. Costs on spectacles after cataract surgery with monofocal lenses and level of reimbursement of multifocal lenses were the biggest driver of the results, see **Figure 2**.

## CONCLUSIONS

Bilateral multifocal IOL implants decrease patient's dependence on spectacles. From patient's perspective, the initial investment into multifocal lenses is partially compensated by saving of spectacles costs and its maintenance. However, from the patient's perspective, the intervention of MIOLs surgery is still by 826 EUR more expensive compare to standard monoIOLs. This difference is driven exclusively by the fact of practically no reimbursement of MIOLs and simultaneously very low reimbursement level of spectacles and low investments into them from patients' side in the Czech Republic.

The limitation of the analysis may be absence of specific data about utilization of particular type of spectacles after cataract surgery with particular IOLs in the Czech Republic. These data were transferred from foreign study for the purpose of analysis. Another limitation of the analysis is the absence of quality of life issue. It was presumed that the outcomes of monofocal and multifocal IOL are the same but implantation of MIOLs may be associated with higher visual acuity and quality of life, respectively. Moreover, the liberation of the spectacles could be also appreciated in term of higher quality of life.