

Cost-effectiveness of Maternal Toxoplasma Screening in Austria: A Decision-Analytic Model

Andrea-Romana Prusa^a, Evelyn Walter^b, Arnold Pollak^a, Michael Hayde^a, David C. Kasper^a
^aMedical University of Vienna, Austria, ^bIPF Institute for Pharmacoeconomic Research, Vienna, Austria

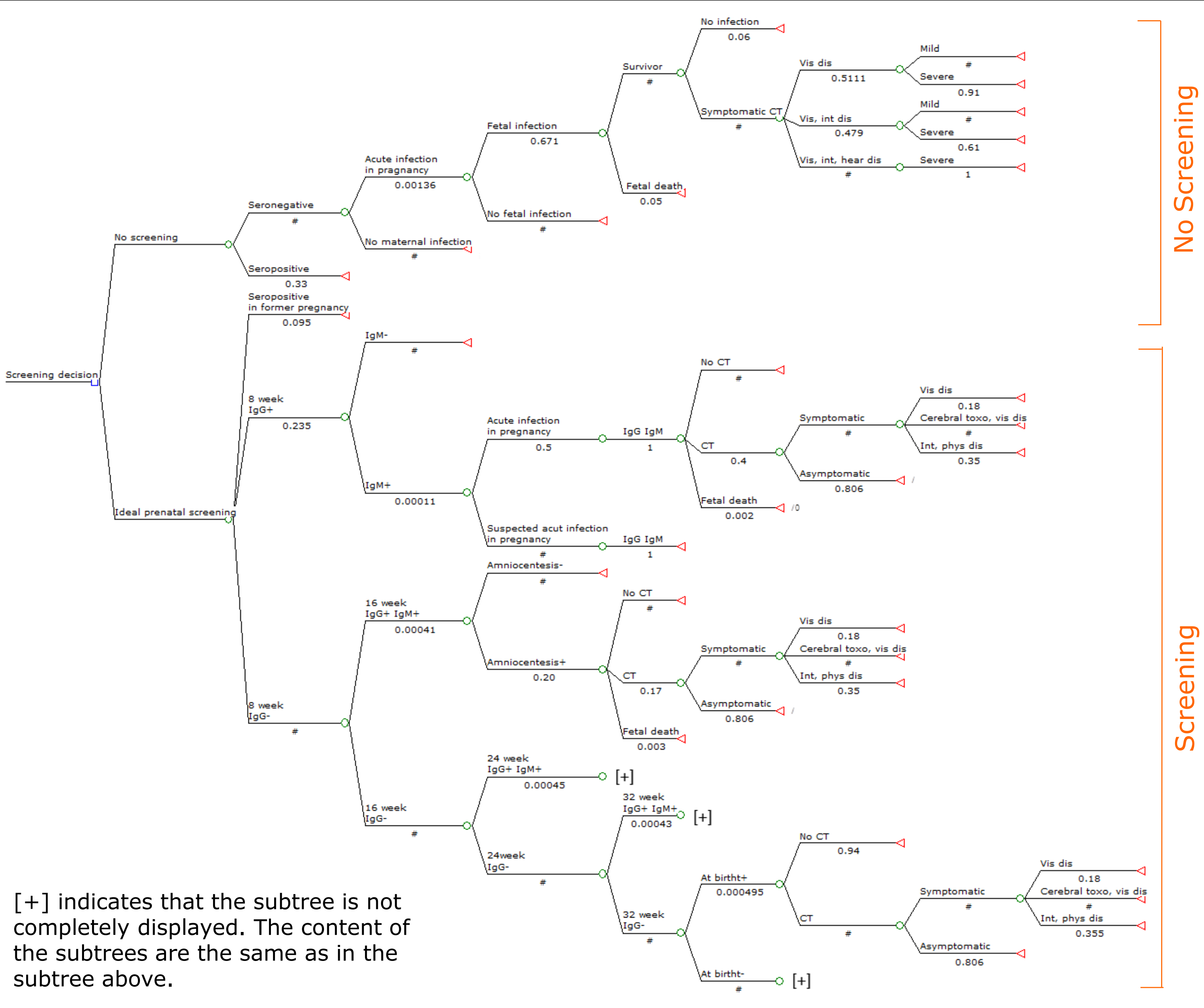
Objectives

Toxoplasma infection during pregnancy can present a serious hazard to the fetus including lifelong disabilities of connatal infected children. This foodborne illness is a common burden worldwide. Prevention strategies of the health care providers are diverse. In Austria, the maternal toxoplasma screening has been implemented four decades ago. The aim of this study was to determine the cost-effectiveness of the maternal toxoplasma screening.

Methods

We developed a two arm decision-analytic model. One arm of the model assessed the costs and consequences of no prevention, while the other one evaluated the screening. The study population included pregnant women and offspring screened and treated for toxoplasma infection. The average number of births was 76,547 and 50,000 pregnant women were susceptible to infection. The analysis focused on lifetime consequences of the connatal infection. This encompassed direct costs (screening, cost of illness, maternal and pediatric treatment), indirect costs (changed job situation of parents, human-capital of dead individuals, blindness and special schools), quality-adjusted-life-years (QALYs) and reduced expectation of life. Costs were presented per child and for the Austrian birth rate. Costs from published sources were used for 2012 from the societal perspective. QALYs, life-years (LYs) and costs were projected over a life-time horizon and discounted at 3% per anno.

Fig. 1: Model Design



Source: own developed

Clinical Data

Seroprevalence, probabilities of symptoms (symptomatic and asymptomatic) in the screening arm derived from the nationwide database of the reference center (Medical University of Vienna). The no screening probabilities of symptoms were modeled in accordance with the Stillwaggon paper.

Resource Use and Costs

Data on the resource use of screening (IgG, IgM, amniocentesis (PCR), newborn-test, head ultrasound, blood test, fundoscopy, ECG), maternal and pediatric treatment (medication, dosage and treatment duration) derived from the nationwide database of the reference center. Data on the resource use of symptoms was collected in two steps. First, the medical resources were derived by literature (e.g. disease specific guidelines). In a second step this literature review was verified by experts. Direct medical costs derived from a number of publicly available sources like outpatient clinic catalogue as well as the DRG catalogue (LKF) and official price lists for the Austrian Health insurances funds. Indirect Cost represent statistical and published data as well as own calculations. When necessary, prices were adjusted to 2012 prices using the consumer price index.

Results

Without screening, the total discounted societal cost (direct and indirect) amounts to 174.43 € per child screened (calculations based on the 76,547 newborns). This strategy resulted in a discounted quality-adjusted life expectancy of 31.121 QALYs. The corresponding life expectancy without quality adjustment amounted to 31.128 life-years.

The screening strategy accounted for 37.72 € and quality-adjusted life expectancy increase to 31.130 QALYs over lifetime. Total life expectancy without quality adjustment increased to 31.13 life-years. From the societal perspective, a universal screening program resulted in cost savings of 136.71 € per child. Screening results in 0.0087 QALYs gained and 0.002 LYs saved per child. The incremental cost-effectiveness ratio (ICER) amounts to -15,713.79 € from the societal perspective.

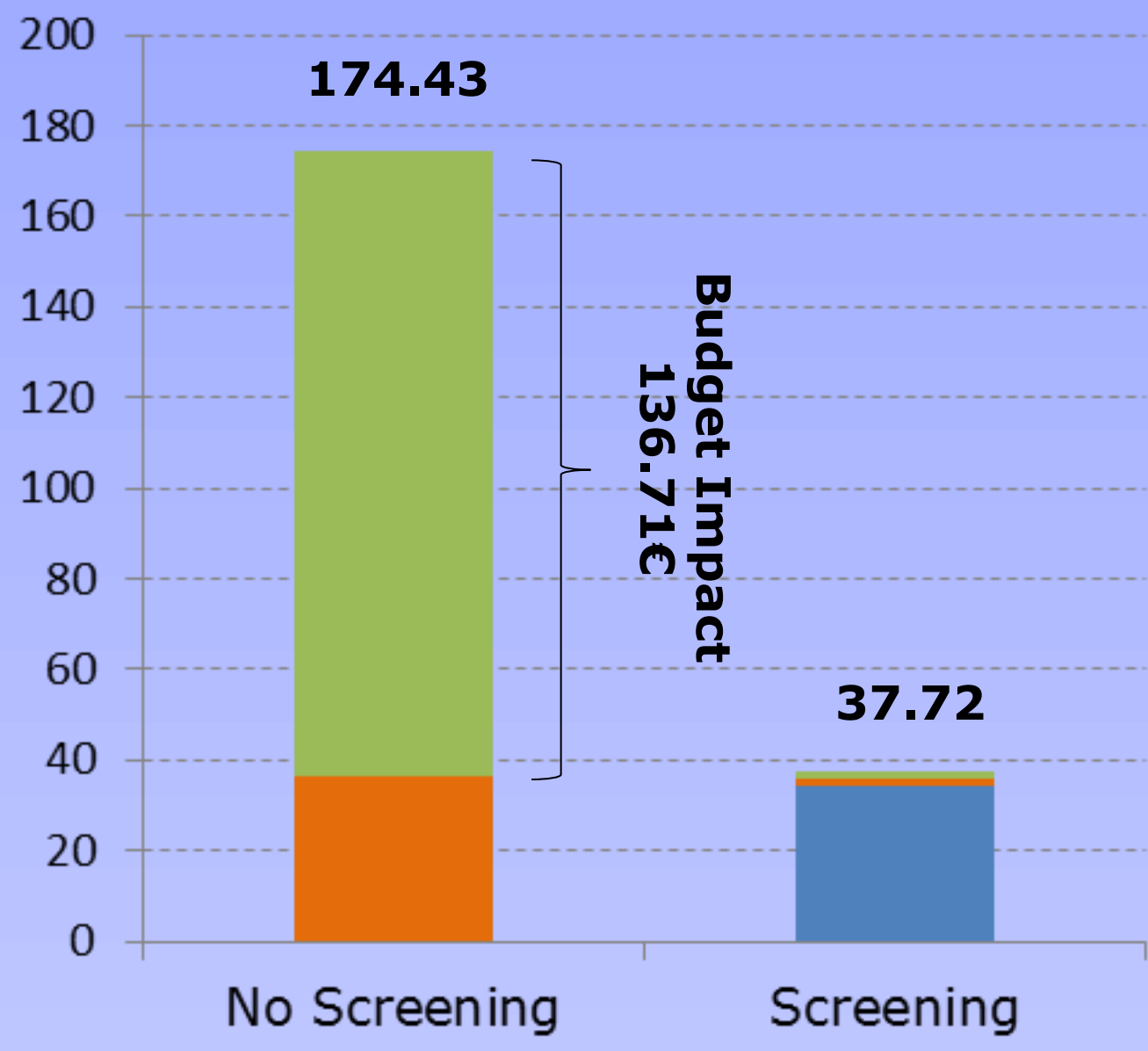
Tab. 1: Results, 2011/2

Strategy	Lifetime costs per infant (€)	QALYs per infant	ICER	LYs per infant	Lifetime costs per birth Cohort (€)	QALYs per birth cohort	LYs per birth cohort
No- screening	174.43	31.12		31.13	13.35 m	2,382,219	2,382,747
Screening	37.72	31.13	Dominant	31.13	2.89 m	2,382,885	2,382,908
Difference	136.71	-0.01		-0.01	10.46 m	-666	-161

Source: own calculations

34.49 € out of the 37.72 € (total costs per child of the universal screening strategy) are screening and maternal treatment costs. 3.23 € accounts for follow up costs due to fetal disease. According to our calculations 5 pregnant women can be screened in order to treat one infected child.

Fig. 2A: Total costs per infant , 2012



Source: IPF own calculations

Fig. 2B: Cost distribution No Screening

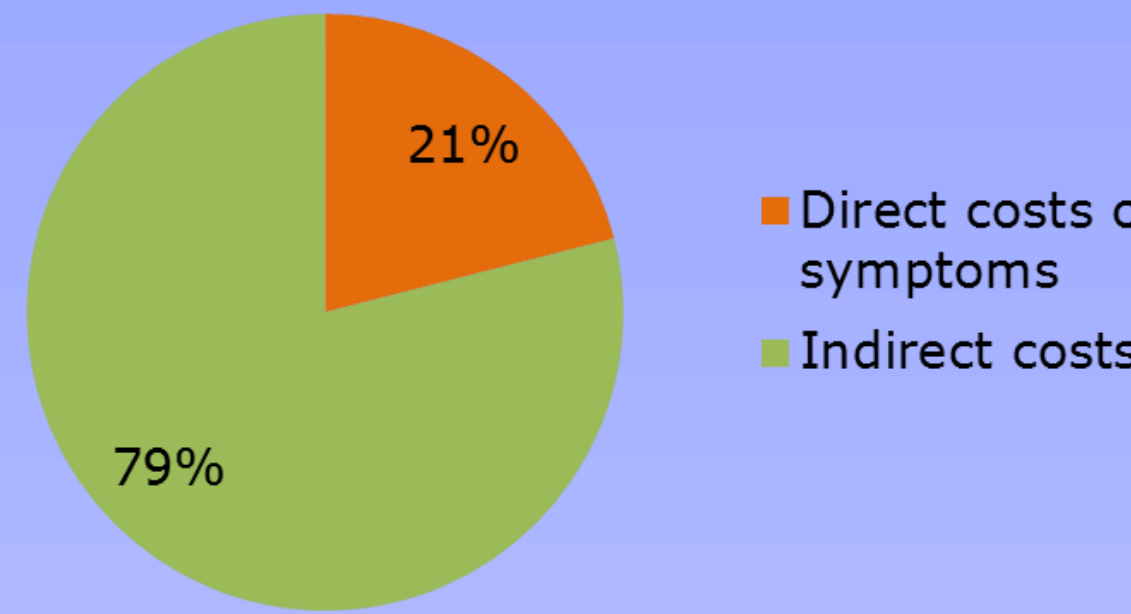
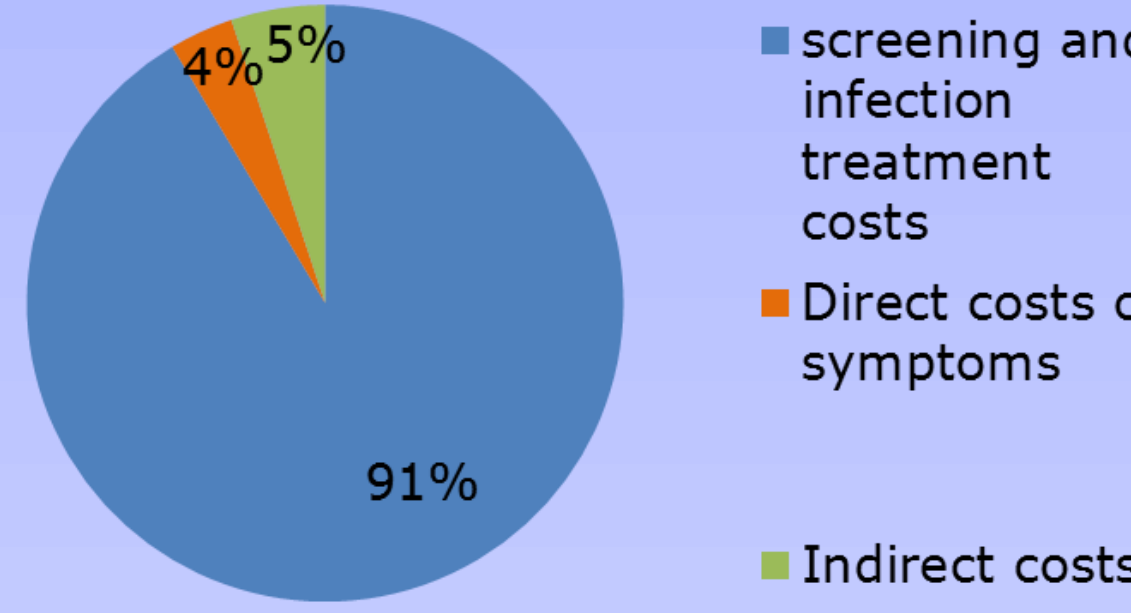


Fig. 2B: Cost distribution Screening

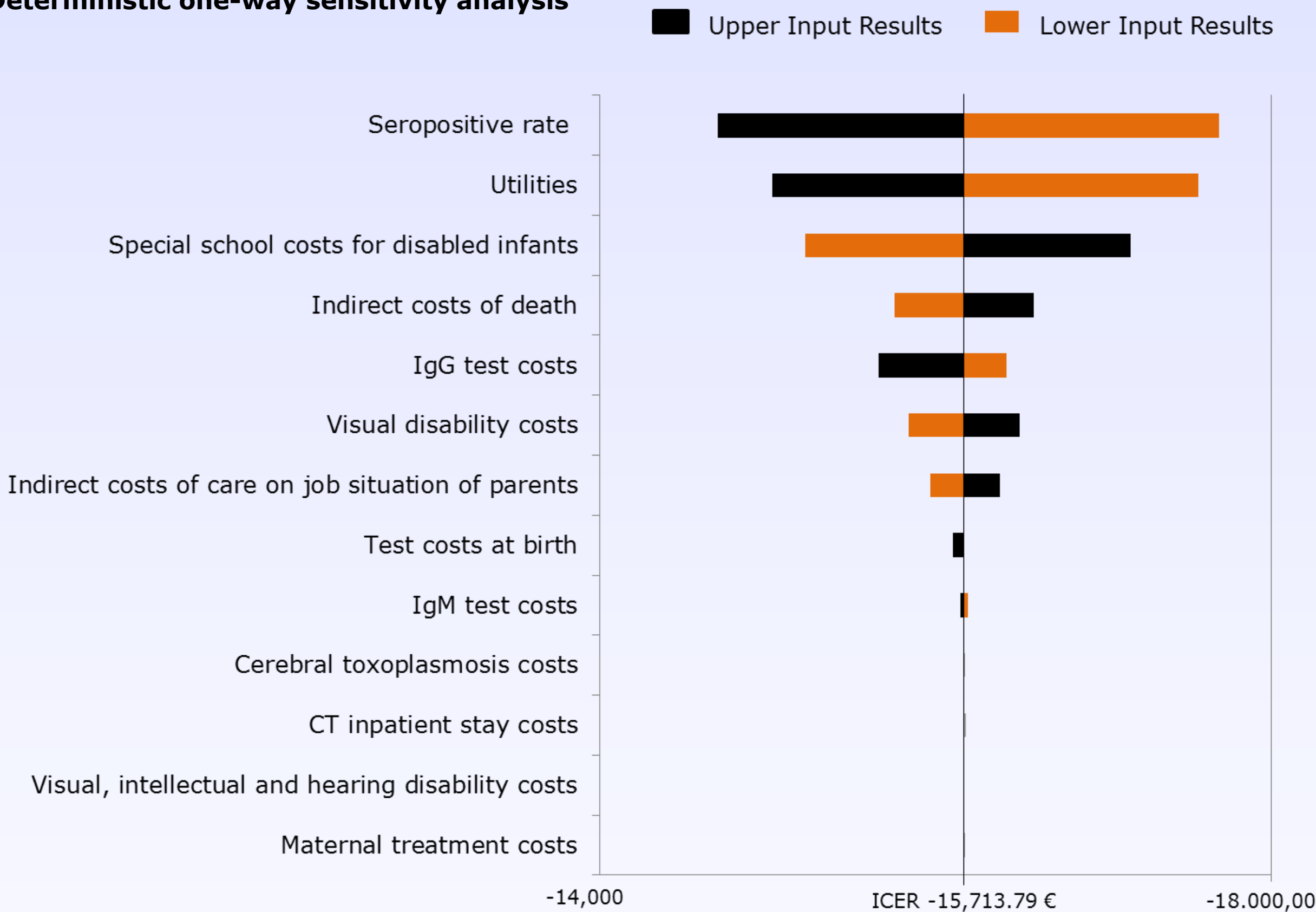


Transferred to the entire birth cohort, universal screening is able to reduce total costs from 13.35 million € to 2.89 million € from the Austrian societal perspective each year. Screening results in 665 QALYs gained and more than 161 LYs saved for the entire birth cohort.

Sensitivity Analysis

In the deterministic one-way sensitivity analyses (Figure 2), our results were robust to a wide range of plausible estimates of unit cost data. Cost savings persisted for the screening strategy in all variations of the sensitivity analyses. Unit costs of IgG exhibit a great influence on total costs (35 € - 43.3 €) per child in the screening arm. The incremental cost-effectiveness advantage for the screening strategy ranged between -16,026.44 € and -15,072.41 €. Among cost components, indirect costs show a greater influence on total costs than direct costs.

Fig. 3: Deterministic one-way sensitivity analysis



Source: own calculations

Conclusion

Funding the maternal toxoplasma screening saves money and is cost-effective for the society and the Austrian health care system.

References

Stillwaggon E, Carrier CS, Sautter M, McLeod R. Maternal serologic screening to prevent congenital toxoplasmosis: a decision-analytic economic model. PLoS Negl Trop Dis. 2011 Sep;5(9):e1333.
Brennig C, Schöllbauer V, Walter E. Cost of blindness in Austria. Congressposter ISPOR 14th Annual European Congress, 2011
Carroll A, MD, Downs S. Comprehensive Cost-Utility Analysis of Newborn Screening Strategies, PEDIATRICS Volume 117, Number 5, May 2006
Gold M, Siegel J, Russel L, Weinstein MC (1996) Cost-Effectiveness in Health and Medicine. WB Saunders, Philadelphia
König H, Barry J. Cost effectiveness of treatment for amblyopia: an analysis based on a probabilistic Markov model, Br J Ophthalmol 2004;88:606–612.
Petrou S, Johnson S, Wolke D, Hollis C, Kochhar P, Marlow N. Economic costs and preference-based health-related quality of life outcomes associated with childhood psychiatric disorders, BJP 2010, 197:395-404.
Schulenburg JM Graf von der, Greiner W, et al. Hanover Consensus Group. German Recommendations on Health Economic Evaluation: Third and updated version of the Hanover Consensus. Value in Health 2008;11, 539-544.
Statistik Austria. Jahrbuch der Gesundheitsstatistik 2011, Wien 2011
WHO; Global Burden of Disease, http://www.who.int/topics/global_burden_of_disease/en/
Lange K., Danne T., Kordonouri O., et al., Diabetesmanifestation im Kindesalter: Alltagsbelastungen und berufliche Entwicklung der Eltern, in: Deutsche Medizinische Wochenschrift 129, 2004
Walter E, Brennig C, Schöllbauer V. How to save money: congenital CMV infection and the economy. In: Halwachs-Baumann G (eds.) Congenital Cytomegalvirus Infection. Springer-Verlag Wien, 2011, pp121-144
Additional Literature with the author