

Cost-effectiveness analysis of the helicopter emergency medical services for patients with myocardial infarction in Austria

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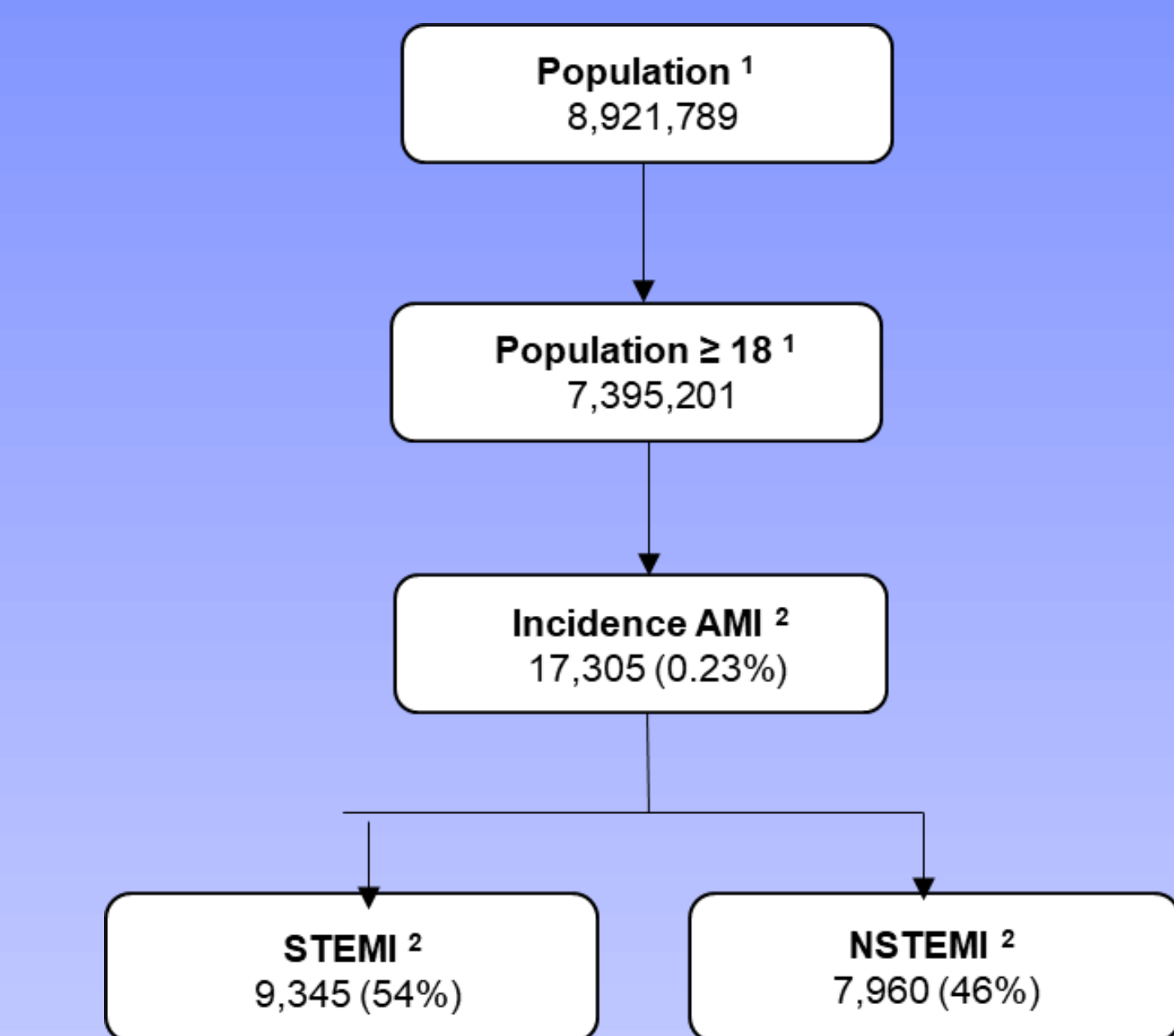
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Objectives

Myocardial infarction (MI) is a life-threatening disease. Accordingly, a time limit of 90 minutes between initial medical contact and percutaneous coronary intervention (PCI) has been established for ST-segment elevation myocardial infarction (STEMI). Thus, many STEMI patients require airlift by helicopter emergency medical services (HEMS) to match the goal of 90 minutes. However, HEMS remains a poorly evaluated aspect of MI care. The aim of this study was to evaluate the cost-effectiveness of HEMS airlift compared to a ground-based ambulance-transport for patients with MI to a PCI center.

Figure 1: Derivation of the enclosed target population



- The target population of the analysis included patients who were admitted in a public hospital with PCI center for at least one day.
- The incidence of an acute MI (AMI) requiring hospitalization amounts to 0.234% in Austria. This means that 17,305 people are affected every year.
- According to the characteristics of the AMI patients (n=615) of the University Of Emergency Medicine (NFM) of the Medical University of Vienna at the General Hospital AKH, the proportion of ST elevation infarction (STEMI) was 54% and non-ST elevation infarction NSTEMI 46%. The average age of those affected was 64 years (Tulder et al. 2013).

¹Statistik Austria - Bevölkerung am 01.01.2020

² Tulder et al. 2013

Source: own developed

Methods

A Markov-model was developed based on the distinction between STEMI and non-STEMI to simulate consequences over a 10-year time-horizon. Consequences include recurrent MI, heart failure (HF) due to MI, death due to MI and recurrent MI or other reasons. Health benefits were measured in quality-adjusted life-years (QALYs) and life-years (LYs). Probabilities were derived from the literature. According to data derived from the OEAMTC Air Rescue, 6.9% of all hospital admissions are provided by HEMS. The target value for an appropriate use of HEMS was assumed to be 20%. Direct costs (2020 €) were derived from published sources from the payer's perspective. QALYs, LYs and costs were discounted (3% p.a.). Monte-Carlo-simulation accounted for uncertainty.

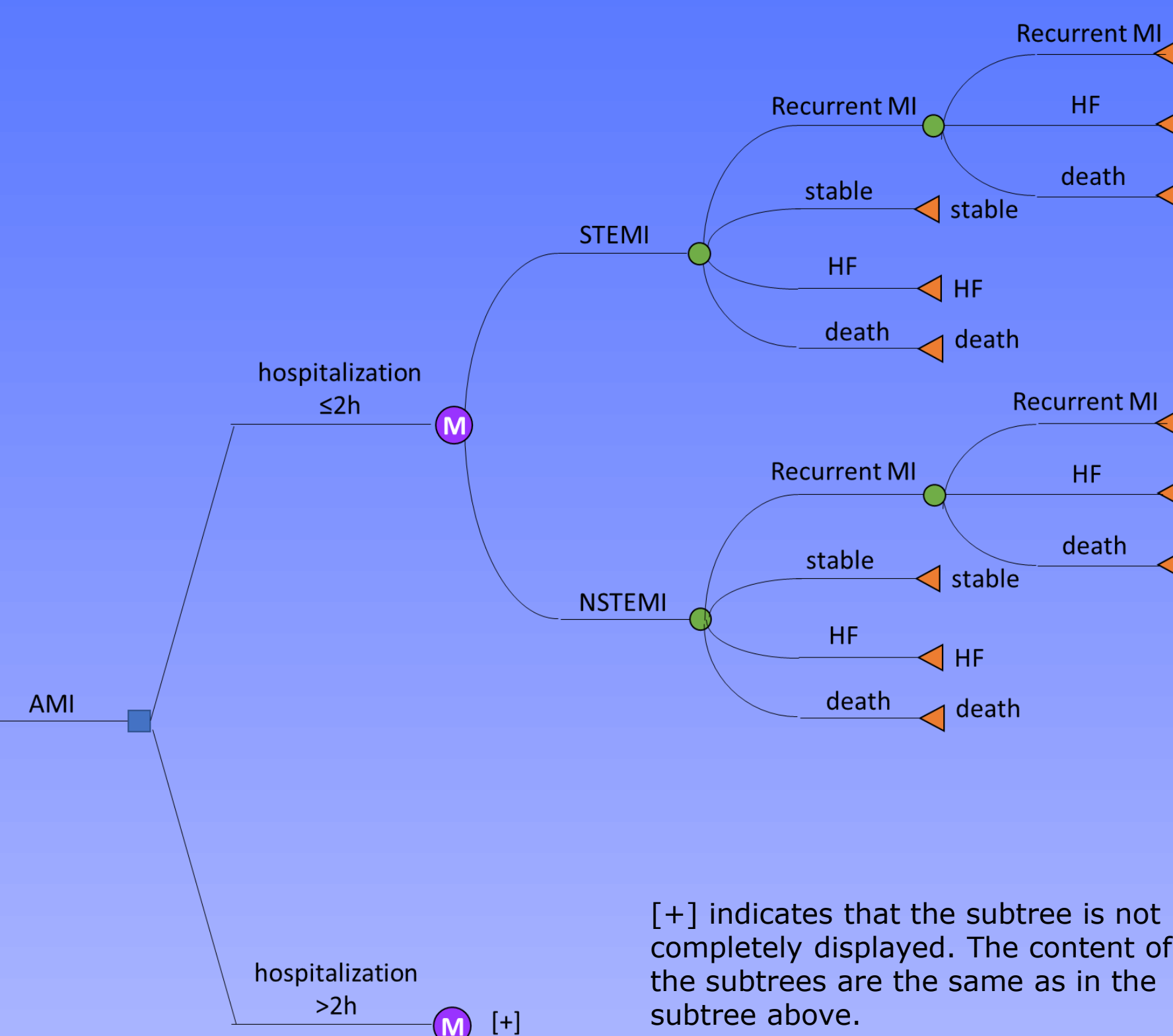
Comparators (therapeutic alternatives)

- SCENARIO (1)
- Increased share of HEMS (20%)
- Current situation of HEMS (6.9%)
- SCENARIO (2)
- Patient delivered with HEMS
- Patient delivered with ground-based ambulance-transport

Clinical Data

Clinical data include the distribution of AMI by STEMI and NSTEMI, the in-hospital mortality and the improvement in outcome as a result of faster hospital admission. Furthermore, mortality in the first year and subsequent years as well as the incidence of recurrent MIs and heart failure (HF) as a result of a MI was integrated.

Figure 2: Model Design



Model overview:

- The model distinguished between STEMI and NSTEMI to determine the effect of time on outcomes for patients in particular with STEMI undergoing primary percutaneous coronary intervention (PCI) (Tulder et al. 2013, Montalescot et al. 2007).
- The dependence of the treatment effect on time was considered based on OR (GISSI-1 Collaborative Group 1986, Boersma et al. 1996 [Thrombolysis] and McNamara et al. 2006 [PTCA]).
- The analysis considered the probability to develop HF after MI (Montalescot et al. 2007, Taylor et al. 2009).
- Information on future events (recurrent MI, mortality) is integrated into the model (Montalescot et al. 2007, Taylor et al. 2009).
- Utility values for the health states were derived from the study by Taylor et al. (2009).
- The model was carried out over a time horizon of 10 years.

Source: own developed

Resource use and costs

The total costs of analysis from the payer's perspective includes direct costs of first and recurrent MI, transportation costs, monitoring costs, HF costs and rehabilitation costs. Furthermore, cost components outside the healthcare system were considered, such as costs for nursing homes and the care allowance. Costs were adjusted for inflation, when necessary.

- MI costs include inpatient stay of the main diagnosis HDG06.03 as well as the additional services such as thrombolysis with t-PA (MEL26.01), PTCA (MEL21.11) and CABG (MEL08.02). Resource use and costs were extracted from the Austrian DRG-system.
- HF costs according to NYHA classes were extracted from a publication by Biermann et al. (2012).
- Rehabilitation costs, nursing home costs and the care allowance were derived from the literature.

Results

A >20% proportion of MI patients who were transported by HEMS to a PCI center is associated with savings over a 10-year time-horizon (2,140.- € to 13,640.- € per patient). Savings are due to reduced follow-up costs for rehabilitation, HF, nursing home and care allowance costs. Patients also achieve a higher life expectancy (0,17 to 0,46 LYs) and quality of life [0,13 to 0,38 QALYs].

The following illustrations present the results of the two comparisons in detail:

(1) Increased share of deliveries by HEMS (20%) vs. current situation (6.9%)

Table 1: Base case results of scenario (1)

Strategy	HEMS increased share	HEMS Current situation
Total costs per patient	113,113.30 €	115,253.19 €
Difference	-2,139.88 €	
QALYs	4.118	3.999
Difference	0.119	
ICER/QALY		DOMINANT
LYs	5.352	5.204
Difference	0.149	
ICER/LY		DOMINANT

Source: own calculations

Figure 3: Additional costs and savings of Scenario (1)

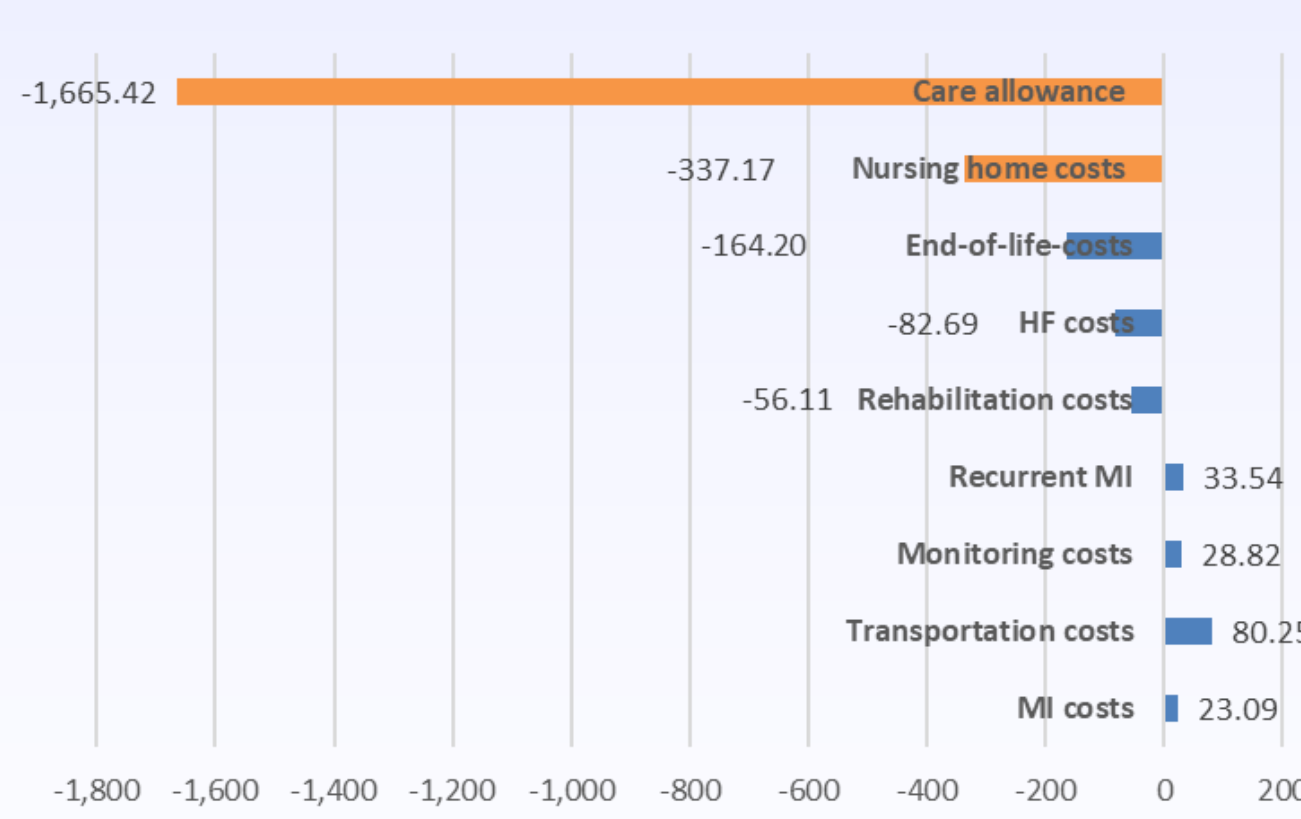
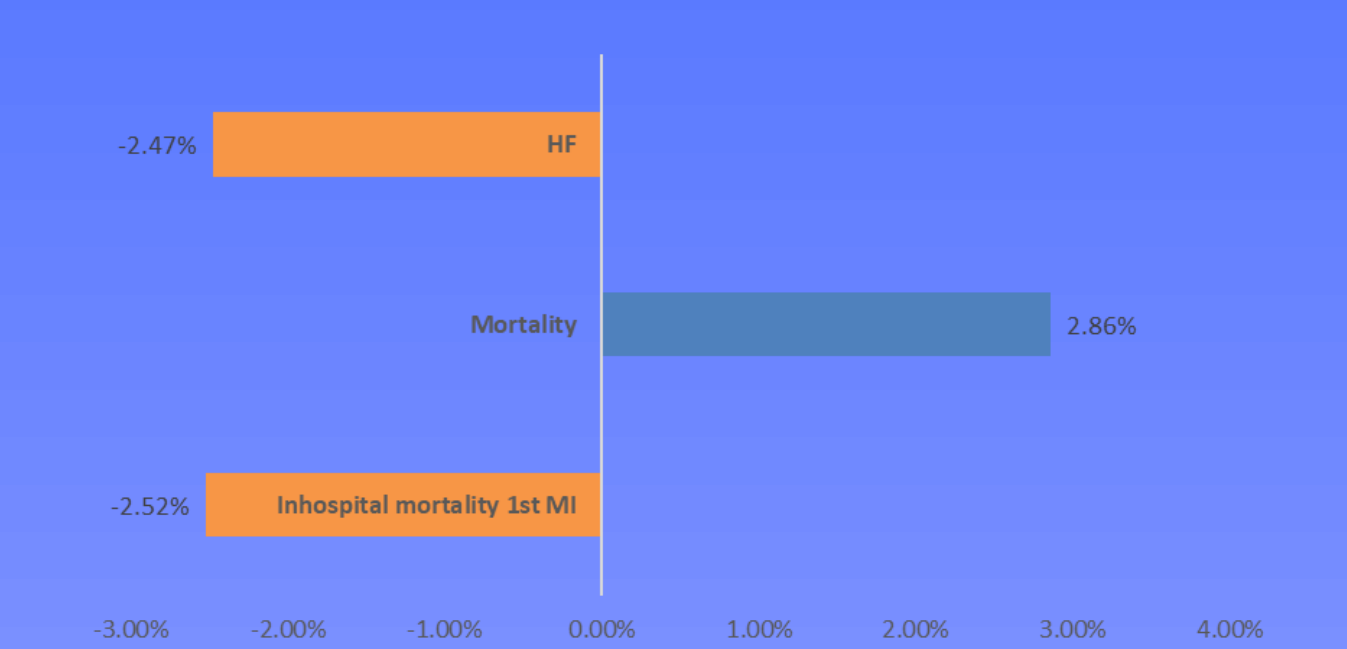


Figure 4: Outcomes over 10 years of scenario (1)



Source: own calculations

(2) Patient delivered with HEMS vs. patient delivered with ambulance-transport

The cost advantage increases significantly to -13,640 € when a HEMS is compared with a ground-based ambulance-transport. The comparison showed again a dominant result.

Table 2: Base case results of scenario (2)

Strategy	HEMS	No HEMS
Total costs per patient	108,831.71 €	122,472.05 €
Difference	-13,640.34 €	
QALYs	4.194	3.848
Difference	0.347	
ICER/QALY		DOMINANT
LYs	5.440	5.025
Difference	0.415	
ICER/LY		DOMINANT

Figure 5: Additional costs and savings of Scenario (2)

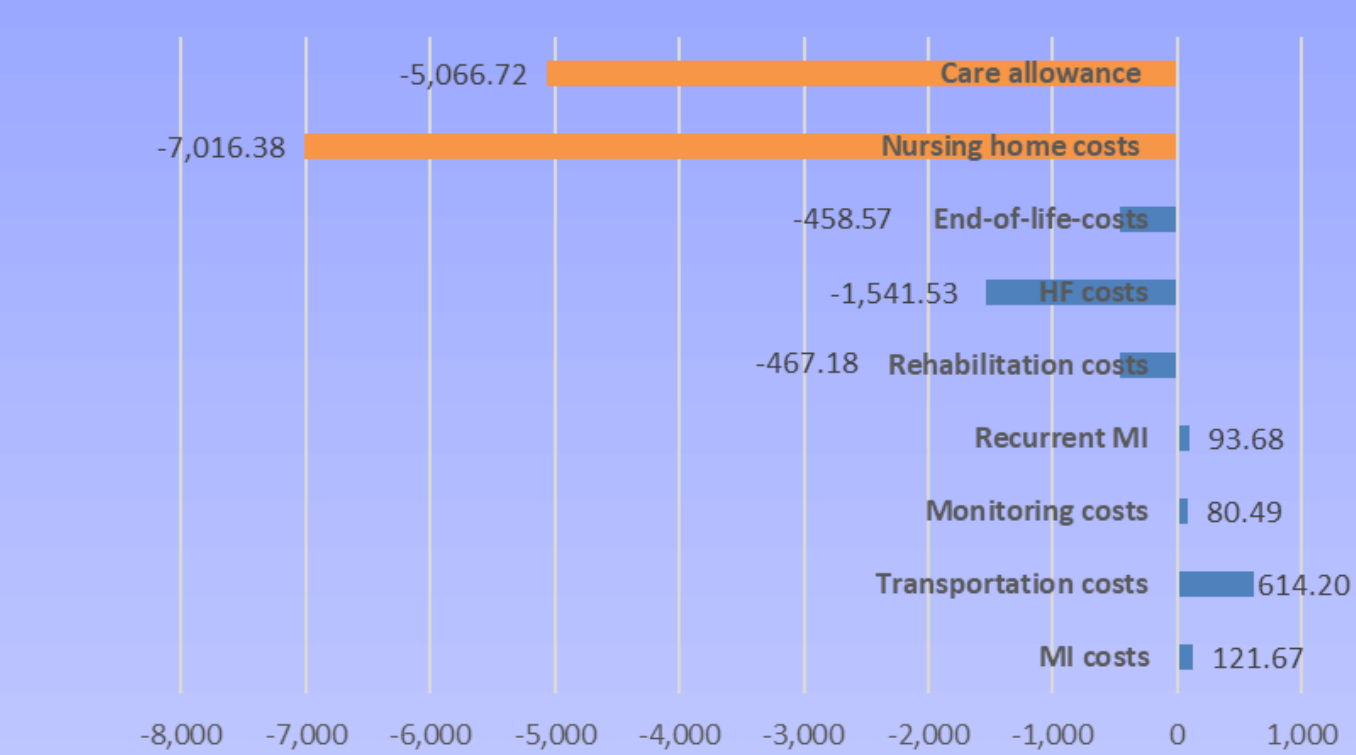
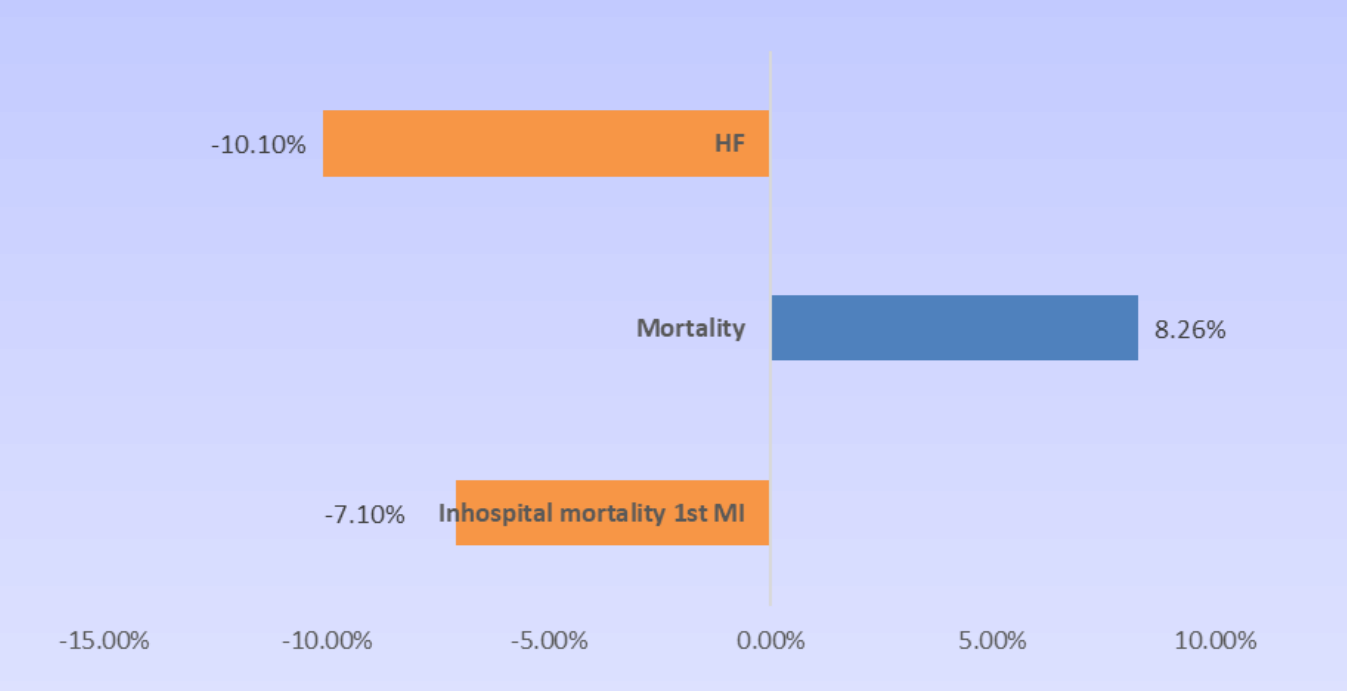


Figure 6: Outcomes over 10 years of scenario (2)



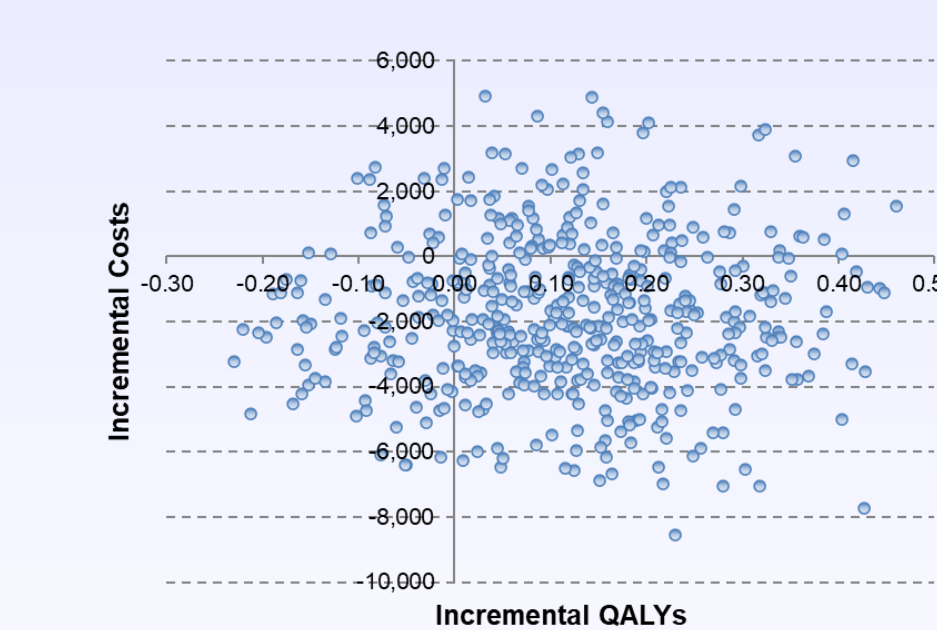
Source: own calculations

Sensitivity Analysis

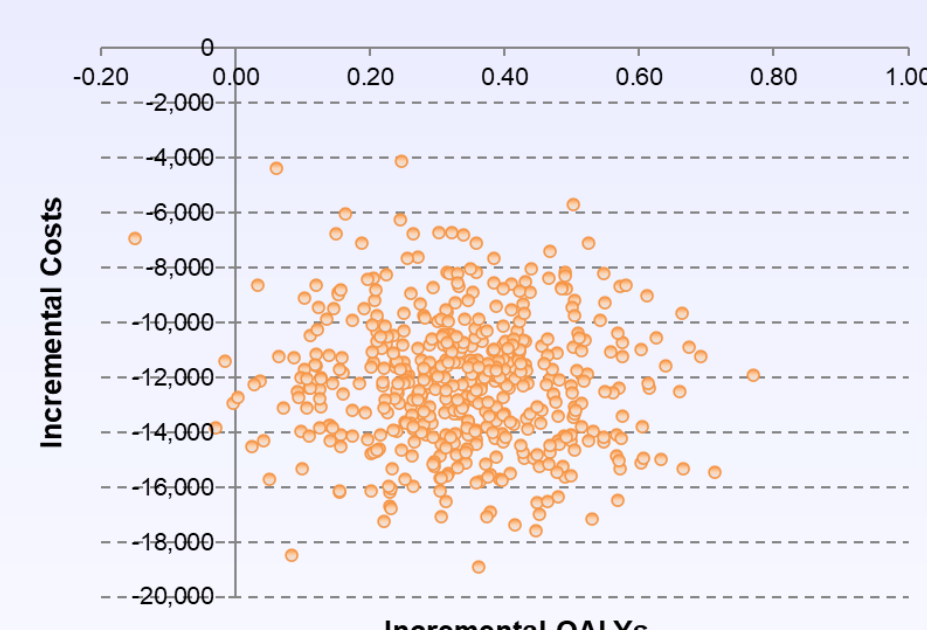
Probabilistic and deterministic sensitivity analysis were carried out to examine the robustness of the model.

Figure 7: Scatterplots of the probabilistic sensitivity analysis (PSA)

Scatterplot, increased HEMS vs. current situation



Scatterplot, HEMS vs. no HEMS



Source: own calculations

Conclusion

In the entire cohort of MI patients in 2020 (n=17,305), savings of 37 million € could be achieved. 1€ spend in HEMS leads to savings of 9.7€ in the health-care and social system.

References

Montalescot G, Dallongeville J, Van Belle E, Rouanet S, Baulac C, Degrandisart A, Vicaux E; OPERA Investigators. STEMI and NSTEMI: are they so different? 1 year outcomes in acute myocardial infarction as defined by the ESC/ACC definition (the OPERA registry). Eur Heart J. 2007 Jun;28(12):1409-17. doi: 10.1093/eurheartj/ehm031. Epub 2007 Apr 5. PMID: 17412730.

Additional literature with the authors

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