

Cost-effectiveness of landiolol, an ultra-short-acting beta-blocker, for prevention of postoperative atrial fibrillation in Germany

Evelyn Walter^a, Karin Schalle^a
^aIPF Institute for Pharmaeconomic Research, Vienna, Austria

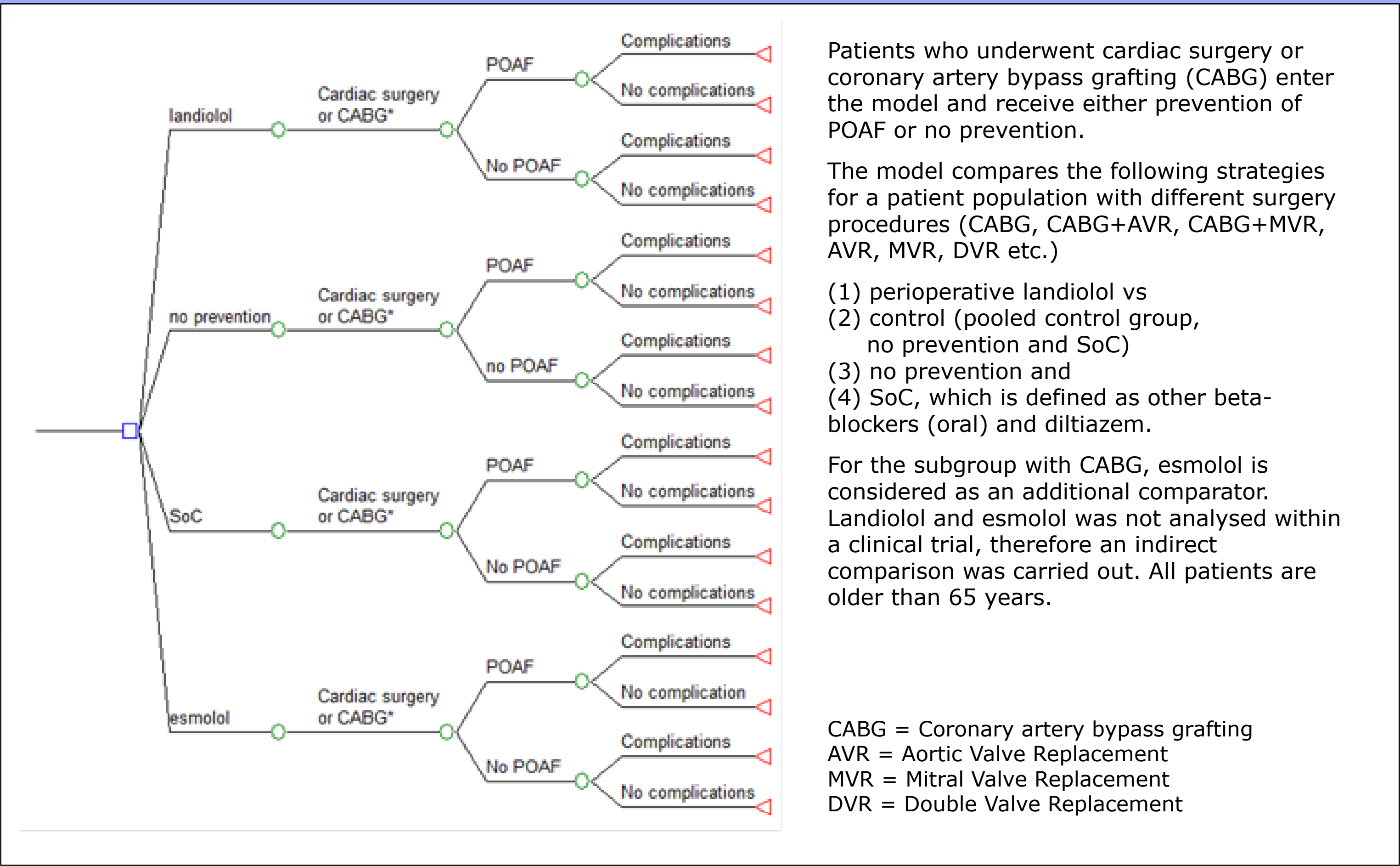
Objectives

Postoperative atrial-fibrillation (POAF) is common among surgical patients and associated with a worse outcome. Arterial-fibrillation (AF) is the most frequent complication arising after coronary-artery-bypass-grafting (CABG) surgery, occurring in 30% of cases. The incidence of this complication is even higher after valve-replacement surgery (30–40%) and after compound operative procedures (40–60%). Beta-blockers reduce POAF and supraventricular tachycardia and have direct antiarrhythmic activity. Landiolol hydrochloride, is an ultra-short-acting beta-blocker half-life of approximately 4 min. The selectivity ratio of landiolol is higher than other beta-blockers.

Methods

A decision-model was developed to reflect the cost-effectiveness of landiolol vs. no-prevention, standard-of-care (SoC) and esmolol for the patient group with different cardiac surgeries and a subgroup of CABG. The model benefit is expressed in a reduction in POAF episodes and reduced complications. Clinical data were derived mainly from the meta-analysis of Li et al. (2015) involving 807 patients (9 RCTs). Based on meta-analysis findings a decision tree model for two patient populations, (1) for patients with cardiac surgery in general and (2) for patients with CABG, was developed. The model calculates total inpatient costs (incl. surgery, ICU, complication and re-hospitalisation) over the hospital-length-of-stay (LOS). Costs from published sources were used (2016 Euro) from the German hospital perspective. A one-way deterministic sensitivity-analysis accounts for uncertainty.

Fig. 1: Model Design



Source: own developed

Clinical Data

The economic model of landiolol was designed based on clinical trial data of the RCTs and the meta-analysis of Li et al. (2015). In addition, a recent publication from Sezai and colleges (2015) was added.

- The AF protecting effect of landiolol in the all-surgery patient population was:
- The POAF incidence was 12.4% with landiolol and 36.7% for the *control group*.
 - AF incidence for landiolol exhibits 13.5% compared to 38.4% for *no prevention*.
 - AF incidence was 19.1% for landiolol and 39.2% for *SOC*.

The AF-protecting effect of landiolol in the CABG patient population is illustrated as follows:

- The POAF incidence was 12.1% with landiolol and 34.2% for the control group.
- AF incidence for landiolol exhibits 13.0% compared to 35.5% for no prevention.
- AF incidence was 8.8% for landiolol and 30.4% for SOC.
- For the indirect comparison the net effect of esmolol vs. control was calculated and expressed as adjusted trial difference of the SoC effect (30.4%) in the landiolol trial.

Resource Use and Costs

Resource use data were derived via literature search including German data to reflect the German clinical practice. The CEA collects hospitalization costs due to cardiac surgery (including ICU costs), costs of complication and hospital readmission. Medication costs for POAF prevention are covered in the German G-DRG lump sum. All costs were derived from public price lists, tariff catalogues and the literature. When necessary, prices were adjusted to 2016 prices using the consumer price index. Due to the short time horizon of the model, discounting of costs is not necessary.

Results

Patients with POAF had a higher incidence of mortality, morbidity and LOS including ICU and more frequent readmissions and finally higher costs. Per patient costs in the all-surgery population with landiolol are estimated between 24,234.21 €-25,910.02 € and AF occurred in 12.4%-19.1% of cases. Analyzing the CABG subgroup, per patient costs with landiolol are estimated between 23,960.86 €-24,216.84 €. AF cases occurred in 8.8%-12.1% of patients. Compared to comparators landiolol is able to reduce costs between 1,536.92 € (no-prevention) and 1,448.23 € (esmolol)

Tab. 1: Results, all-surgery patient population

Strategy	Total costs (€) per patient landiolol	Total costs (€) per patient comparator	POAF free patients (%) landiolol	POAF free patients (%) comparator	Additional costs/savings per POAF avoided (ICER)
L vs. C	24,650	26,538	87.6%	63.3%	-7,783
L vs. nP	24,234	25,870	86.5%	61.6%	-6,569
L vs. SoC	25,910	27,751	80.9%	60.8%	-9,150

Tab. 2: Results, CABG patient population

Strategy	Total costs (€) per patient landiolol	Total costs (€) per patient comparator	POAF free patients (%) landiolol	POAF free patients (%) comparator	Additional costs/savings per POAF avoided (ICER)
L vs. C	24,163	25,672	87.9%	65.8%	-6,834
L vs nP	24,217	25,754	87.0%	64.5%	-6,848
L vs. SoC	23,961	25,421	91.2%	69.6%	-6,766
L vs. E	23,961	25,409	91.2%	69.8%	-6,768

L = Landiolol; C = Control; nP = No prevention; SoC = Standard of Care; ICER= incremental cost effectiveness ratio
Source: own calculations

Compared to controls in the all-surgery patient population, prevention with landiolol reduces costs of hospital stay by 1.888 € (-1.636 € - 1.888 €) and reduces POAF by 24.3% (20.1% - 24.9%). An in-depth analysis shows that the major proportion of cost reduction is associated with the reduced hospital length of stay (985.07 €- 1,250.92 €) followed by decreased ICU stay costs (223.65 € - 290.36 €) (Fig.2A). The analysis for CABG patients shows similar results. The major proportion of cost reduction is associated with the reduced hospital length of stay (900.43 €- 944.37 €) followed by costs to manage complications (205.72 € - 233.79 €) (Fig.2B).

Fig. 2A: Cost components, all-surgery population vs. Control

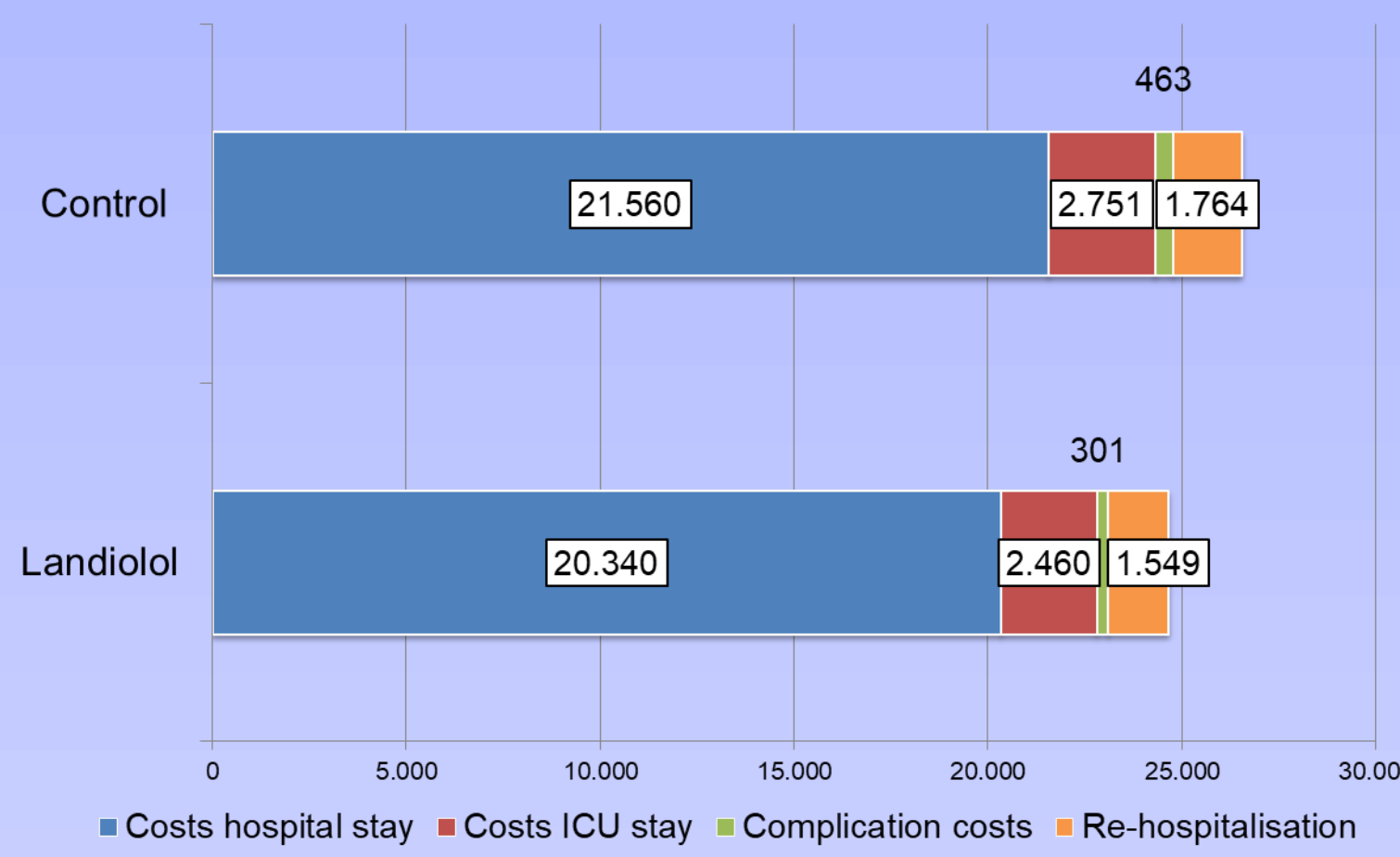
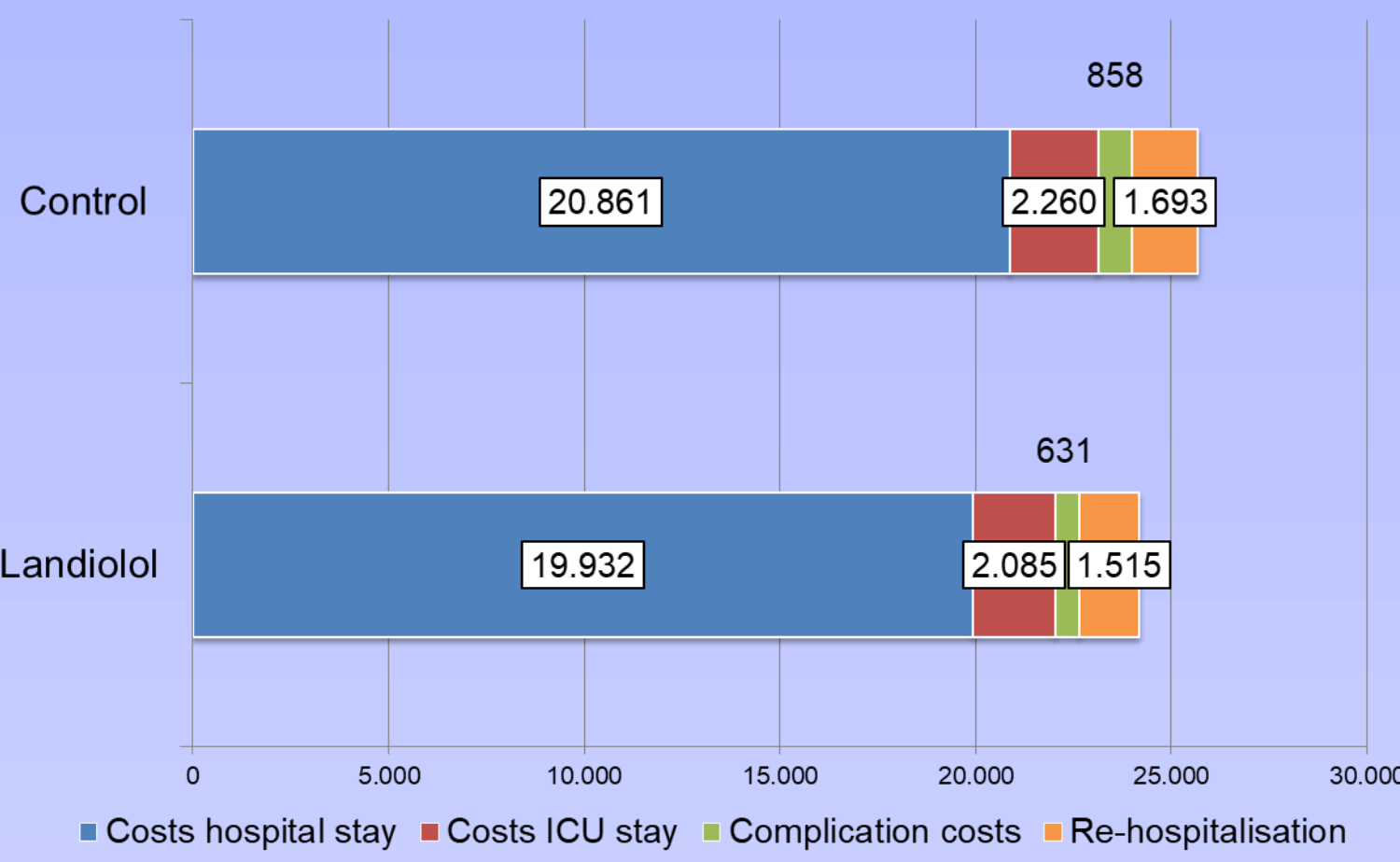


Fig. 2B: Cost components, CABG population vs. Control



Source: own calculations

Sensitivity Analysis

Deterministic sensitivity analysis (SA) was carried out. Fig. 3A display results for the all-surgery population and Fig. 3B for the CABG population. ICERs of landiolol versus control ranged from -6,777.51 to -8,789.27 €. The effect on costs hospital stay, hospital LOS and costs of ICU stay show the greatest influence. Landiolol remains the dominant strategy in all variations of SA.

Fig. 3A: Probabilistic SA, all-surgery population

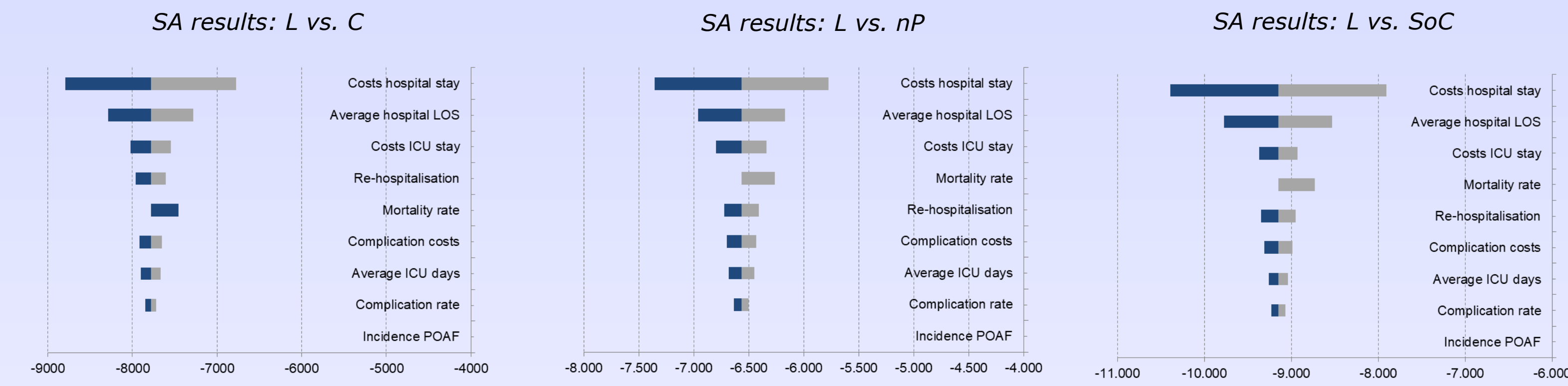
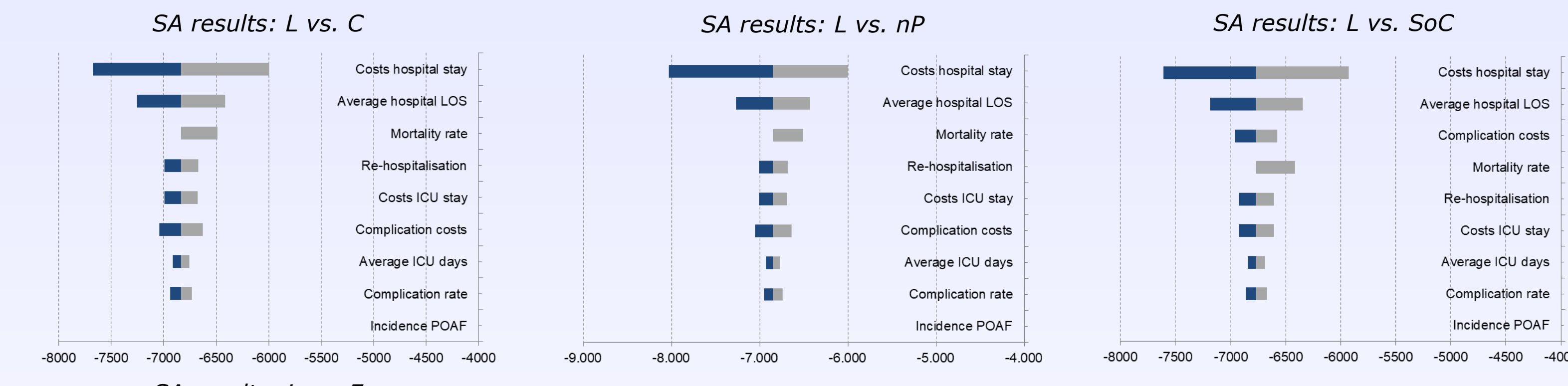


Fig. 3B: Probabilistic SA, CABG population



Source: own calculations

ICERs of landiolol versus control ranged from - 5,992.7 € to -7,675.98 €. Variations of costs hospital stay, hospital LOS and the mortality rate demonstrate the greatest influence. Landiolol remains the dominant strategy in all variations of SA.

Conclusion

The economic analysis of landiolol shows that the use is highly cost-effective - represent the lowest total cost in both patient populations and is associated with a superior effect to prevent POAF. Landiolol generates cost savings from the hospital perspective as well as the German health care system as whole.

References

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Additional Literature with the author