COST-EFFECTIVENESS OF MEDICAL INNOVATIONS:

REVISION HIP ARTHROPLASTY IN TYPE IIIB ACETABULUM DEFECTS WITH A 3D-PRINTED CUSTOM POROUS THREE-FLANGED ACETABULAR IMPLANT.

Materialise World Summit

Philip Tack

Lieven Annemans

Innovations

- Drivers of economies

- The appropiate cost

- Health and economics

Health Technology assessment

- WHO:

  The systematic evaluation of properties, effects, and/or impacts of health technology. It is a multidisciplinary process to evaluate the social, economic, organizational and ethical issues of a health intervention or health technology. The main purpose of conducting an assessment is to inform a policy decision making.
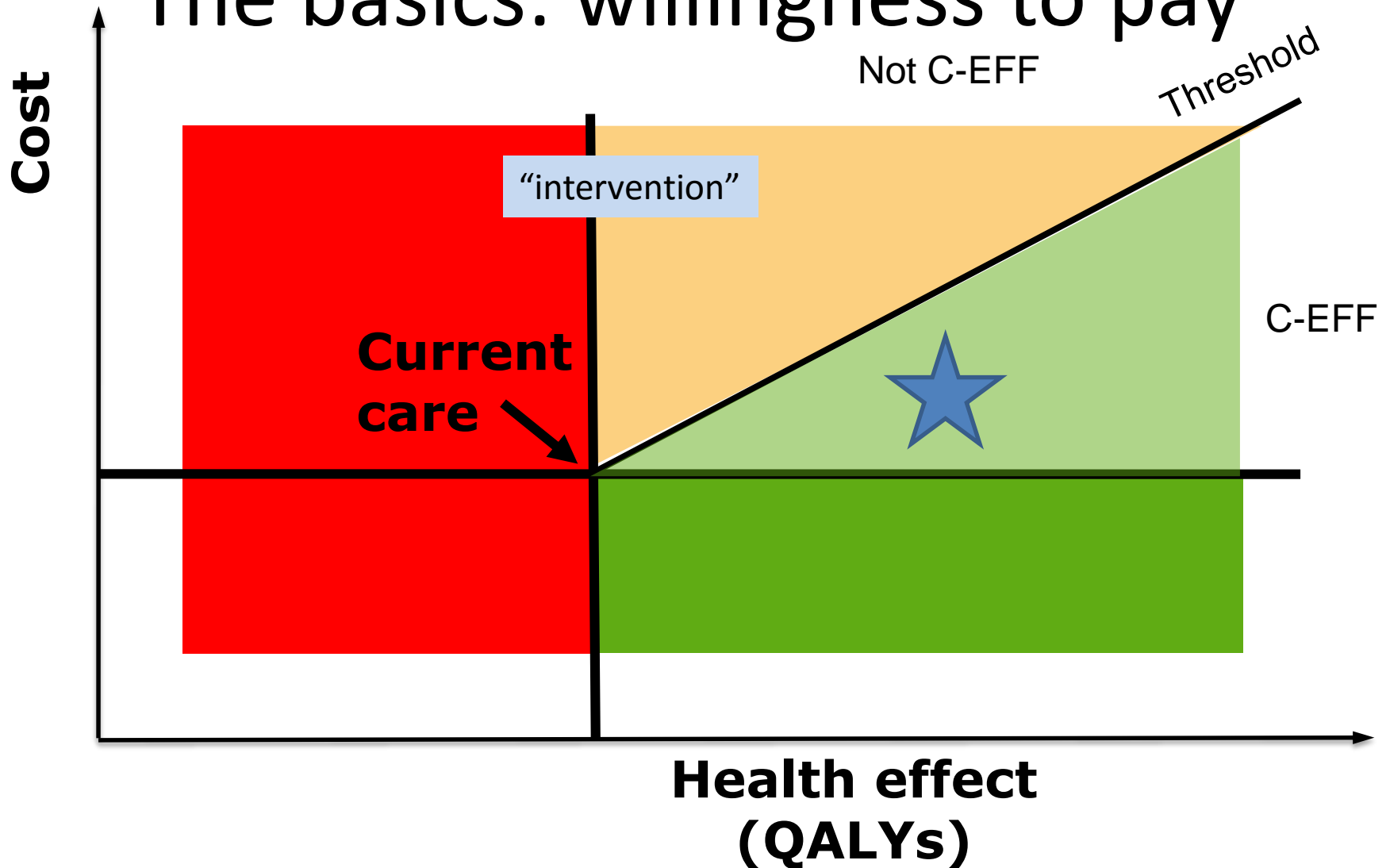
The basics

Lenght of life vs. Quality of life
Quality adjusted life years (QALY)
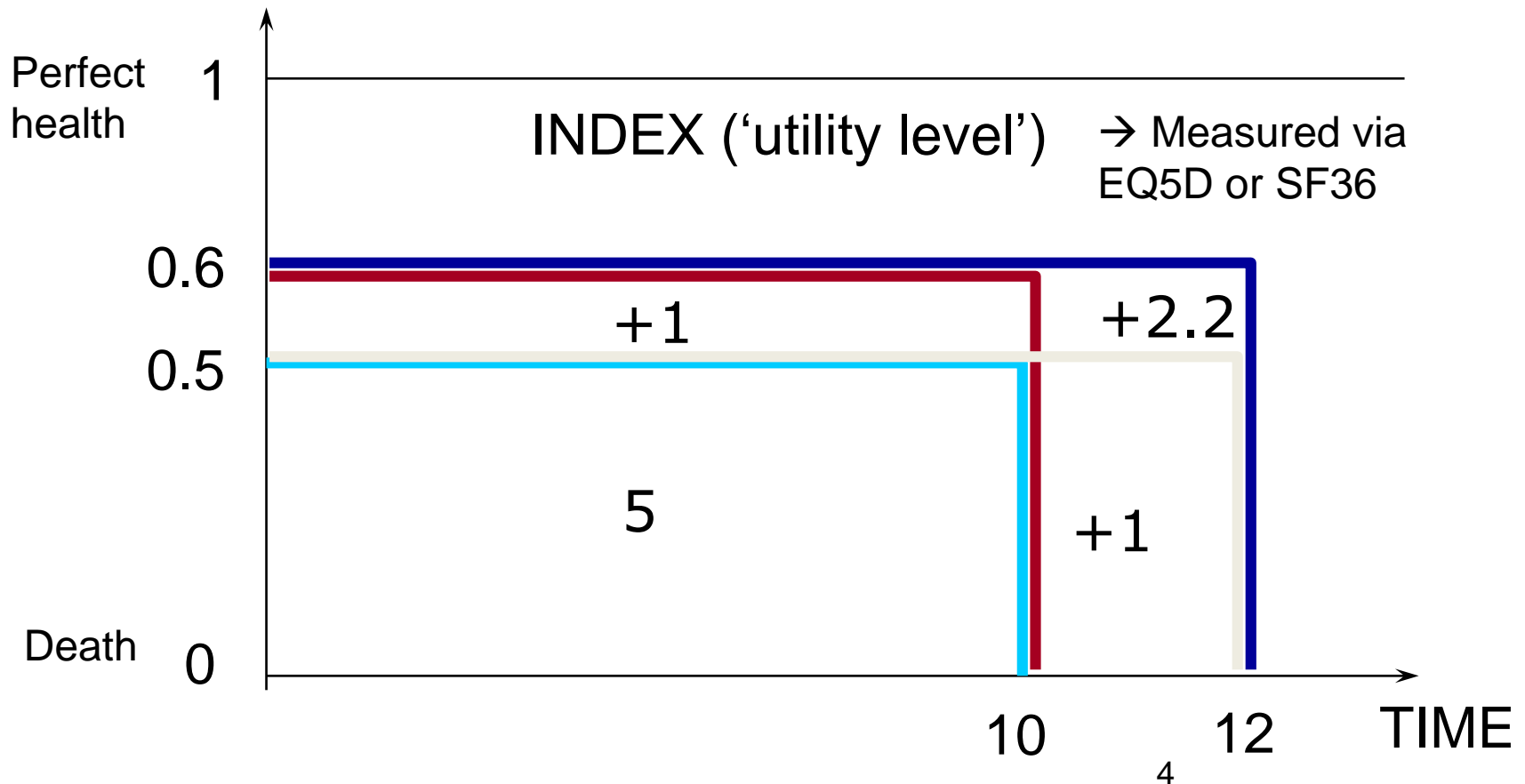
The basics: Costs… for who?

- Patients
- Hospitals
- Doctors
- Public healthcare providers
- Insurance companies
- ….

Working example:
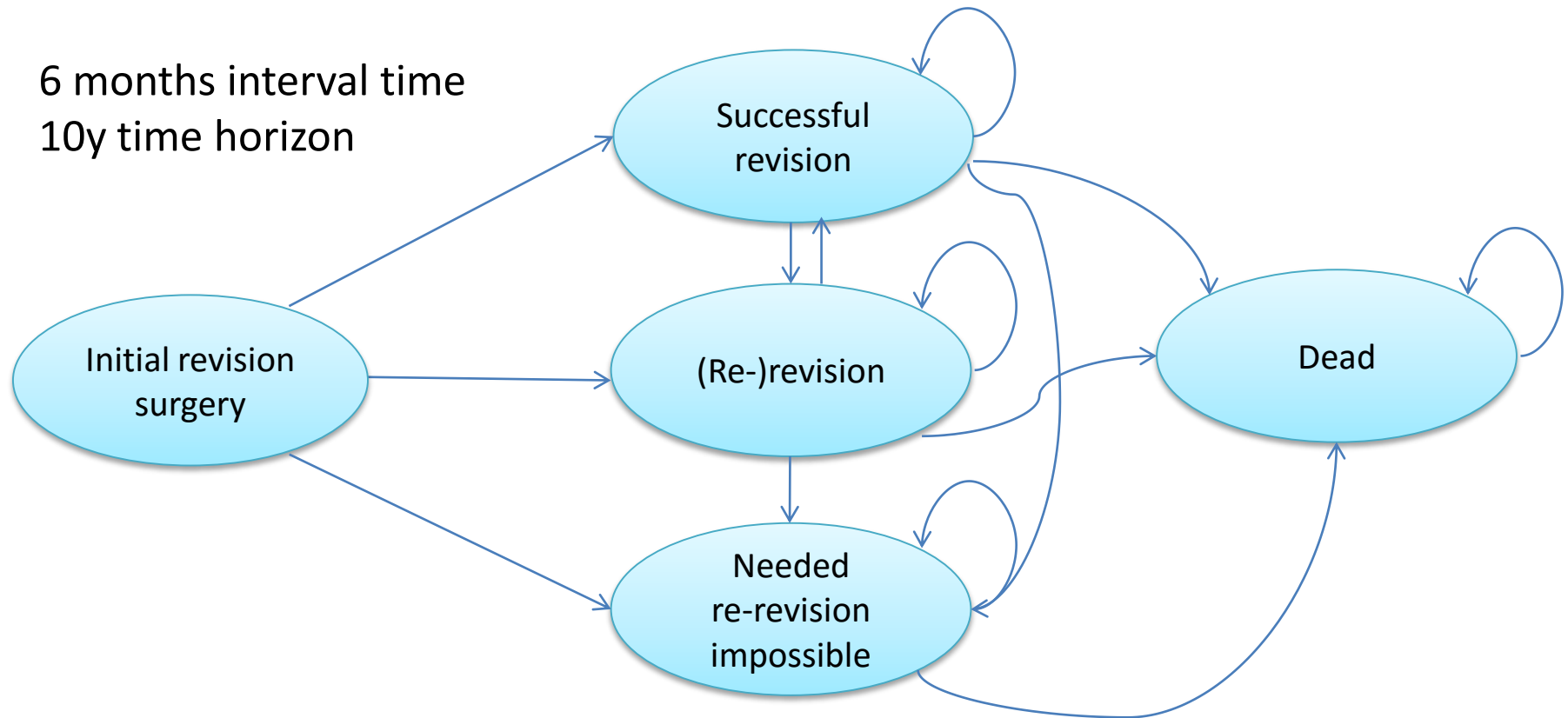# 3D printed implant for total hip revision arthroplasty

Clinical evidence

- Clinical studies → usable data
- → Structure of the model
- → Transition probabilities
- → Complications profile
- → Utilities & Costs

Building the model

6 months interval time
10y time horizon

Successful revision

Initial revision surgery

(Re-)revision

Needed re-revision impossible

Dead

Complications profile

Custom Triflanged Acetabular Component					
Type of complications	Berasi	Barlow	Wind	Tauton	Average
Sciatic nerve pain	4.17%		5.26%	5.26%	3.07%
Bursitis	4.17%			0.00%	0.61%
Dislocation	0.00%	22.37%	26.32%	21.05%	19.07%
Loosening	0.00%	4.62%	5.26%	3.51%	3.62%
Infection (maj)	8.33%	6.35%	5.26%	7.02%	6.75%
infection (min)			10.53%	0.00%	1.23%
All operative complications		26.98%			10.43%
Dislocation Barlow calculated		22.37%			8.65%
Debridement		3.17%		3.51%	2.45%

aMace	
Type of complications	Myncke
Dislocation	18.18%
Infection	4.55%
Loosening	0.00%
Other	13.64%
Hematom	4.55%
Sciatic nerve palsy	4.55%
Pelvic instability	4.55%

Utilities

	Successful	Re-revision aMace	Re-revision Triflanged	Re-revision impossible
Men <65	0.7731	0.5507	0.5928	0.4513
Men 65-74	0.7487	0.5333	0.5740	0.4371
Men 75-85	0.6756	0.4812	0.5180	0.3944
Men 85+	0.6756	0.4812	0.5180	0.3944

Transition probabilities & Costs

- Transition probabilities:
  - Implant's profile (separate models)
  - Age of the patient
  - State in t-1

Cost side

- Perspective: Public Healthcare Provider
- Dead
- Successful revision
- Impossible revision / resection arthroplasty
- Re-revision... Implant dependent
  - Complications
  - Revalidations
  - Implant itself
  - ....

Patient X

- Male, <65years old
- Needs a re-revision and has a acetabular paproski type IIIB defect
- Standard CTAC or new aMace implant

aMace		CTAC		DELTA aMace vs CTAC		
QALY	COST	QALY	COST	QALY	COST	ICER
7.15	€ 25,316.96	7.0152118	€ 23,114.66	0.13051719	€ 2,202.31	€ 16,873.69

What about other profiles?

|	aMace Integrated		CTAC		Delta aMace vs. CTAC		ICER
	QALY	COST	QALY	COST	QALY	COST	
Male, <65y	7.15	€ 25,316.96	7.02	€ 23,114.66	0.13	2202.31	16873.69
Male, 65-74y	5.70	€ 25,310.73	5.62	€ 22,729.94	0.08	2580.78	31372.29
Male, 75-84y	4.91	€ 25,308.63	4.84	€ 22,644.90	0.07	2663.73	37031.90
Male, 85+	3.10	€ 25,289.58	3.07	€ 21,988.99	0.03	3300.59	99017.03
Female, <65y	6.98	€ 25,317.20	6.85	€ 23,132.14	0.13	2185.06	16955.23
Female, 65-74y	5.84	€ 25,311.40	5.75	€ 22,769.46	0.09	2541.94	28563.32
Female, 75-84y	5.93	€ 25,311.18	5.83	€ 22,795.01	0.10	2516.17	24706.18
Female, 85+	3.75	€ 25,292.35	3.69	€ 22,086.19	0.06	3206.16	55972.21
Average, <65y	7.05	€ 25,317.08	6.92	€ 23,123.34	0.13	2193.74	16949.78
Average, 65-74y	5.86	€ 25,311.10	5.77	€ 22,751.83	0.09	2559.27	29091.45
Average, 75-84y	5.80	€ 25,310.11	5.71	€ 22,729.70	0.09	2580.41	27292.76
Average, 85+	3.70	€ 25,291.48	3.64	€ 22,053.85	0.05	3237.63	60683.17

Uncertainty / Variance

- Results of the studies
- Utility estimates
- Cost estimates
- Transition probabilities
- …..

- What is the impact of a mistake or change of the value chosen for a specific variable?
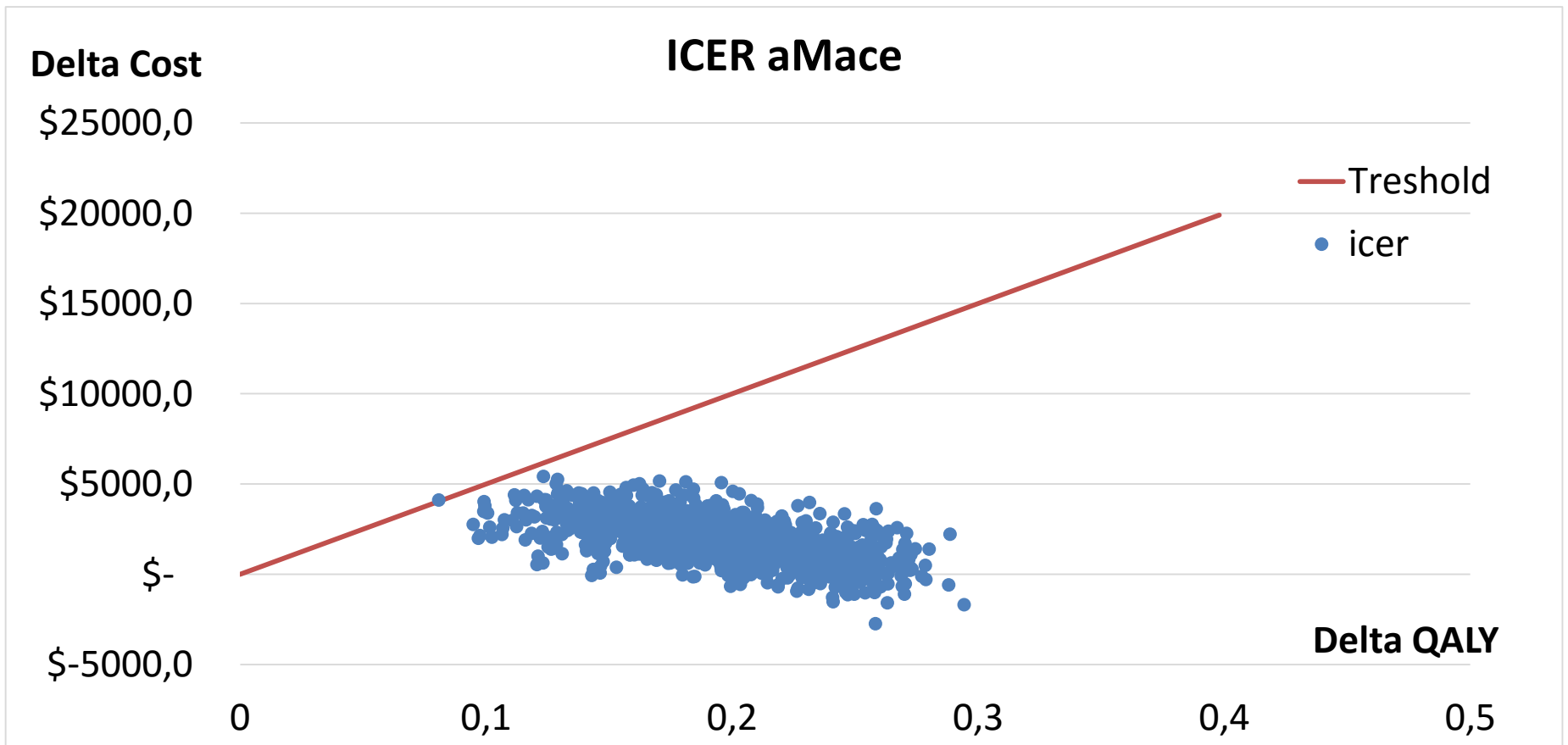
Sensitivity analysis
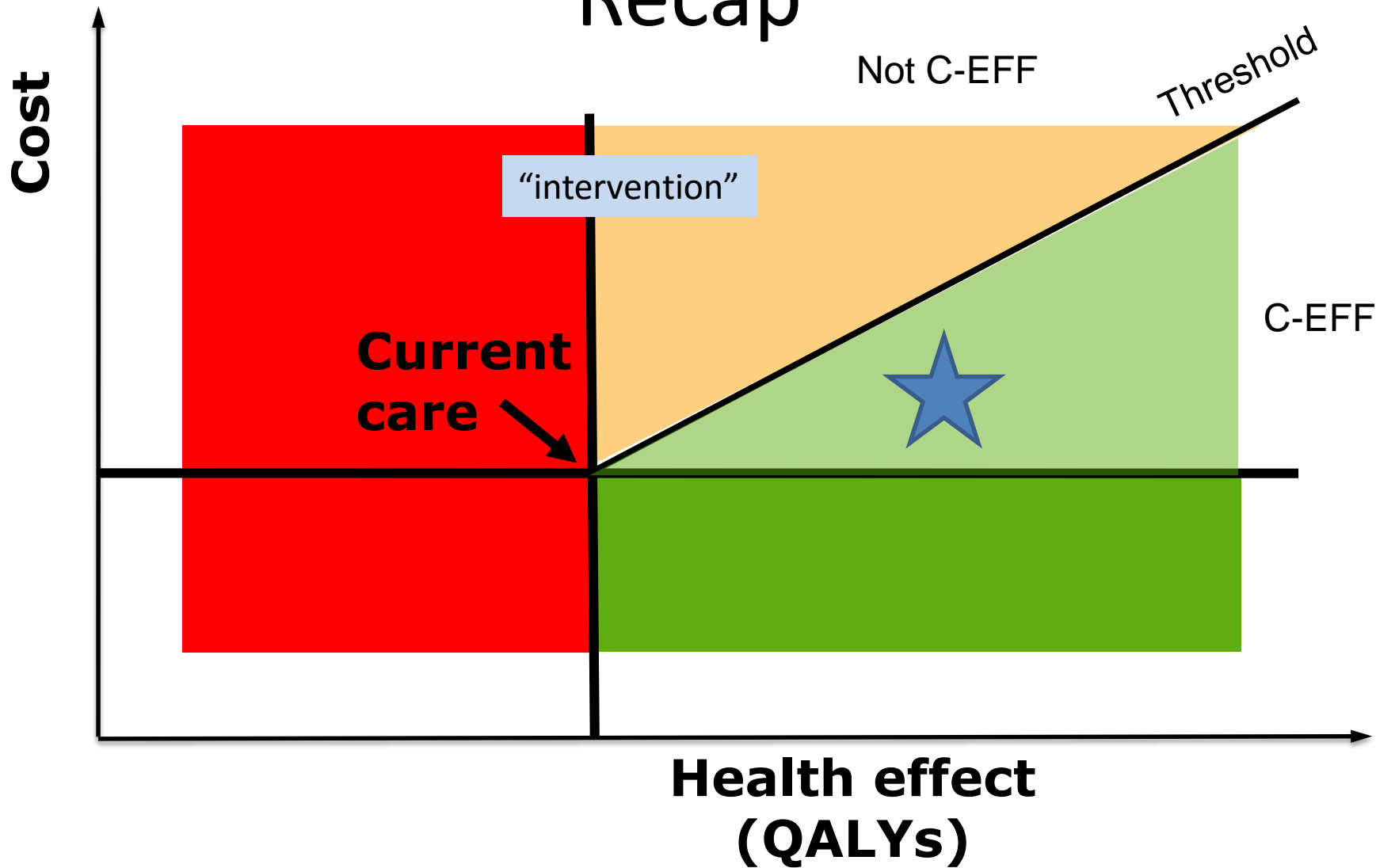
- Deterministic: +30%; -30%

- Basecase: €16873
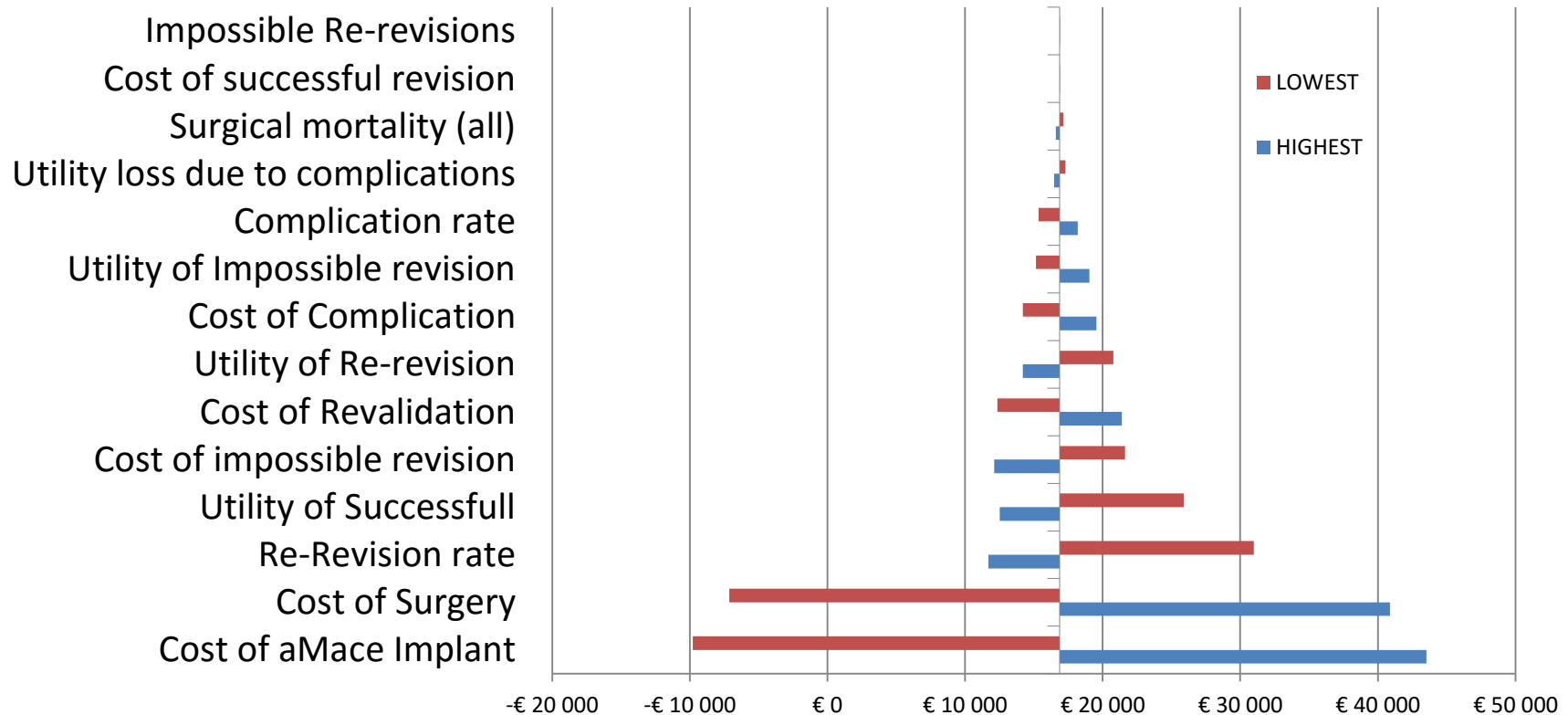
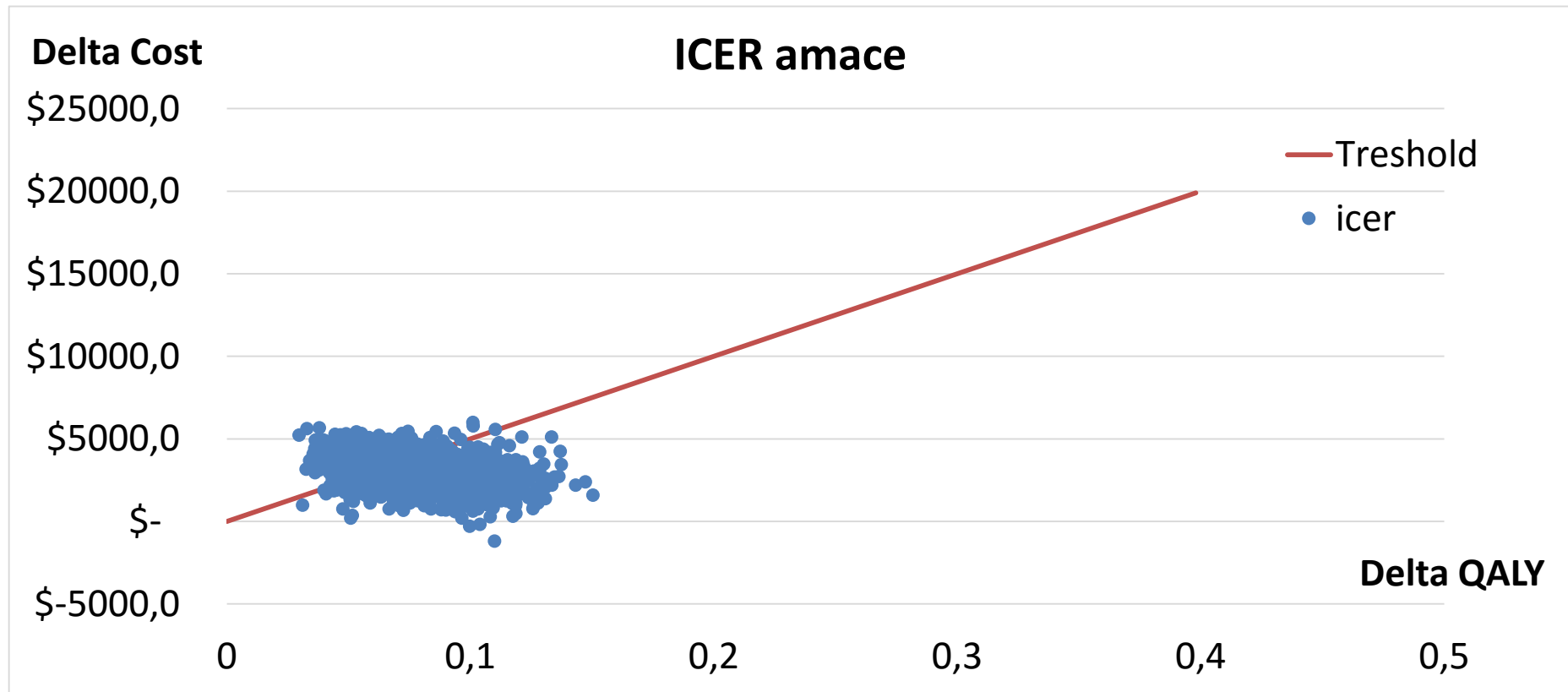# Sensitivity analysis: Probabilistic
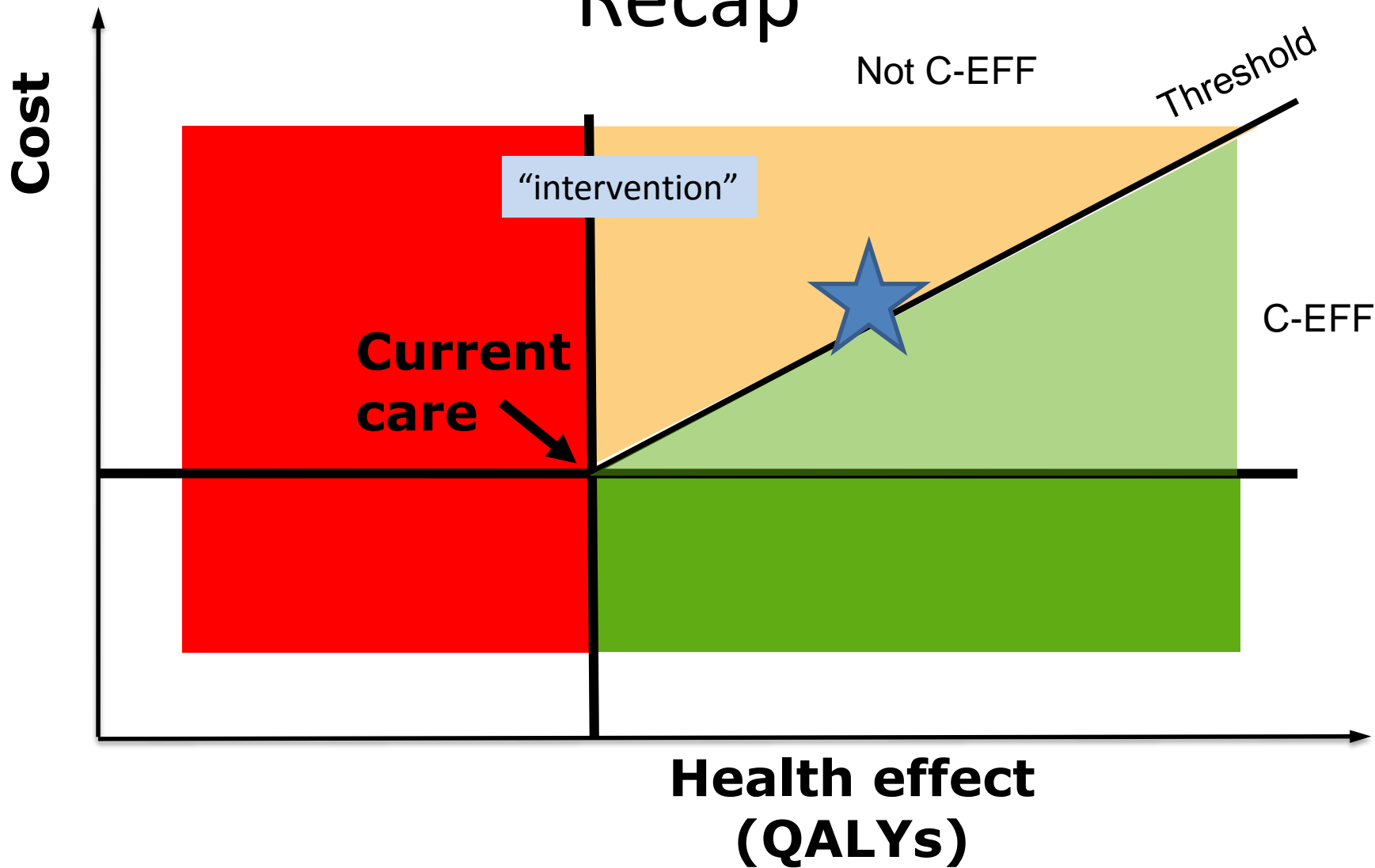
- <65 years old male

Recap

85+ year old woman

Basecase: €55972

Recap

Conclusions for this case

- Good value for money
- <85 years: cost effective at €50k/QALY
- Basecase: 65 year old man: ICER of 16873
- High impact:
  - Price of the new 3D-printed implant
  - Price of the surgery
  - Re-revision rate
  - Utility estimate for successful surgery

Perspective

- What about other (applications of) new technologies (like medical 3D-printing)

- Early data generation

- Reimbursement to generate evidence?

- Proving the value or pushing the price?

Value for money of Medical 3D-printing

- Complex cases – not for standard procedures
- High impact on QoL
  - Young patients
  - High morbidity associated with failure

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