The future (challenges) of surgical robotics

Maroeska Rovers

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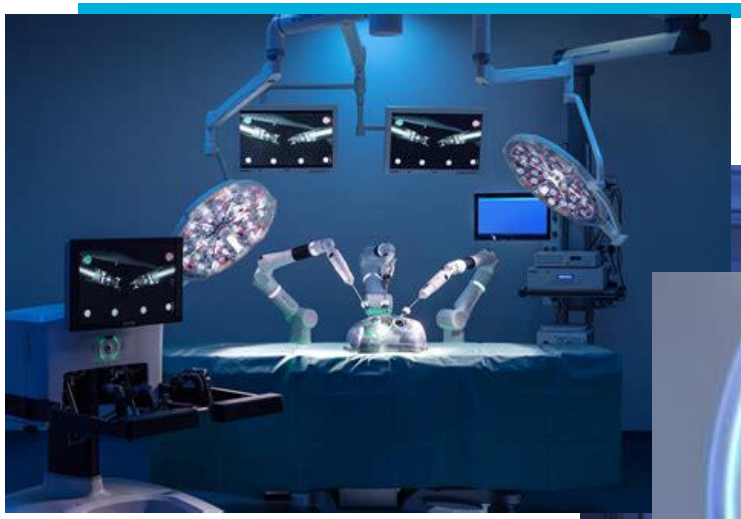
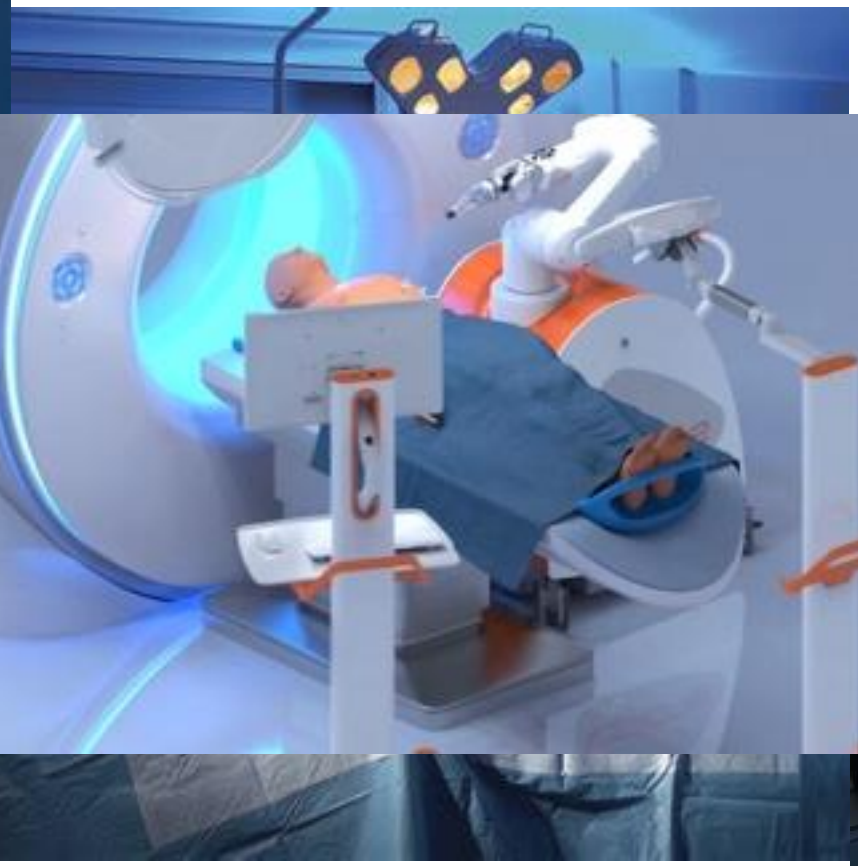
Radboudumc





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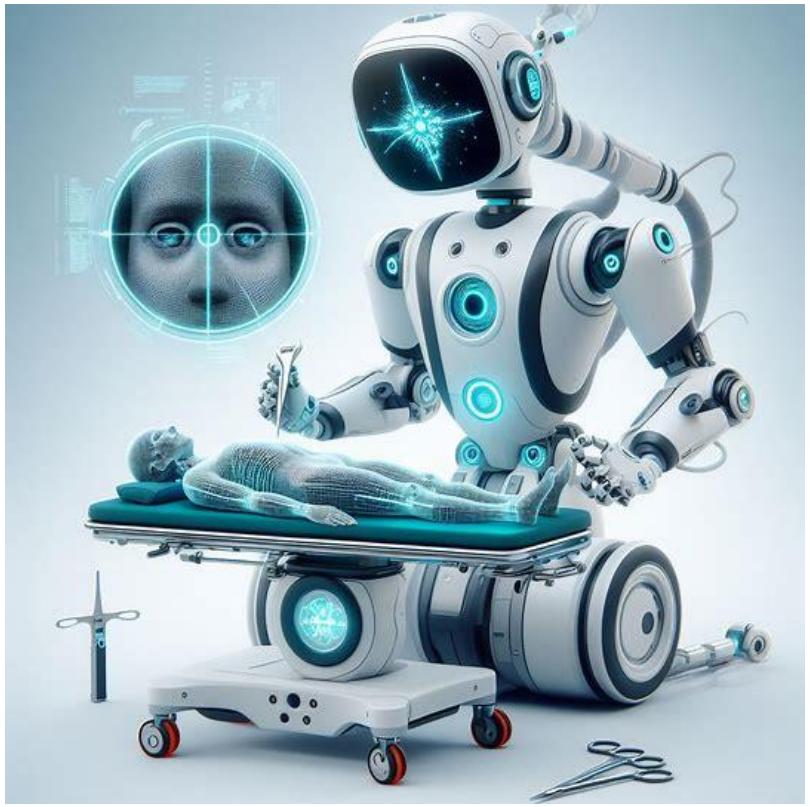
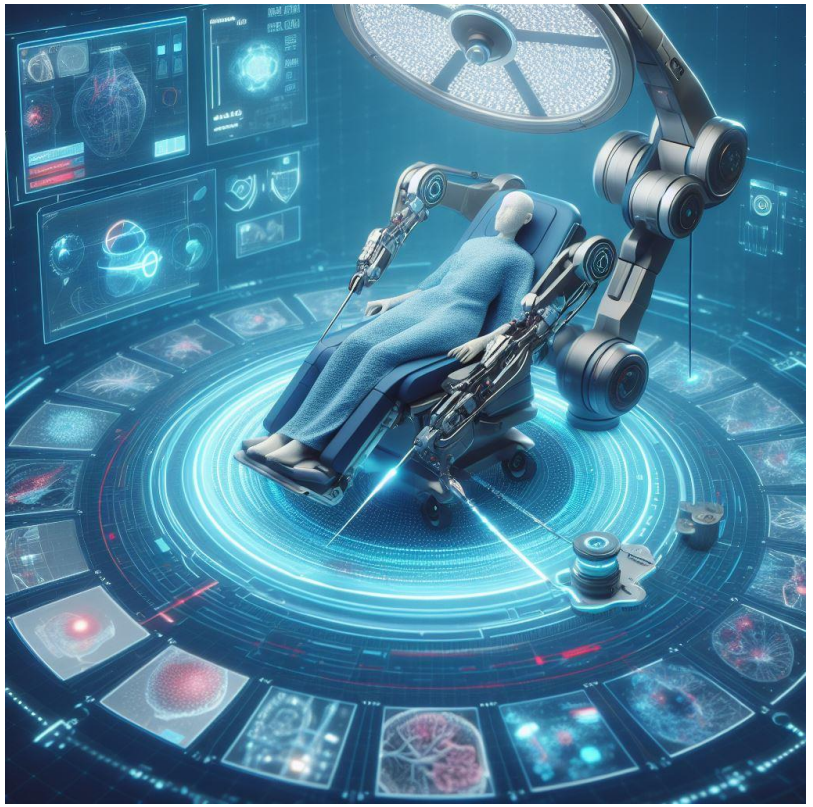
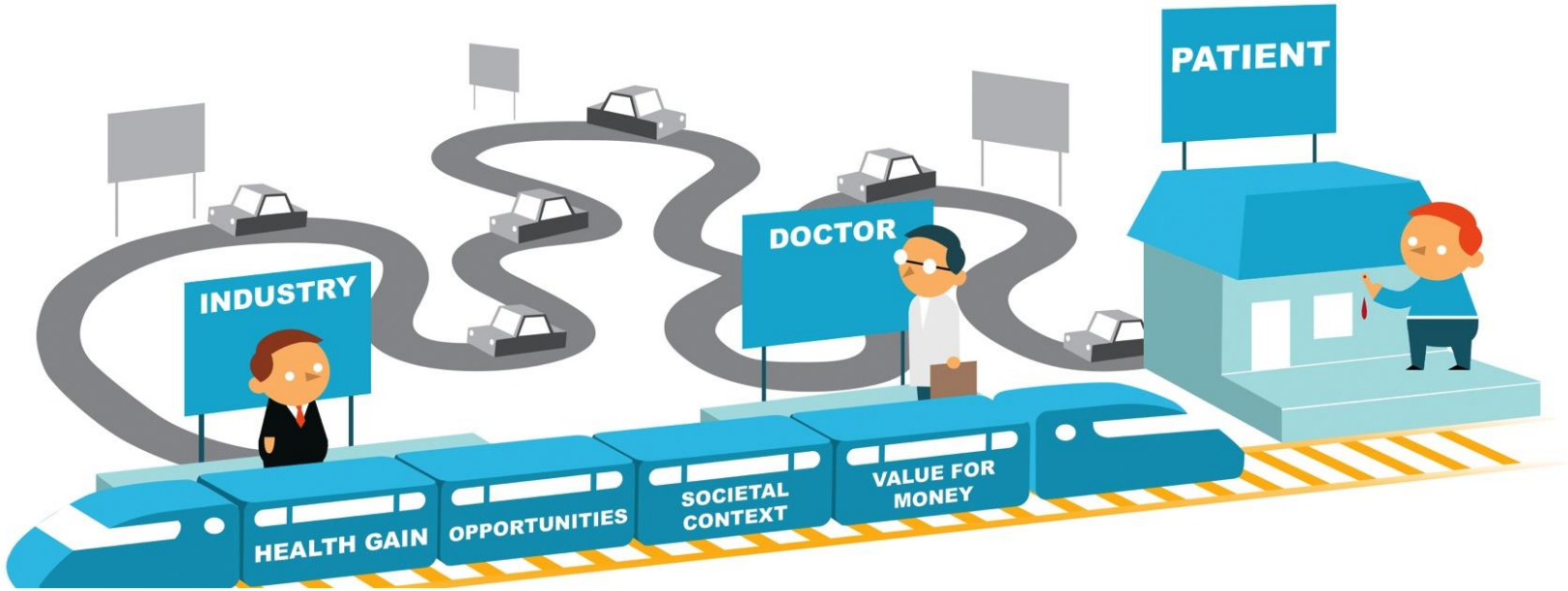


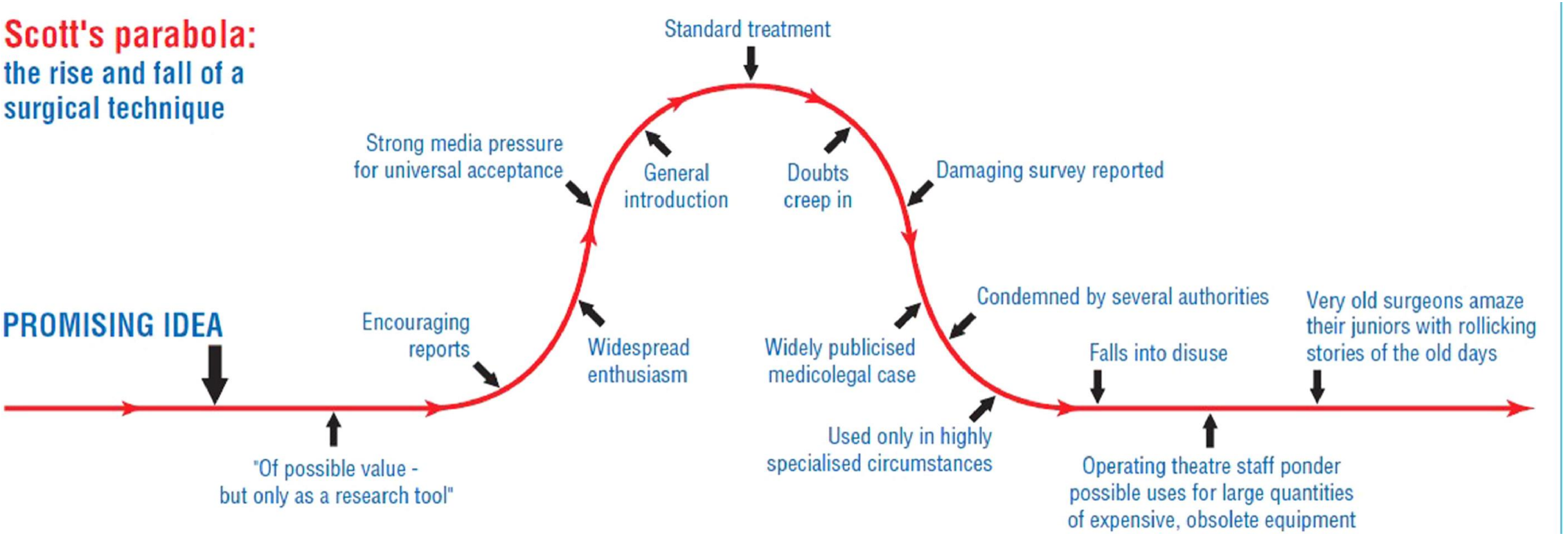


©Copilot

Innovation is hard



- About 80% of ideas and concepts will never launch
- About 70% of launched product will dissapear within 2 years


Scott's parabola:
the rise and fall of a surgical technique
PROMISING IDEA
"Of possible value - but only as a research tool"
Encouraging reports
Strong media pressure for universal acceptance
Widespread enthusiasm
General introduction
Standard treatment
Doubts creep in
Damaging survey reported
Widely publicised medicolegal case
Condemned by several authorities
Used only in highly specialised circumstances
Falls into disuse
Operating theatre staff ponder possible uses for large quantities of expensive, obsolete equipment
Very old surgeons amaze their juniors with rollicking stories of the old days

“Ugly baby syndrome” - Mary Dixon Woods

- You are always biased in favour of the ideas you develop
- Need to ask: “Do idea I gave birth to really work?” [or is my baby “ugly”?]
- Beware the “conspiracy of enthusiasm”
- Only solution is to objectively evaluate your idea

The challenge

Buxton's law: "It's always too early to do an RCT, until it's suddenly too late."

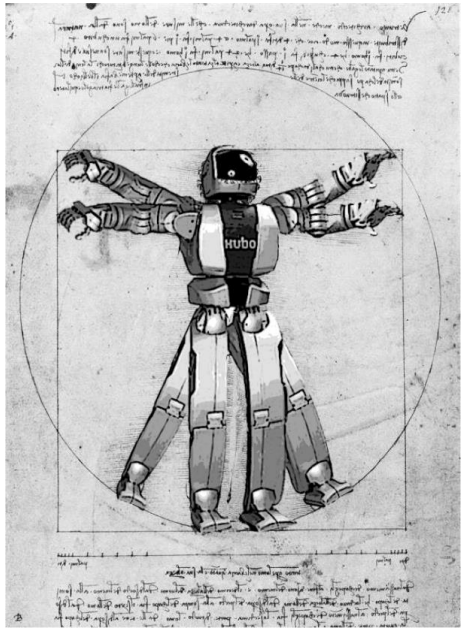
- Too early: still learning
- Too late: no equipoise
- Surgeons are more likely to have a problem with equipoise.

Evidence so far…..

Eligible articles for manuscript (n=153)

- Prostate (n = 14)
- Nephrectomy (n = 5)
- Colorectal (n = 23)
- Lobectomy and thymectomy (n = 9)
- Gynecology (n = 14)
- Hepatopancreatobiliary (n = 27)
- Upper GI and Bariatrics (n = 13)
- Others (e.g. Cardiovascular, Otolaryngology) (n = 48)

Ann. Surg. 2021;273(3):467-473.



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The challenge

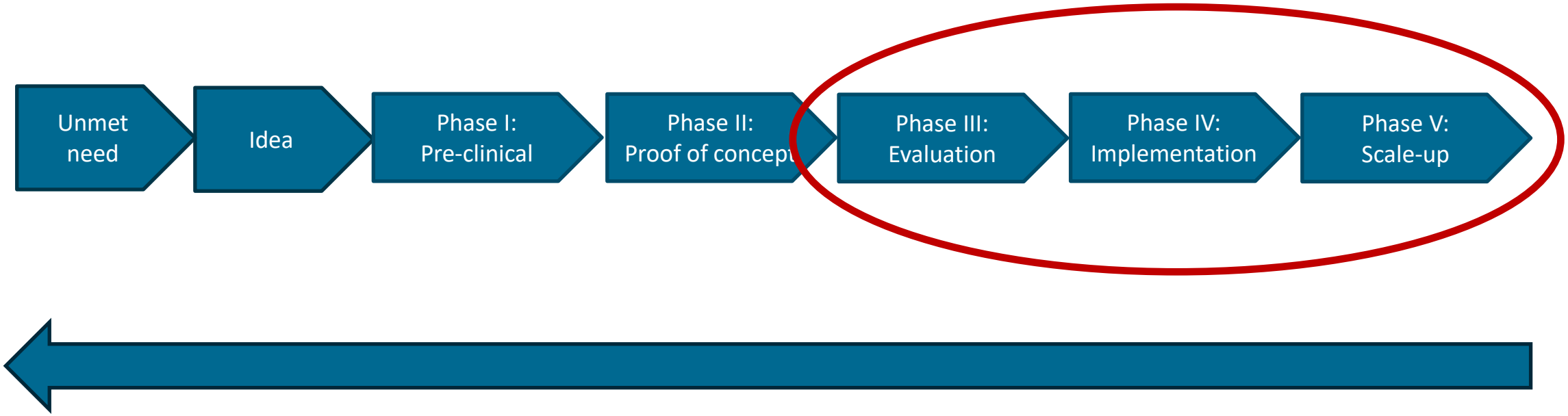
- Added Value
- Effectiveness
- Affordability
- Staffing
- Decarbonized footprint

Problem & conditions

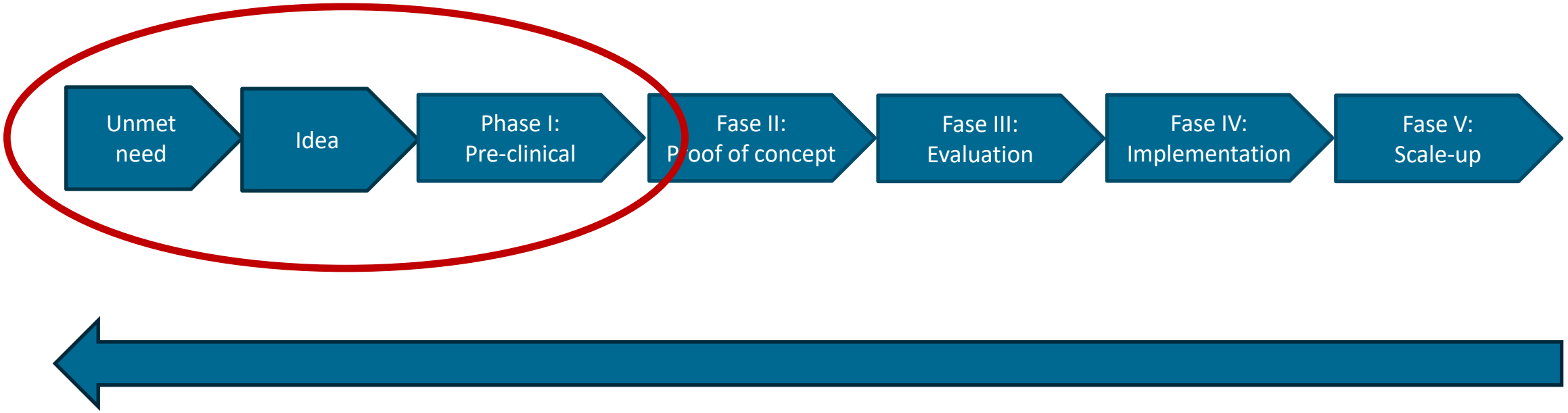
- https://www.dropbox.com/scl/fi/wqdcg9h3mxwfs17dz5rn0/Elevate-Health-VICI-animaties-1.mp4?rlkey=1tra5omly4eo0na5nkrb97tg6&dl=0

- See also: https://surginginnovation.com

Innovation funnel



Innovation funnel



nature medicine

Consensus Statement

https://doi.org/10.1038/s41591-023-02732-7

The IDEAL framework for surgical robotics: development, comparative evaluation and long-term monitoring

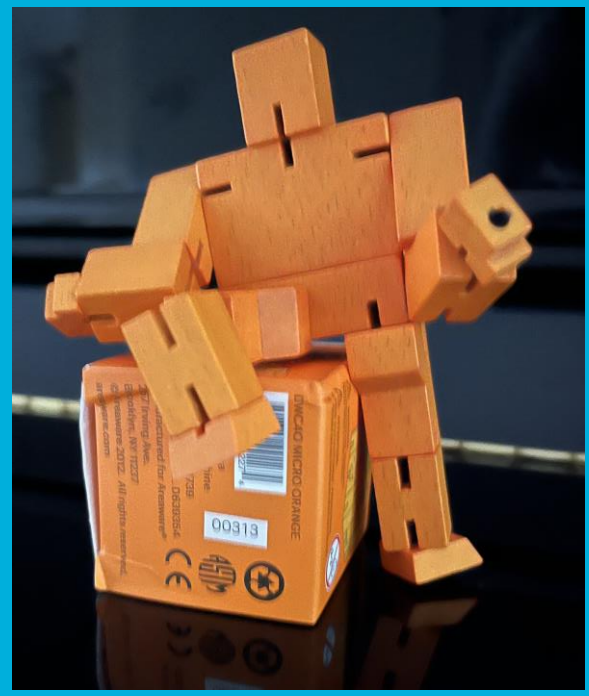
Systematic review

Involving stakeholders

Clinical studies

Early HTA

Can a new surgical robot be of added value and (cost-) effective?



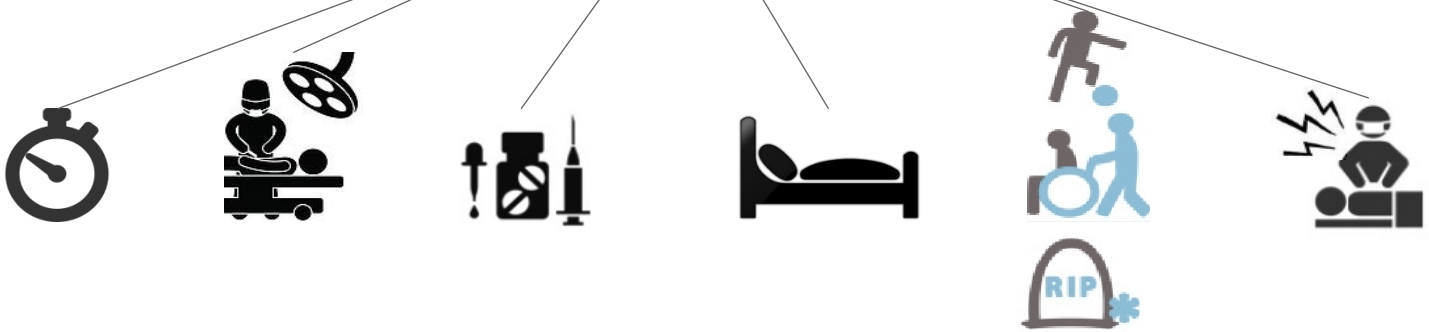
Patel S, Rovers MM, Sedelaar MJP, et al.
How can robot-assisted surgery provide value for money?
BMJ Surg Interv Health Technologies 2021;3:e000042

Radboudumc

Fixed cost

Extra variable cost

Potential revenues



Fixed cost

Variable	Value	Source
Robot	€2.000.000	Surgical Intuitive
Maintenance cost (per year)	€124.380	Surgical Intuitive
Depreciation years	7	Surgical Intuitive
Interest rate	4.2%	Dutch cost manual
Number of procedures	100 (70 – 200)	Numbers Radboudumc

Variable cost

	Variable cost per procedure	Difference with robot system
Robot	€1.658	-
Scopic	€1.454	-€204
Open	€337	-€1.320

Extra cost per procedure as compared to scopic

Fixed cost

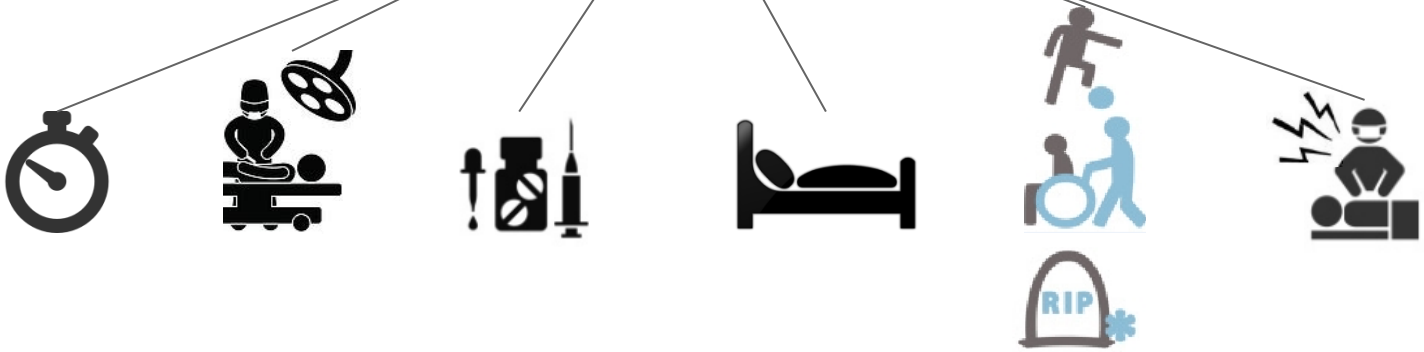
€4.601 / procedure

€4.804 / per procedure

Extra variable cost

€204 / per procedure

Outcomes



Extra cost per procedure as compared to open

Fixed cost

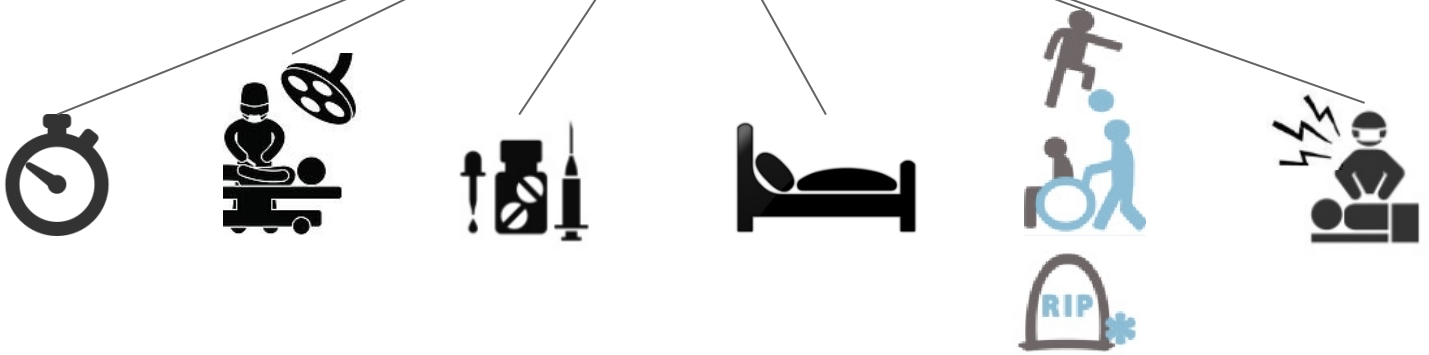
€4.601 / procedure

€5.921 / per procedure

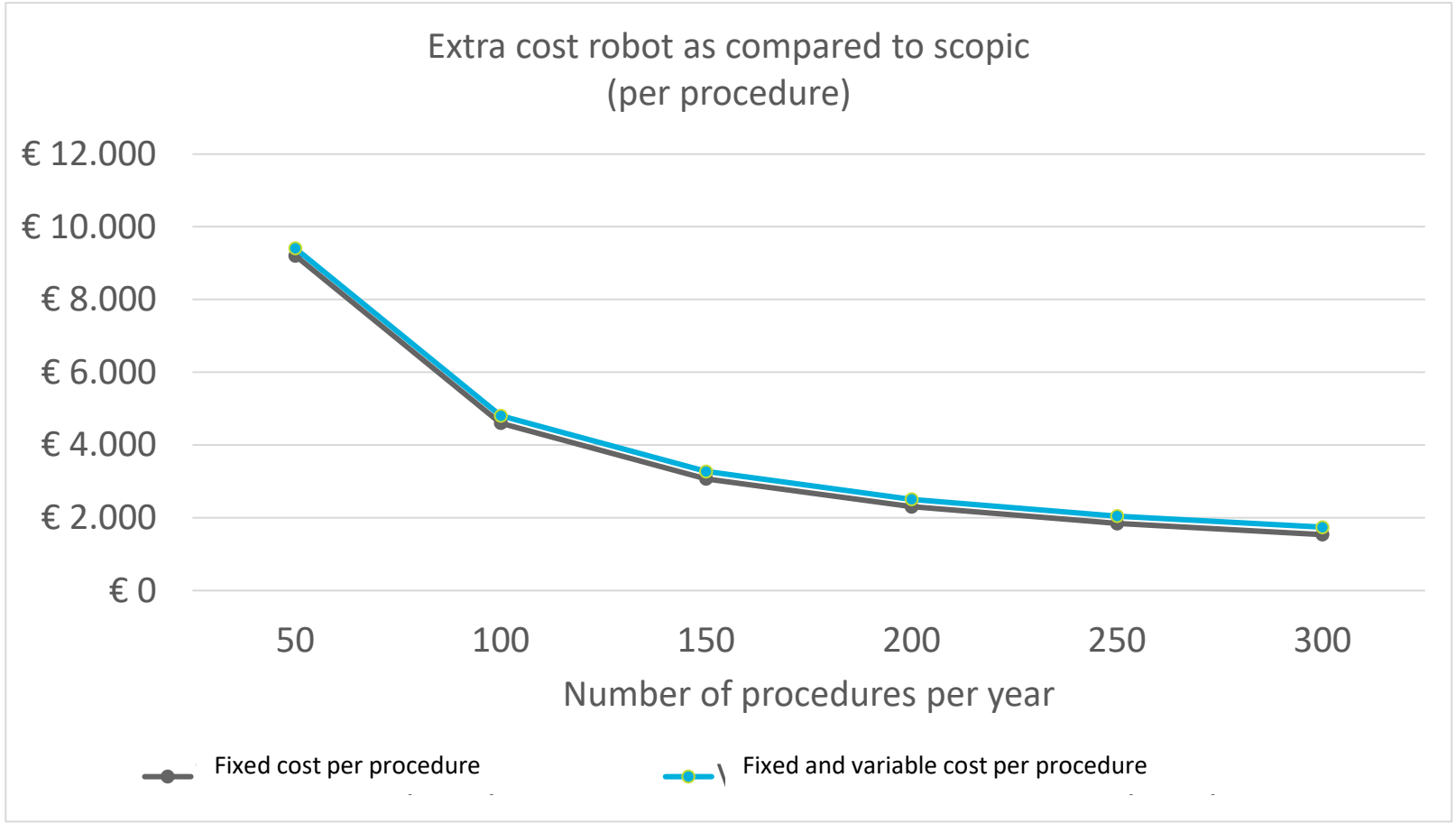
Extra variable cost

€1.320 / per procedure

Outcomes



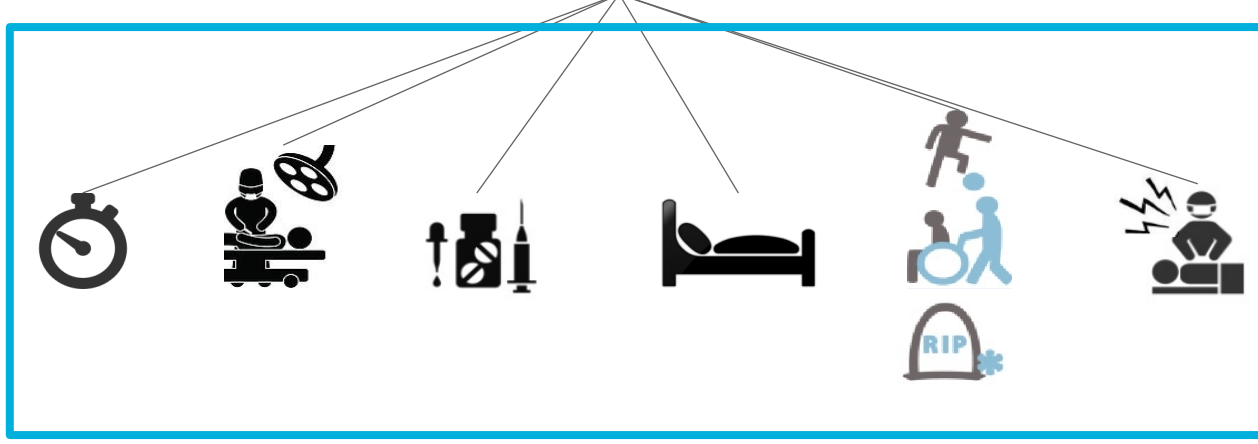
Number of procedures



Fixed cost

Extra variable cost

Potential revenues



€13.01/minute; €13.60/minute (Cost manual vs. Radboudumc)

€337/conversion (cost materials open procedure)

€642/day (Cost manual)

€80.000/QALY (ZIN)

€758/day; €1029/day (Cost manual vs. Radboudumc)

Base Case (as compared to scopic)

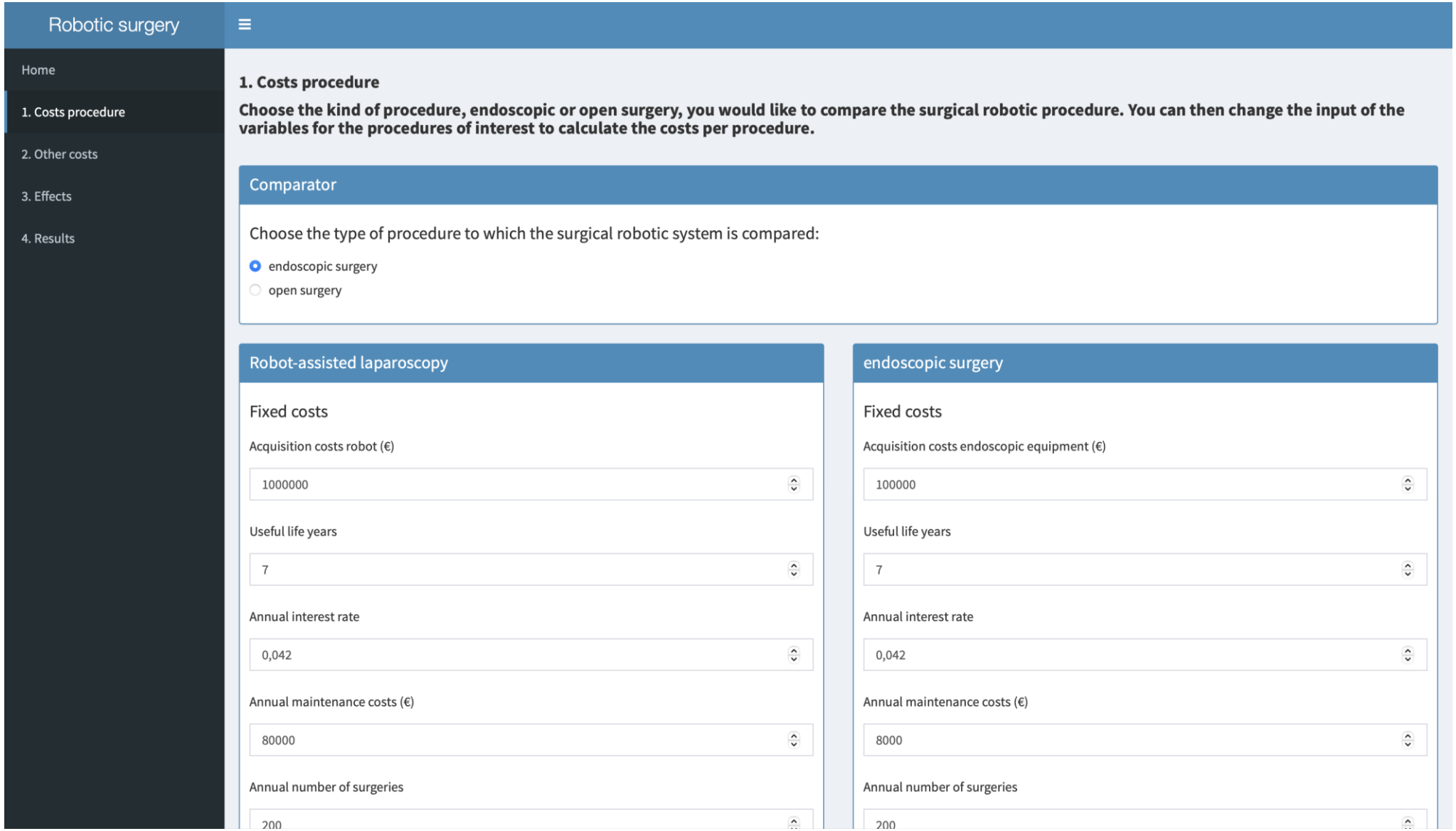
	Base Case – Total cost
Extra cost per procedure	*€4.804*
QALYs	0,060
Hospitalization	-7,5
Duration operating time (min)	-369 / -353*
Absenteeism surgeon (days)	-6,3 / -4,7*
Probability conversion	N/A (>-1)
Probability peri-operative complication	N/A (>-1)
Probability persistent complications	-0,71
Probability adjuvant treatment	-0,95
Probability metastases	-0,11

= 22 days in perfect health

Gain in QALYs is needed for the system to become cost-effective

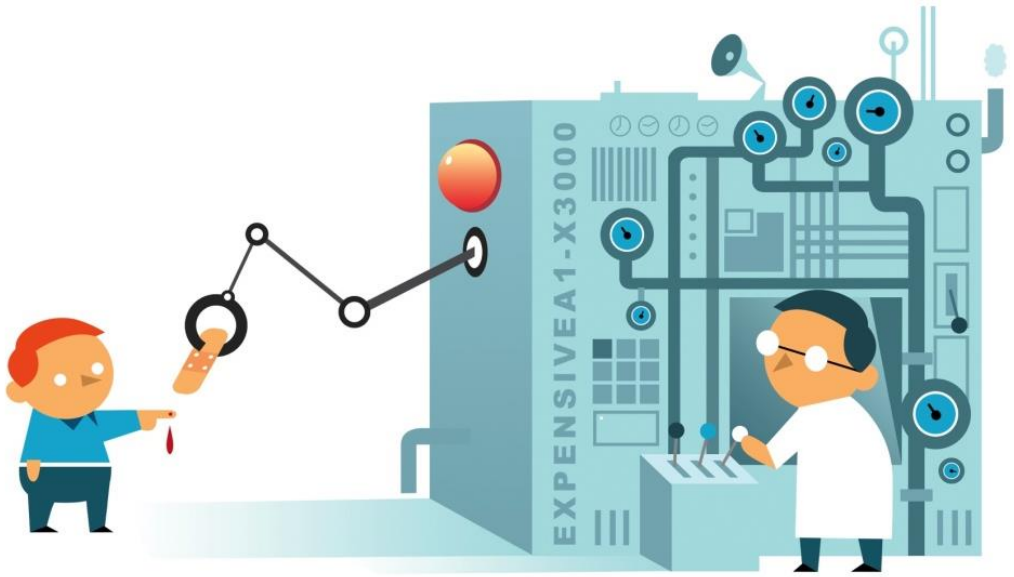
200 procedures per year

	Base Case – Total cost	Scenario – 200 procedures/yr
Extra cost per procedure	*€4.804*	*€2.504*
QALYs	0,060	0,031
Hospitalisation	-7,5	-3,9
Duration operating time (min)	-369 / -353*	-193 / -184
Absenteeism surgeon (days)	-6,3 / -4,7*	-3,3 / -2,4
Probability conversion	N/A(>-1)	N/A (>-1)
Probability peri-operative complication	N/A (>-1)	N/A (>-1)
Probability persistent complications	-0,71	-0,37
Probability adjuvant treatment	-0,95	-0,49
Probability metastases	-0,11	-0,06



https://sejal.shinyapps.io/supplement_robot-assisted_surgery_article/

Take home message



It is never too early to evaluate a new surgical robot!