Cost-effectiveness of orthopaedic surgical interventions

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Bruges, 23 November 2024

GHENT UNIVERSITY

The fundamental objective of health systems

- "To make ***the best use*** of the ***limited healthcare funds*** available in order to promote health and provide health care."

- "The underlying principle can be seen as maximizing ***value for money*** by selecting the *optimal mix* of services subject to the *budget constraints* faced by the system."

Thomas R. and Chalkidou K. Cost-effectiveness. In Health system efficiency. How to make measurement matter for policy and management. WHO. European Observatory on Health Systems and Policies, 2016

How to know what is value for money?
→ Cost-effectiveness analysis

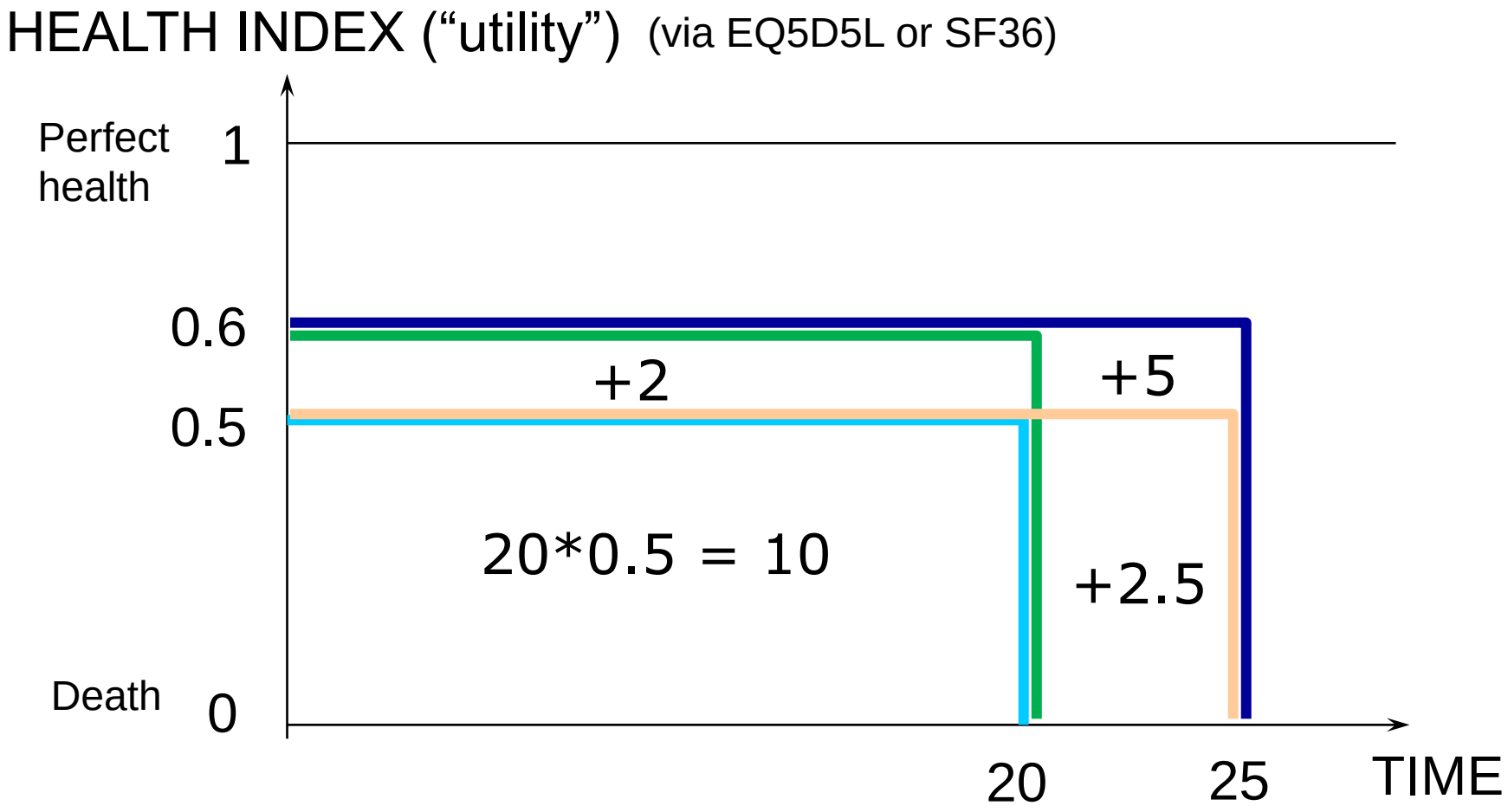
Public Expenditure

Cost Offsets
Impact on Health

Intervention

How to measure impact on Health?

Quality Adjusted Life Years (QALYs)



Annemans L. Health-economics-non-economists (2018) – Pelckmans Pro Eds. ISBN 978-94-6337-113-1

EQ-5D-5L

5 dimensions
5 levels each
3125 profiles
3125 utility values

EQ-5D Domain		Response Category
Mobility	1	I have no problems walking
	2	I have slight problems walking
	3	I have moderate problems walking
	4	I have severe problems walking
	5	I am unable to walk
Self-Care		I have no problems washing or dressing myself
		I have slight problems washing or dressing myself
		I have moderate problems washing or dressing
		I have severe problems washing or dressing
		I am unable to wash or dress myself
Usual Activities		I have no problems doing my usual activities
		I have slight problems doing my usual activities
		I have moderate problems doing my usual
		I have severe problems doing my usual activities
		I am unable to do my usual activities
Pain or Discomfort		I have no pain or discomfort
		I have slight pain or discomfort
		I have moderate pain or discomfort
		I have severe pain or discomfort
		I have extreme pain or discomfort
Anxiety or Depression		I am not anxious or depressed
		I am slightly anxious or depressed
		I am moderately anxious or depressed
		I am severely anxious or depressed
		I am extremely anxious or depressed

Example

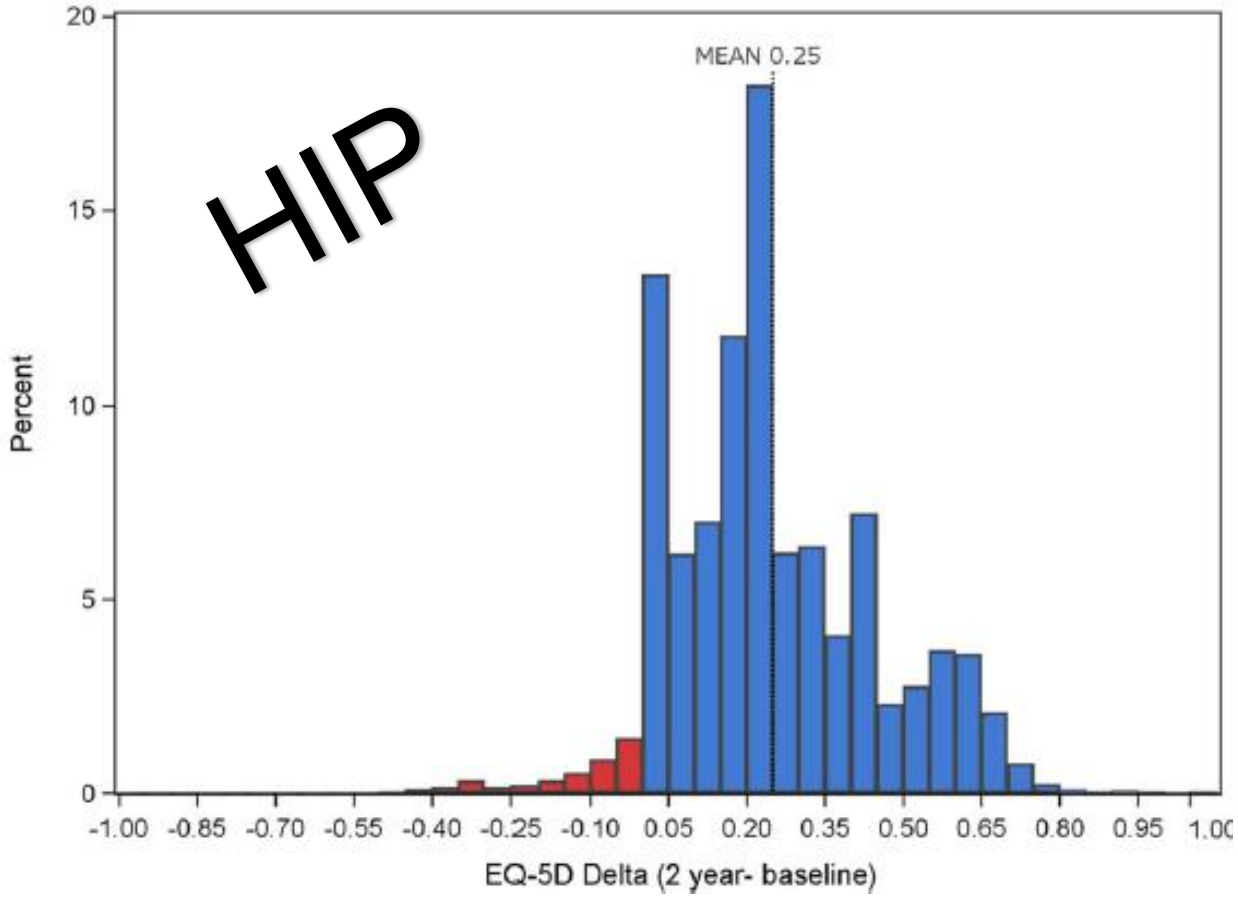
Quality-Adjusted Life Years After Hip and Knee Arthroplasty

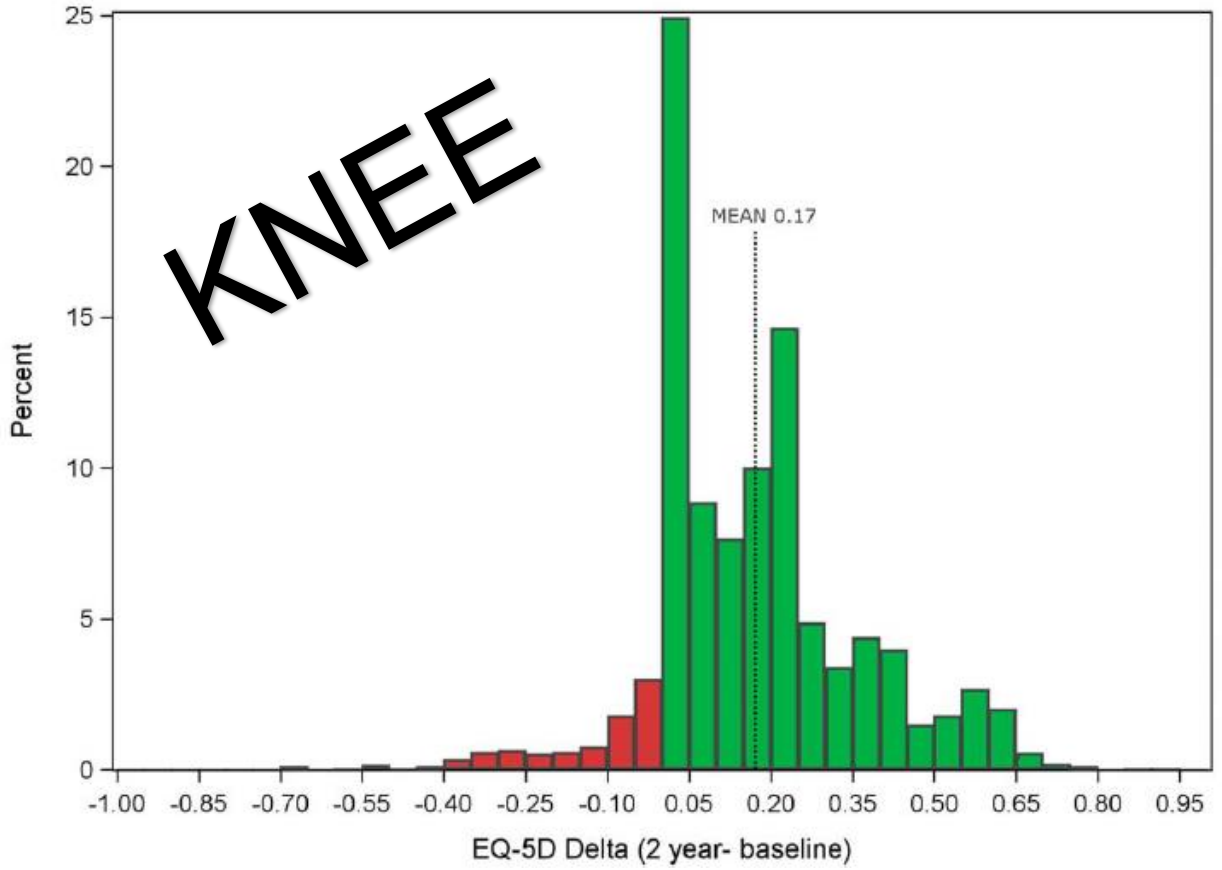
Health-Related Quality of Life After 12,782 Joint Replacements

Joseph F. Konopka, MD, MSc, Yuo-yu Lee, MS, Edwin P. Su, MD, and Alexander S. McLawhorn, MD, MBA

Investigation performed at the Adult Reconstruction & Joint Replacement Division, The Hospital for Special Surgery, New York, NY

JBJS Open Access 2018





Konopka et al. JBJS Open Access 2018

Example 2 – impact of robotic technique in TKR

healthcare

MDPI

Article

Does Robotic Assisted Technique Improve Patient Utility in Total Knee Arthroplasty? A Comparative Retrospective Cohort Study

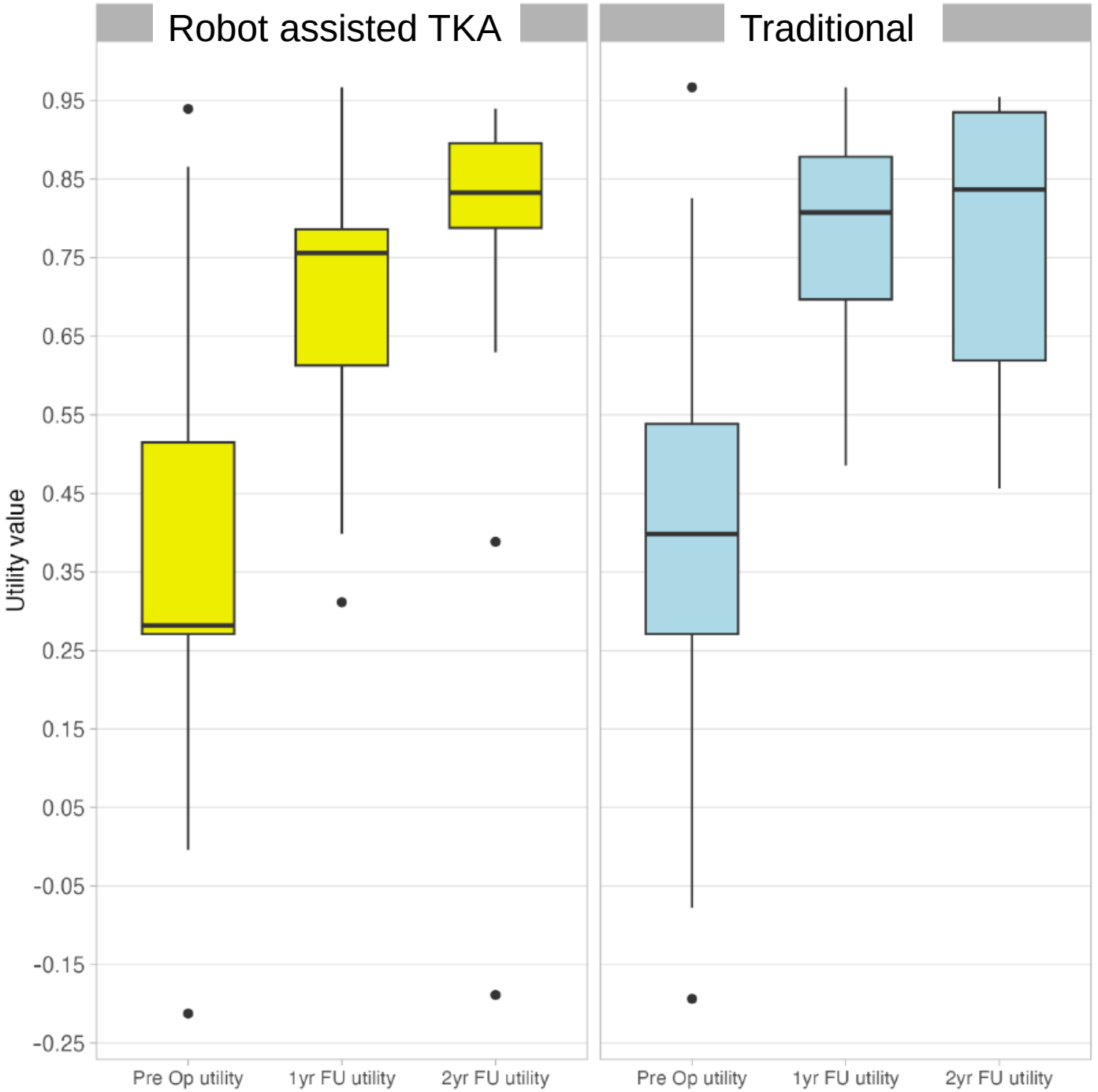
Matteo Ratti [1,*], Daniele Ceriotti [1], Riccardo Rescinito [1], Rabia Bibi [1] and Massimiliano Panella [1,2]

[1] Department of Translational Medicine (DiMeT), Università del Piemonte Orientale, 28100 Novara, Italy; 10036607@studenti.uniupo.it (D.C.); 10033325@studenti.uniupo.it (R.R.); 20036124@studenti.uniupo.it (R.B.); massimiliano.panella@uniupo.it (M.P.)

[2] Habilita S.p.A. Casa di Cura Villa Igea, Str. Moirano, 2, 15011 Acqui Terme, Italy

* Corresponding author: matteo.ratti@uniupo.it

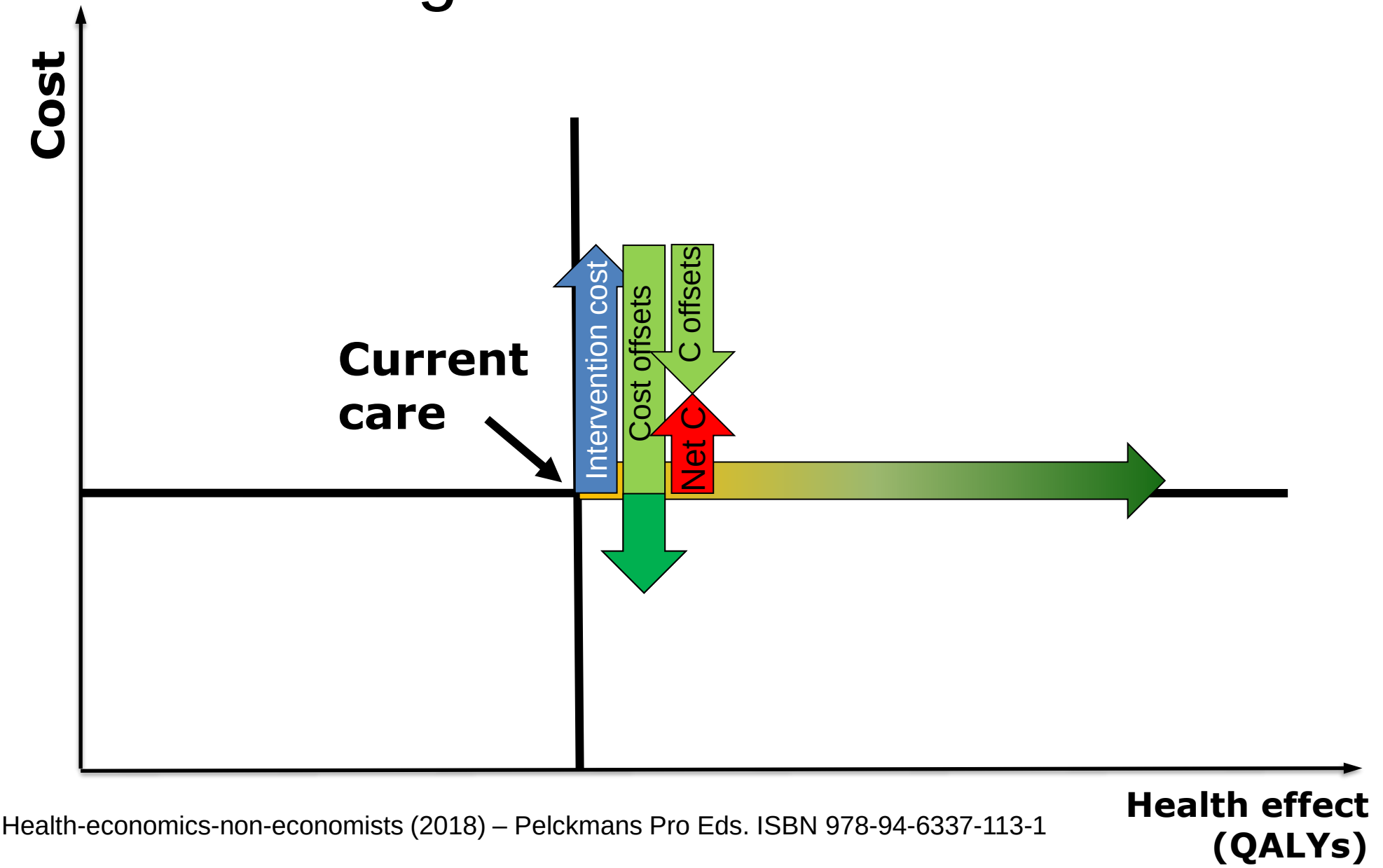
Italy, University of Piemonte
Retrospective cohort study (quasi-experimental design)
n = 142 (72 operated with a robotic technique with 70 operated with traditional technique)
2 years follow up



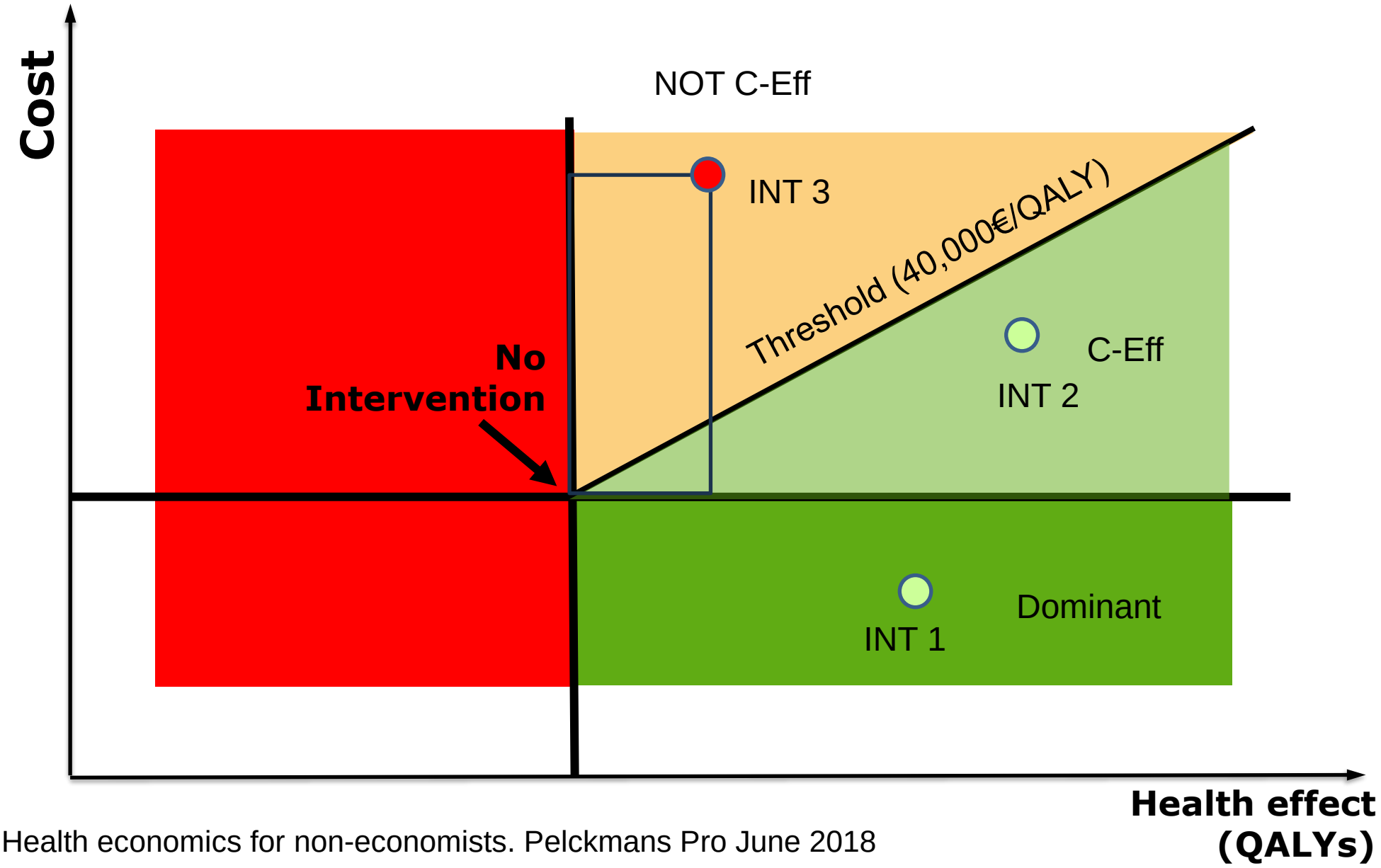
Large effect in both arms

No significant difference, accounting for differences in patient characteristics

Adding the cost dimension



Cost-effectiveness



Annemans L. Health economics for non-economists. Pelckmans Pro June 2018

Handbook Language

Incremental Cost-Effectiveness* Ratio (ICER)

$$ICER = \frac{C_{INT} - C_{NO\ INT}}{Eff_{INT} - Eff_{NO\ INT}}$$

* Sometimes also called ‘cost-utility’

Annemans L. Health-economics-non-economists (2018) – Pelckmans Pro Eds. ISBN 978-94-6337-113-1

Methods: modelling – example THR

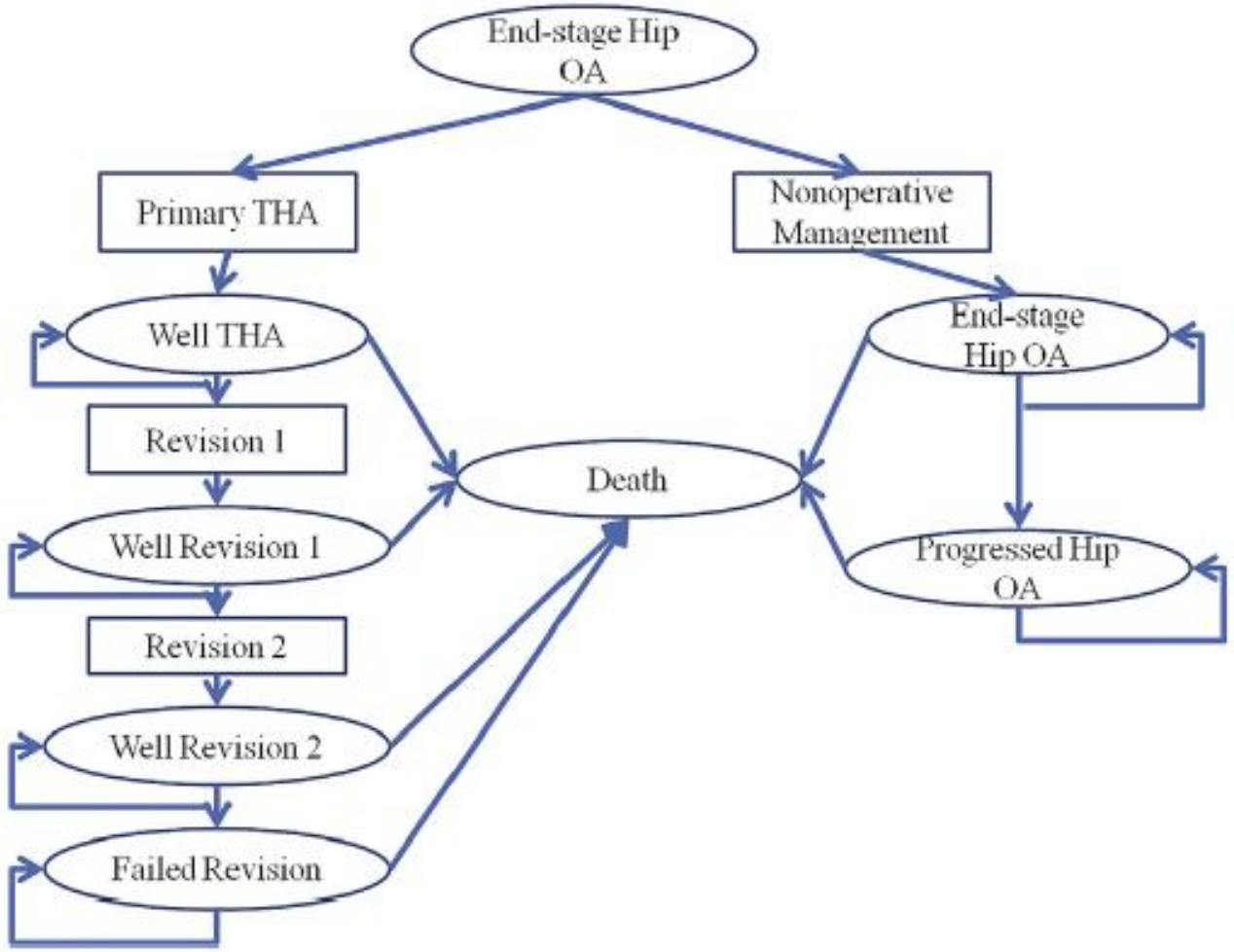


Fig. 1. Markov decision model.

Ponnusamy K et al. The Journal of Arthroplasty 33 (2018)

Example 1: reverse total shoulder arthroplasty

Shoulder & Elbow
2021, Vol. 13(1) 90–97

DOI: 10.1177/1758573219897860
journals.sagepub.com/home/sel
SAGE

Cost-effectiveness of the reverse total shoulder arthroplasty. Does indication affect outcome?

Jamie A Nicholson, Rhiannon Jones, Deborah J MacDonald, Iain Brown and Julie McBirnie

University of Edinburgh, Royal Infirmary of Edinburgh
N = 67 (46 primary)
Age = 72 yr
Follow up = 2 years

Table 3. Incremental cost-effective ratio (ICER) analysis.

	ICER
Indication	
Whole cohort	
1 year EQ-5D gain 0.3981	£16,827.43 per QALY one year
2 year EQ-5D gain 0.4029	£8313.48 per QALY two year
Primary	
2 year EQ-5D gain 0.4409	£7596.76 per QALY
Revision	
2 year EQ-5D gain 0.2851	£11,748.51 per QALY
Estimated cost for life expectancy	
Mean life expectancy in Scotland = 79.2 years	
Mean age of cohort at surgery = 72.3 years	£16,827.43/ 6.9 = £2438.78 per QALY
Mean life years post-surgery = 6.9 years	

EQ-5D: EuroQol five-dimension questionnaire; QALY: quality-adjusted life year.
Prices quoted in pounds sterling (£/GBP).

Nicholson et al. Shoulder & Elbow 2021, Vol. 13(1) 90–97

J Shoulder Elbow Surg (2021) 30, 1007–1017

Example 2: systematic review

JOURNAL OF SHOULDER AND ELBOW SURGERY
www.elsevier.com/locate/ymse

Cost-effectiveness analyses in shoulder arthroplasty: a critical review using the Quality of Health Economic Studies (QHES) instrument

William M. Cregar, MD[a], Alexander Beletsky, BA[b], Gregory L. Cvetanovich, MD[c], Brian T. Feeley, MD[d], Gregory P. Nicholson, MD[a], Nikhil N. Verma, MD[a,*]

Shoulder arthroplasty is a cost-effective procedure when used to treat a multitude of shoulder pathologies. The overall quality of economic analyses in shoulder arthroplasty is relatively good, with an average QHES (Quality of Health Economic Studies) score of 86.22 points.

Example Total Knee Arthroplasty

Received: 21 March 2024 | Accepted: 16 June 2024

DOI: 10.1002/ksa.12343

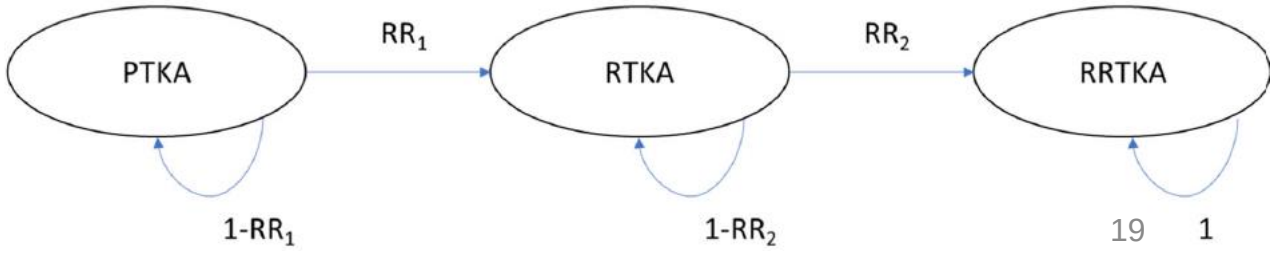
KNEE ARTHROPLASTY

Knee Surgery, Sports Traumatology, Arthroscopy WILEY

Similar QALY gain in primary and revision knee arthroplasty: A cost analysis and Markov model

Soeren Möller[1] | Nora Gautschi[2] | Klaus Möller[2] | David F. Hamilton[3] | Karlmeinrad Giesinger[1]

- Swizerland, based on 2197 patients – projection over 25 years
- Accounting for revisions and revisions of revisions



Results Möller et al 2024

	PTKA	RTKA
EQ-5D preoperative ($M \pm SD$)	0.650 ± 0.251	0.635 ± 0.276
EQ-5D 12 months postoperative ($M \pm SD$)	0.898 ± 0.161	0.793 ± 0.250
EQ-5D delta ($M \pm SD$), p value	0.248 ± 0.265, $p < 0.0001$	0.158 ± 0.323, $p < 0.0001$
QALYs gained ($M \pm SD$)	5.67 ± 3.98	4.67 ± 4.20
Lifetime cost ($M \pm SD$)	€26,583 ± 8656	€48,390 ± 22,784
Cost per QALY (M)	€4686	€10,364

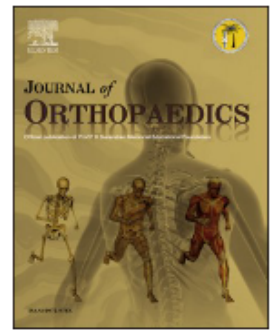
Möller S et al. Knee Surg Sports Traumatol Arthrosc. 2024;1–7.

Journal of Orthopaedics 22 (2020) 485–492

Contents lists available at ScienceDirect

Journal of Orthopaedics

journal homepage: www.elsevier.com/locate/jor



Check for updates

Modelling the cost-effectiveness of total knee arthroplasty: A systematic review

Achi Kamaraj, Kendrick To, KT Matthew Seah *, Wasim S. Khan

Division of Trauma & Orthopaedic Surgery, Addenbrooke's Hospital, University of Cambridge, Cambridge, CB2 0QQ, UK

Results systematic review Kamaraj et al. (2020)

- Resurfacing the patella = cost-effective compared to not resurfacing it during TKA largely due to the associated reduced revision rates.
- However, this is only true when resurfacing was performed on arthritic patella
- Routinely resurfacing non-arthritic patella was not shown to be cost-effective.
- TKA is cost-effective compared non-operative management options, regardless of patient factors that could potentially influence decision-making policies such as their severity (Oxford Knee Score), risk for perioperative complications and BMI.

"These findings are important in ensuring a potentially cost-effective treatment option is not denied to patients based on these aforementioned metrics."

Example Total Hip Arthroplasty

Vogl *et al. BMC Health Services Research* 2014, **14**:342
http://www.biomedcentral.com/1472-6963/14/342

BMC
Health Services Research

RESEARCH ARTICLE Open Access

The impact of preoperative patient characteristics on the cost-effectiveness of total hip replacement: a cohort study

Matthias Vogl[1,2*], Rainer Wilkesmann[3], Christian Lausmann[3] and Werner Plötz[3,4]

Munich Germany
n = 292
Prospective follow up 6 months

Results Vogl et al (2014) in function of Age

Underlying value set	Age group			
	≤59	60-69	70-79	≥80
	QALYs			
VAS-AL based	6.398	3.280	1.697	0.990
UK QALY based	10.967	6.122	4.341	2.531
German EB-QALY based	7.565	4.098	2.583	1.506
	Cost/QALY in €			
VAS-AL based	1.927	3.085	3.771	9.391
UK QALY based	1.124	1.653	2.372	3.672
German EB-QALY based	1.630	2.469	3.246	6.171

Example Total Hip Arthroplasty – impact of earlier intervention

The Journal of Arthroplasty 30 (2015) 945–949

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

The Cost–Utility of Total Hip Arthroplasty: Earlier Intervention, Improved Economics

Carlos J. Lavernia, MD [a], David A. Iacobelli, MD [a,b], Larry Brooks, PhD [b], Jesus M. Villa, MD [a,b]

- The groups with worse preoperative WOMAC were associated with a less cost-effective intervention.
- The best cost-effectiveness was achieved by patients with better WOMAC-total ($8256/QALY-gained).
- As patients aged, the cost-effectiveness of THA worsened.
- Patients 75 years of age or older and with worse scores had the least cost-effective interventions ($25,937/QALY-gained).
- THA remains a cost-effective intervention even when performed in older “sicker” patients.

Received: 3 June 2020 | Accepted: 28 October 2020

DOI: 10.1111/ijcp.13806

SYSTEMATIC REVIEW

THERAPY AREA: OTHER

THE INTERNATIONAL JOURNAL OF CLINICAL PRACTICE WILEY

Cost effectiveness analyses of total hip arthroplasty for hip osteoarthritis: A PRISMA systematic review

Nikhil Agarwal[1] | Kendrick To[2] | Wasim Khan[2]

Based on 28 health economic evaluations

We have shown that THA is a cost-effective treatment for hip osteoarthritis. These findings should be implemented into clinical practice to improve cost utility in health services across the world.

Discussion

- The aim of health policy is to invest in interventions that provide value for money
- Identified studies in shoulder, knee and hip point to overall cost-effective results, also confirmed in systematic reviews
- Younger age and better functioning at baseline result in better cost-effectiveness
- Not clear in several studies whether joint infection was incalculated
- Mostly healthcare perspective – rarely societal perspective
- Key condition: appropriate selection of the target patient

Cost-effectiveness of orthopaedic surgical interventions

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Ghent University

Bruges, 23 November 2024

THANK YOU

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