University of St.Gallen
School of Medicine

Cost-effectiveness of rapid recovery after hip replacement from the payer's perspective and broader societal benefits

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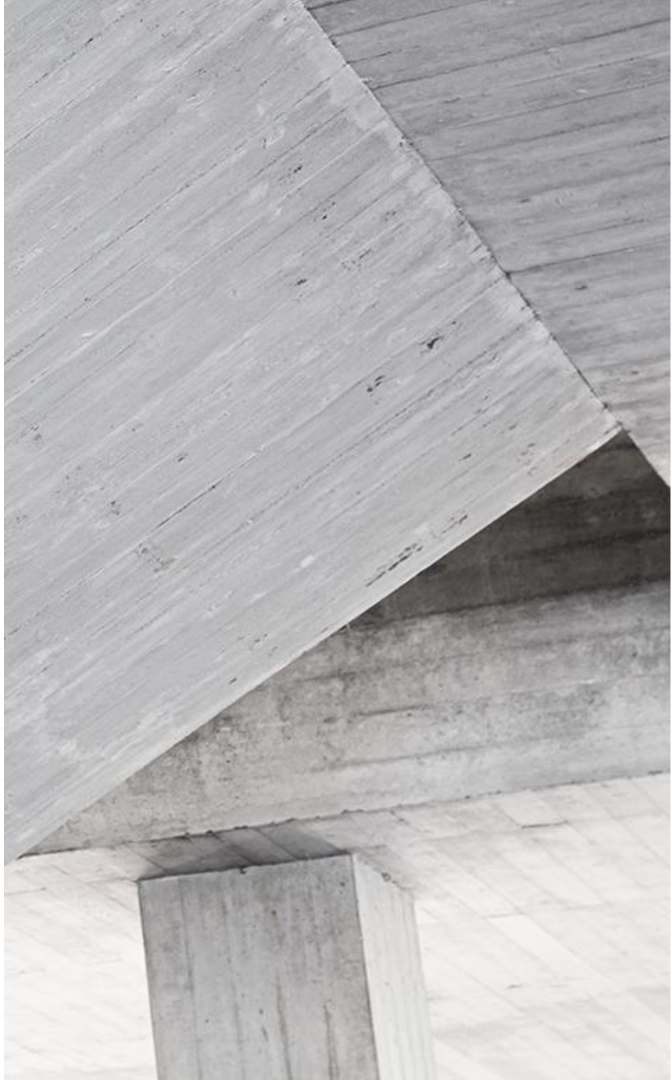

Intro

Intro | Rapid recovery to decrease costs and increase quality of care

Hip replacement:
- Growing number of procedures
- Evolution of medical technologies
- Improvements in surgical techniques and post-operative care enhance patient outcomes and reduce complication rates

→ High volume: even modest advancements translate into considerable aggregate benefits
→ Better outcomes: also alleviate financial pressures on healthcare systems by decreasing post-operative and disability costs

Introduction | Rapid recovery to decrease costs and increase quality of care

Rapid recovery (RR) after joint replacement: post-operative care protocols including pre- and post-operative elements, such as pre-operative health literacy education, physiotherapy, and early mobilization (i.e., within 6 hours post-surgery)

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Research questions:

1. *Do patients receiving RR show larger improvements than patients receiving conventional care?*
2. *Are there economic benefits connected with RR?*
3. *Is RR cost-effective from the payer's perspective?*

Data & Methods

Data | Observational study with RCT data

Dataset: Patient-level observational data from the German Innovation Fund study “PROMoting Quality” from 2019 to 2020 from nine German hospitals

Outcome measures:

- Disease-specific PROMs HOOS-PS for the assessment of joint-associated problems and functionality
- Generic PROM EQ-5D-5L to capture health-related quality of life (HRQoL)

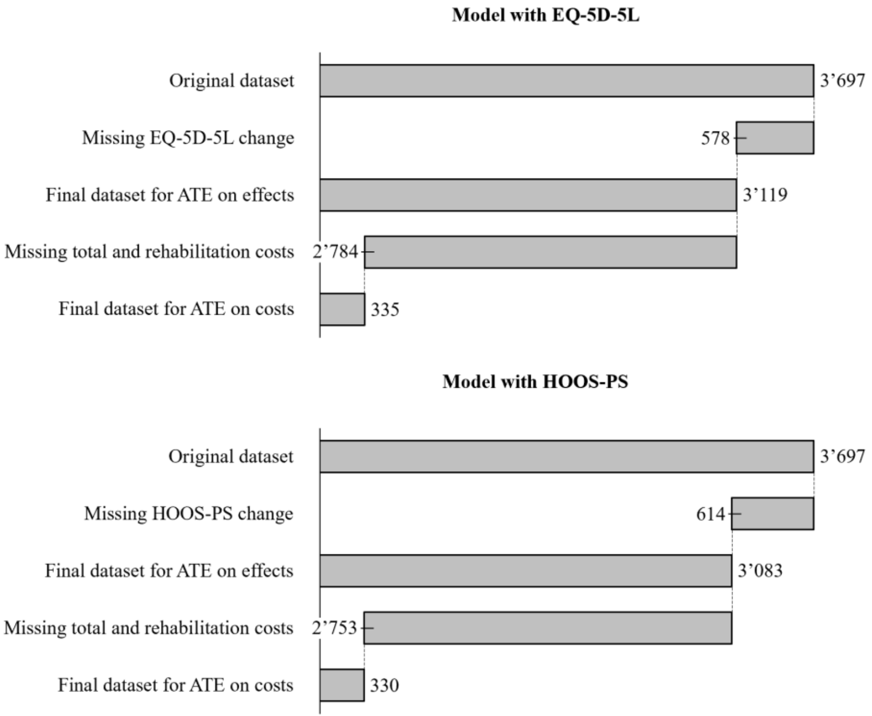
Costs

- Payer’s perspective: health insurance patient-level cost data until one year post-surgery

Other variables

- Patients’ demographics, previous treatments, comorbidities, and mobilization time
- Patients mobilized within 6 hours from their surgery follow a RR path

Datasets | Sample sizes for ATE calculation



- Two analyses, one with the EQ-5D-5L as outcome measure, and one with the HOOS-PS as outcome measure
- For each model, the Average Treatment Effect (ATE) is estimated separately for the effects and for the costs
- Using the EQ-5D-5L model → ATE of RR on length of say

Methods | Non-randomization and causal forest

Retrospective setting: treatment assignment to RR or CC is non-random (potential bias) → propensity scores

→ ATE estimation using the augmented inverse-probability weighted scores by Robins et al. (1994) and the causal forest developed by Wager & Athey (2018):

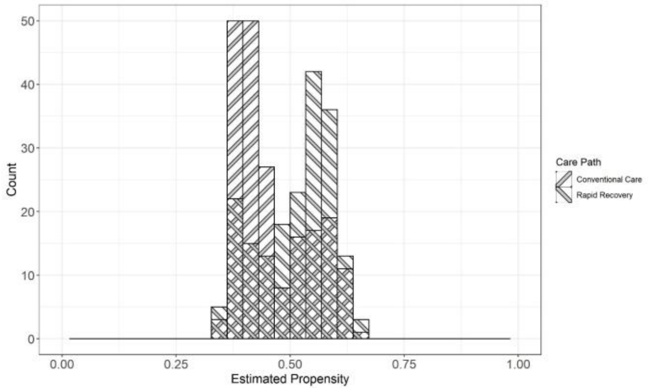
$$\hat{\tau} = \frac{1}{n}\sum_{i=1}^{n} \hat{\Gamma}_{i,ate}$$

Where $\hat{\Gamma}_i$ is defined as:

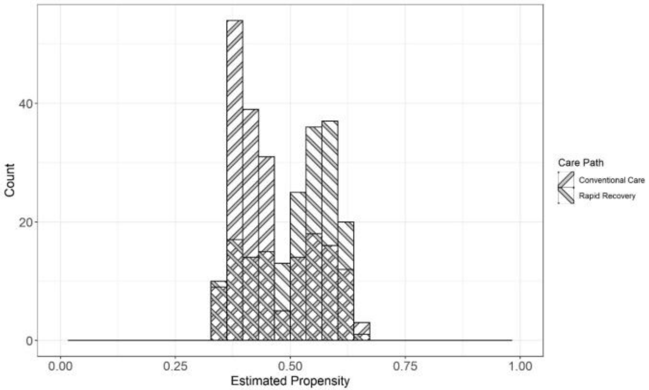
$$\hat{\Gamma}_i = \hat{\mu}_{(1)}(X_i) - \hat{\mu}_{(0)}(X_i) + \frac{d_i}{\hat{e}(X_i)}\left(Y_i - \hat{\mu}_{(1)}(X_i)\right) - \frac{1 - d_i}{1 - \hat{e}(X_i)}\left(Y_i - \hat{\mu}_{(0)}(X_i)\right)$$

Methods | CIA, Exogeneity, SUTVA, Common support assumptions

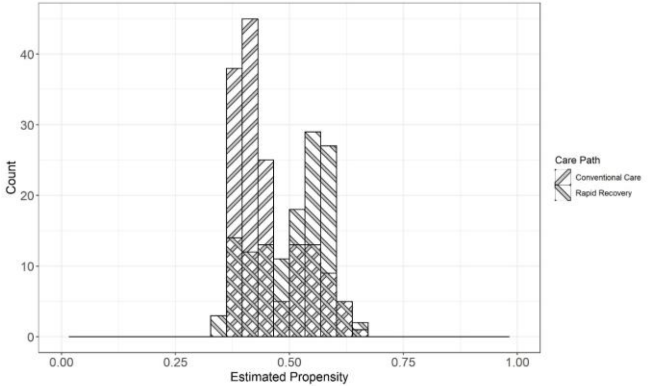
Common support for the effects of the analysis with EQ-5D-5L



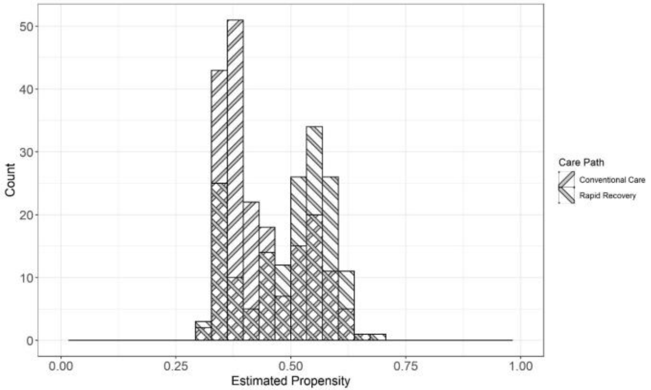
Common support for the effects of the analysis with HOOS-PS



Common support for the costs of the analysis with EQ-5D-5L



Common support for the costs of the analysis with HOOS-PS



Methods | Models and sensitivity analyses

Models:

- One model for the ATE on length of say, one for the ATE on effects, one for the ATE on costs
  - Dependent variables: length of stay, EQ-5D-5L change, HOOS-PS change, total costs
  - Independent variable of interest: being on the RR path (i.e., mobilized within 6h post-surgery)
  - Control variables: socio-demographic variables (age, sex, living situation, job, job effort, and education), clinical and outcome variables (pre-surgery PROM score, height, weight, comorbidities, pre-surgery hip and knee problems and treatments), and variables related to the surgery (hospital, duration, complications)

Sensitivity analyses:

- PSA to account for uncertainty in our model inputs
- CEAC to assess the probability of cost-effectiveness for countries without a cost-effectiveness threshold

Methods | Producivity and nursing staff savings

ATE of RR on hospital length of stay = Average reduction in length of stay attributable to RR

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X

Average daily wage for Germany

=

Productivity savings per patient

Methods | Producivity and nursing staff savings

ATE of RR on hospital length of stay = Average reduction in length of stay attributable to RR

Productivity savings	Nursing staff savings
X	X
Average daily wage for Germany	Average nursing hours per patient day
=	=
Productivity savings per patient	Total nursing hours saved

Methods | ICER and Average Treatment Effects

ATE on costs and effects: ΔE and ΔC

$$\tau = E[Y_i(d=1) - Y_i(d=0)]$$

Methods | ICER and Average Treatment Effects

ATE on costs and effects: ΔE and ΔC

$$\tau = E[Y_i(d=1) - Y_i(d=0)]$$

→ Incremental Cost-Effectiveness Ratio (ICER): ratio of mean incremental costs between treatment and control group and their mean incremental benefits = Additional cost that a decision maker expects to pay to receive an additional unit of health benefit

$$ICER = \frac{\Delta E}{\Delta C} = \frac{E_1 - E_0}{C_1 - C_0}$$

Results

Discussion

Discussion | Key take-aways

Innovative approach to determine the cost-effectiveness of RR for hip replacement patients:

- Focus on the payer's perspective
- Use of generic and disease-specific PROM
- New methodology for economic evaluations with retrospective data
- Estimation of broader economic benefits

Findings:

- RR is the dominant strategy for hip replacement patients
- Additional economic benefits in terms of productivity and nursing capacity savings

→ Cost-effective post-operative path from the German payer's perspective for hip replacement patients

Discussion | Limitations and future research

1. Limited number of hip replacement patients with rehabilitation cost data for ATE on costs (Underestimation)
   → Future research would profit from the inclusion of a larger number of observations with complete cost information for the whole patient path

2. Identification of the effect of the RR path as a whole (Underestimation)
   → Of interest to understand specific components' effects on outcomes and costs

3. Small magnitude of calculated incremental effects (No increase in costs)
   → Of interest to combine PROMs with qualitative assessments of patient satisfaction

4. Representativeness (High-volume specialized hospitals)
   → Future research should expand to more diverse hospital types

Discussion | Conclusions and policy implications

- RR is the recommended post-recovery path for hip replacements in Germany as it is cost-effective and generates broader economic benefits
- Inconsistent adoption due to organizational and logistical challenges → Centralization and educational initiatives
- Health insurers should promote RR while at the same time providing financial incentives and support for centralized care models and professional development programs

Thank you!

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