Regional variation in hip and knee replacements in Switzerland
A small area-variation analysis
Maria M. Wertli

Historical background

- In the 1970s, John Wennberg demonstrated a great variation in the use of elective surgical interventions across U.S. hospital regions not explained by patient preferences and illness

- More care is not necessarily better: higher health care use resulted in more costs but not in better quality of care, patient outcomes, or satisfaction

- Compared to other OECD countries, Switzerland has the highest hip replacement (HR) and one of the highest knee replacement (KR) rates.

- Klauss et al. (2005) showed a 3 to 37-fold variation in age- and sex-standardized rates for orthopedic procedures

Wennberg J. et al. Small area variations in health care delivery. Science 1973;182:1102-8.

Definition

- Preference-sensitive interventions are elective interventions for which there is more than one option and where outcomes will differ according to the chosen option

- Main drivers are physician beliefs about the indications

Variations in preference-sensitive care and controversial medical procedures in Switzerland - The specific aims are:

1. To assess variations in age/sex-standardized HR and KR rates during 2013 - 2016 across Swiss Hospital Service Areas (HSAs)

2. To assess whether regional variations are explained by regional differences in potential determinants of variation, including population demographics, socioeconomic status, level of urbanization, language, population health, and supply factors (number of orthopedic surgeons)

Methods overview

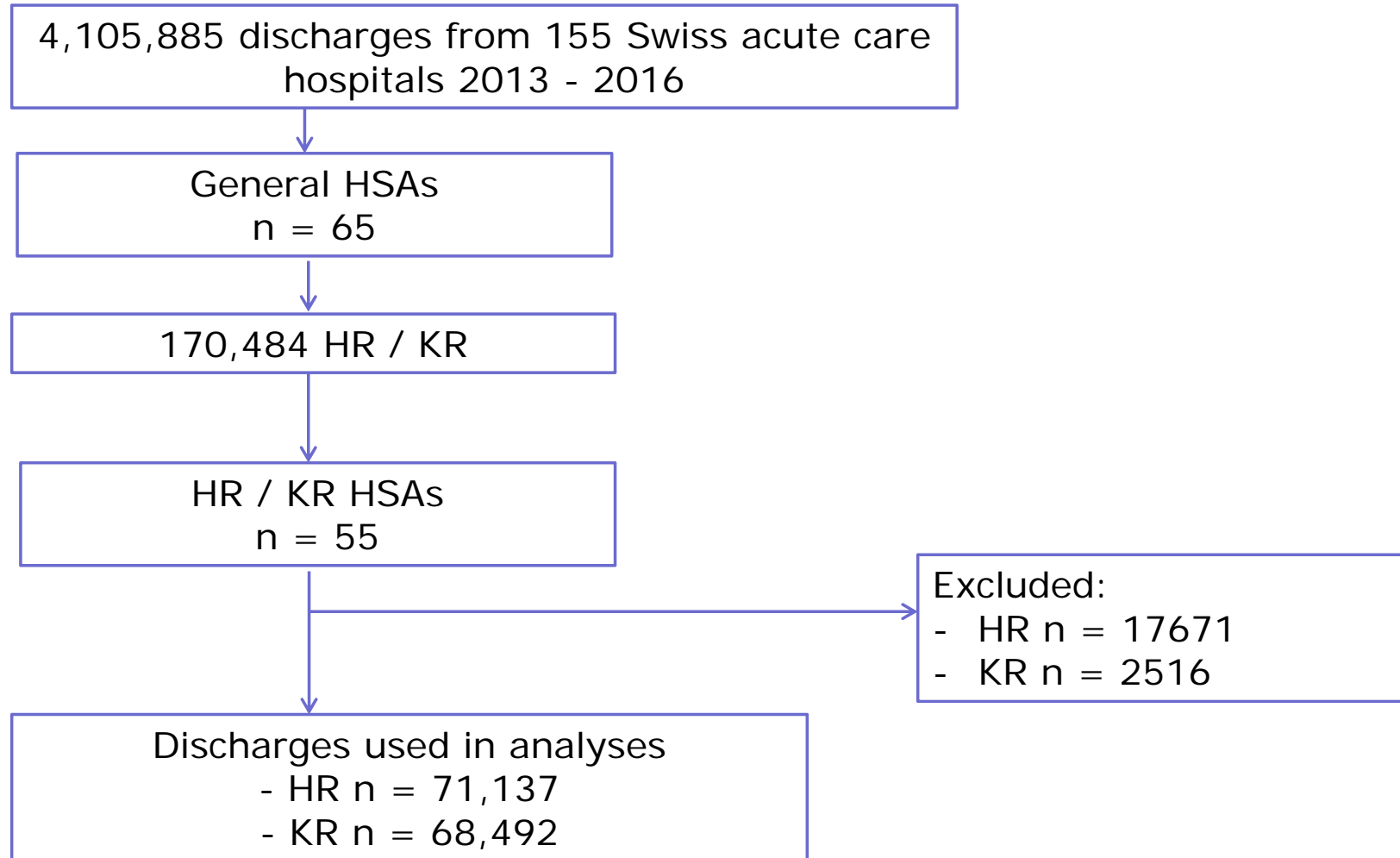|	
Design	Population-based small area variation analysis
Data	Routinely collected, person-level, patient discharge data from all Swiss acute care hospitals (Medizinische Statistik der Krankenhäuser, Swiss Federal Statistical Office [SFSO]) Population-level census data, SFSO spatial planning, FMH statistics
Study period	Calendar years 2013 – 2016
Inclusion	Procedure codes for HR and KR from hospital discharge data
Exclusion	Patients living outside Switzerland at the time of treatment Patients aged <18 years
Numerator	Number of hip and knee replacement hospitalisations aged ≥18 years
Denominator	Total population aged ≥ 18 years in 2013 – 2016

Measures of variation

- Age- and sex-standardized mean HR / KR rates per 100,000 persons

- Extremal quotient (EQ, maximum divided by the minimum rate)

- Systematic component of variation (SCV), a measure of the non-random variation (a SCV >5 indicates a high variation)

- In progressively adjusted multilevel Poisson regression models, average predicted procedure rates were calculated and determinants of variation analyzed:

– Incidence rate ratios (IRRs) = procedure rate in the defined category (e.g., women) relative to the estimated procedure rate in the reference category (e.g., men)

– Percentage reduction in procedure variation across the 55 HSAs by examining the variance of the random intercept

➢ Residual variation in the fully adjusted model

= proxy for unwarranted variation

Determinants of variation

Model 1	Procedure year
Model 2	Age: adjusted in 5 year bands (≥18- <50, ≥50 - <55,.., 80+)
Model 3	- Language region: German (reference), Latin (French, Italian) - Urbanicity: Urban, peri-urban, rural (DEGURBA classification) - Neighborhood socioeconomic position (SSEP): 0 (worst) - 100 (best)
Model 4	- Burden of disease: age-/sex adjusted cumulative rate per 100,000 persons for hip fracture, strokes, surgery for colon or lung cancer, and acute myocardial
Model 5	- Physician supply: per 10 orthopedic surgeons

Study Flow and HSAs

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│  4,105,885 discharges from 155 Swiss acute care   │
│              hospitals 2013 - 2016                │
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│                  General HSAs                     │
│                    n = 65                         │
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│                170,484 HR / KR                    │
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┌─────────────────────────────────────────────────┐          ┌──────────────────────┐
│                  HR / KR HSAs                     │          │ Excluded:            │
│                    n = 55                         │─────────▶│ -  HR n = 17671      │
└─────────────────────────────────────────────────┘          │ -  KR n = 2516       │
                         │                                    └──────────────────────┘
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│            Discharges used in analyses            │
│                - HR n = 71,137                    │
│                - KR n = 68,492                    │
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Characteristics of the study population

Characteristics	HR	KR
	n (%) or mean±SD	
N	71,137 (51%)	68,492 (49%)
Demographics		
Age, years*	68.3 (11.5)	68.7 (9.9)
Females	36,628 (51%)	41,035 (60%)
Swiss nationality	69,632 (93%)	62,207 (91%)
Insurance status		
Basic	49,488 (66%)	45,795 (67%)
Semi-private	17,096 (23%)	15,343 (22%)
Private	8301 (11%)	7,354 (11%)

SD, standard deviation.
*The mean age was calculated using the midpoint of the provided 5-year age interval.

Variation in procedure rates across HSAs

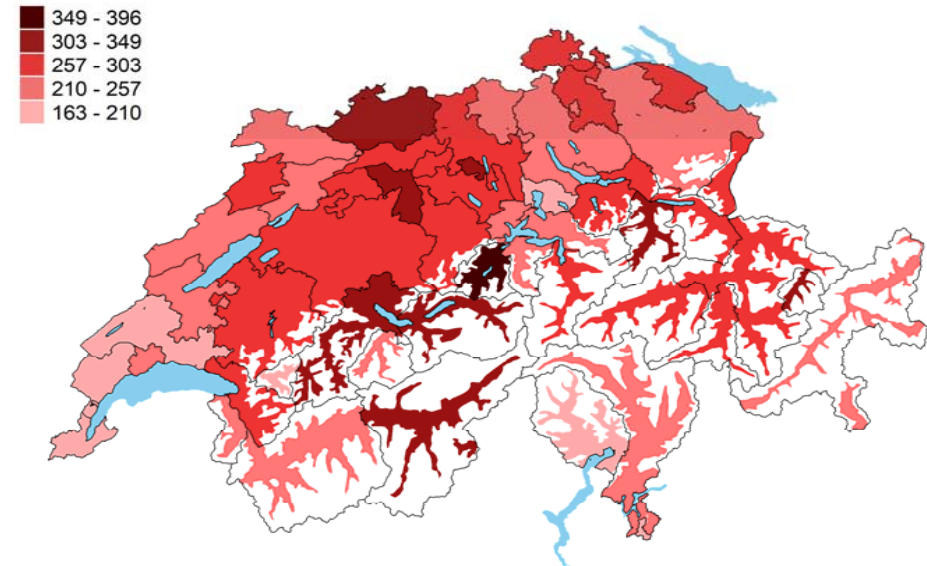| Measures	HR	KR
Mean unstandardized rate (range)[1]	277 (167 – 401)	267 (154 – 391)
Age/sex-standardized rate (range)[1]	268 (180 – 350)	258 (164 – 395)
EQ	1.9	2.4
SCV	1.9	3.1

[1]per 100'000 persons

HR/KR rates per 100,000 persons across Swiss HSAs in 2013 - 2016

Age-standardized HR rates

316 - 350
282 - 316
248 - 282
214 - 248
179 - 214
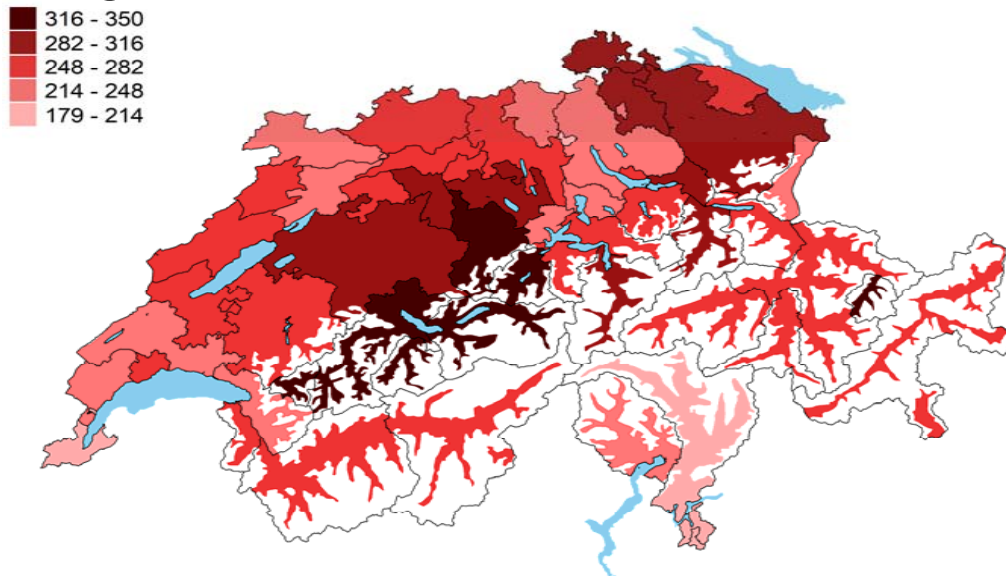
Age-standardized KR rates

349 - 396
303 - 349
257 - 303
210 - 257
163 - 210

Stepwise analysis of determinants of variance in the incidence rates of procedure rates across HSAs

		HR	KR
Age§	18-49	0.14 (0.14 - 0.14)	0.07 (0.06 - 0.07)
	50-59	Reference	Reference
	60-69	2.44 (2.38 - 2.49)	2.72 (2.66 - 2.79)
	70-79	3.79 (3.71 - 3.88)	3.90 (3.82 - 3.99)
	80+	2.76 (2.69 - 2.84)	2.23 (2.17 - 2.29)
Gender§	Male	Reference	Reference
	Female	**0.92 (0.91 - 0.94)**	**1.31 (1.29 - 1.33)**
Language region§	German	Reference	Reference
	Latin	**0.87 (0.81 - 0.93)**	**0.80 (0.75 - 0.86)**
Degree of urbanisation§	Urban	Reference	Reference
	Peri-urban	1.07 (0.97 - 1.19)	1.04 (0.93 - 1.17)
	Rural	1.15 (1.00 - 1.32)	1.06 (0.91 - 1.22)
Mean SSEP (per 10 units)		1.04 (0.93 - 1.15)	1.00 (0.89 - 1.12)
(Semi)private (10%)		0.95 (0.89 - 1.00)	**0.89 (0.84 - 0.95)**
Burden of disease (per 1000)		1.00 (1.00 - 1.00)	0.98 (0.89 - 1.08)
Orthopedic surgeons (per 100)		1.00 (1.00 - 1.01)	1.00 (1.00 - 1.01)
Remaining variance (%)*		**41.5**	**31.0**

§procedure rate in the defined category relative to the procedure rate in the reference category

*difference from the variance in model 1

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Strengths and limitations

- Strengths

  - The use of population-based data of high quality and completeness

  - Fully automated and reproducible approach to generate HSAs

- Limitation

  - Lack of person-level data for the non-cases

  - No population health information

Summary and conclusion

- We found a small variation in HR/KR rates across Swiss HSAs

- A substantial proportion of the variation in HR/KR rates was explained by differences in age/sex and socioeconomic factors

- Compared to other OECD countries, Switzerland had the highest rates for HR and one of the highest rates for KR

Country	HR*	KR*
Switzerland	277	267
USA	204	226
France	241	160
Sweden	234	124

*per 100,000 persons in 2015

https://www.oecd-ilibrary.org/docserver/health_glance-2017

Acknowledgments

- This research project was supported by the Swiss National Foundation NRP 74

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