

# Lessons Learned from the EuroDRG Project



## Patient classification systems and hospital costs of care for knee replacement in 10 European countries

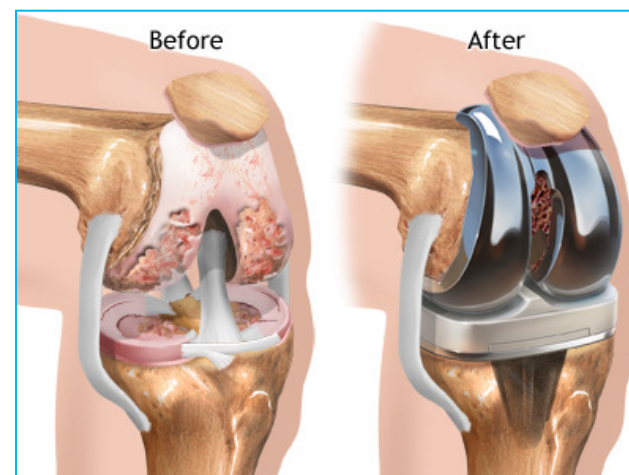
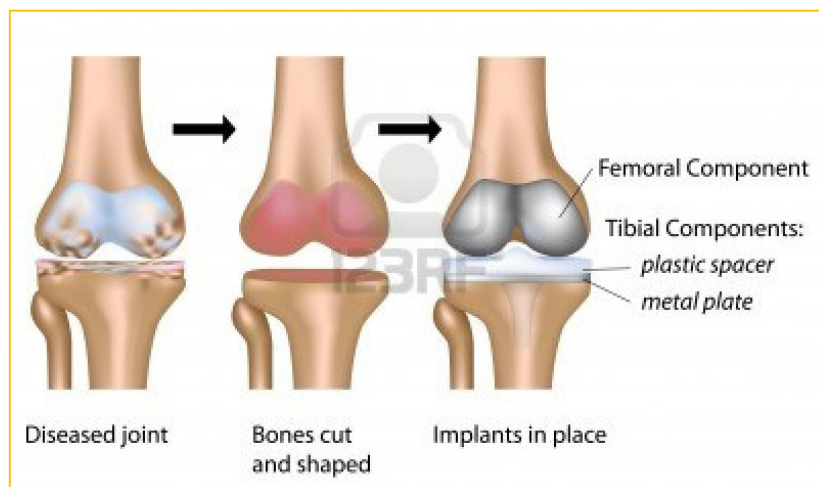
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# Introduction | Knee replacement

- ❑ Common surgical procedure to replace the weight-bearing surfaces of the knee joint
- ❑ Improve a patient's functional capacity and reduce discomfort caused by damage of the knee joint.
- ❑ Rising trend in the utilisation rates of the procedure
  - Ageing of the population
  - Effectiveness of the procedure



## Introduction II

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- ❑ Variability across European countries
  - from 42 (Ireland) to 206 (Germany) /100.000 population
  
- ❑ Prosthesis loosening, progressive joint disease and infection-related complications of the device
  - Factors for **revision surgery**
  
- ❑ Organizational differences in the management of the full process (Rehabilitation)



## Objective of the study

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- ❑ Explore the ability of DRG systems to explain variations in resource consumption of knee replacements
  - Analysis of patient level cost and length of stay (LOS)
  - Estimation of cost (or LOS) function of knee replacement
  - Explore variation of cost at hospital level
  - Evaluation of the performance of DRG systems in 10 European countries
  - Scrutinize improvement patterns



## Knee replacement: episode definition

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- Patient level routinely collected data
- Defined by procedure
- ICD9 CM codes 00.80 - 00.84, 81.54, 81.55 (Total, partial and revision)
- Excluded: age < 1 year



## Data sources

Country	Data year	Database
Austria	2008	Leistungsorientierte Krankenanstaltenfinanzierung (LKF)-database of the Bundesministerium für Gesundheit (BMG)
England	2007/08	Hospital Episode Statistic (HES)
Estonia	2008	Estonian Health Insurance Fund (EHIF)-database
Finland	2008	Finnish Hospital Discharge Register
France	2008	Programme de Médicalisation des Systèmes d'Information en Médecine, Chirurgie, Obstétrique (PMSI MCO)-database
Germany	2008	DRG-statistic of the Federal Statistical Office (Destatis)
Ireland	2008	Hospital In-patient Enquiry (HIPE)-database of the Health Services Executive (HSE)
Netherlands	2008	Database of the Diagnosis Treatment Combinations (DBC)-casemix system
Poland	2009	Register of episodes of care and reimbursement of the National Health Fund (NHF)
Spain	2008	Hospital Minimum Basic Data Set (CMBD) of the Public Hospital Network of Catalonia (XHUP) and Spanish Network of hospital costs (RECH)
Sweden	2008	National Patient Register (NPR) of the Board of Health and Welfare



# The DRG systems characteristics

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- ❑ Procedure driven DRGs
- ❑ From 2 groups in Estonia to 6 groups in Poland
- ❑ In most systems 1 group includes >90% of patients
- ❑ Except the Irish system → include a specific group for revision
- ❑ 3 systems (English, German and Spanish) differentiate complications and comorbidities
- ❑ Polish systems differentiates partial or total replacement and main factor of revision



## Data samples

Country	Model	Patients	Hospitals	Nº DRGs	DRG Primary/Revision	CCs
Finland	Log cost	1.247	5	2	x	
Estonia	Log cost	1.422	8	2	x	
Ireland	LoS	1.831	15	2		
Germany	Log cost	3.535	18	5	x	x
Spain	Log cost	3.637	8	4	x	x
Sweden	Log cost	4.819	30	3	x	
France	Log cost	8.929	79	5	x	
Poland	LoS	10.732	179	6	x	
Austria	LoS	15.392	95	5	x	
England	Log cost	62.828	147	4	x	x





## Data and variables I

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- ❑ 114.372 patients from 584 hospitals of 10 European countries:
  - LOS data: Austria, Ireland, Poland
  - Cost data: England, Estonia, Finland, France, Germany, Spain, Sweden
  
- ❑ Number of patients and hospital varying across countries:
  - from 1.247 in Finland to 62.828 in England
  - 5 hospitals in Finland to 179 in Poland



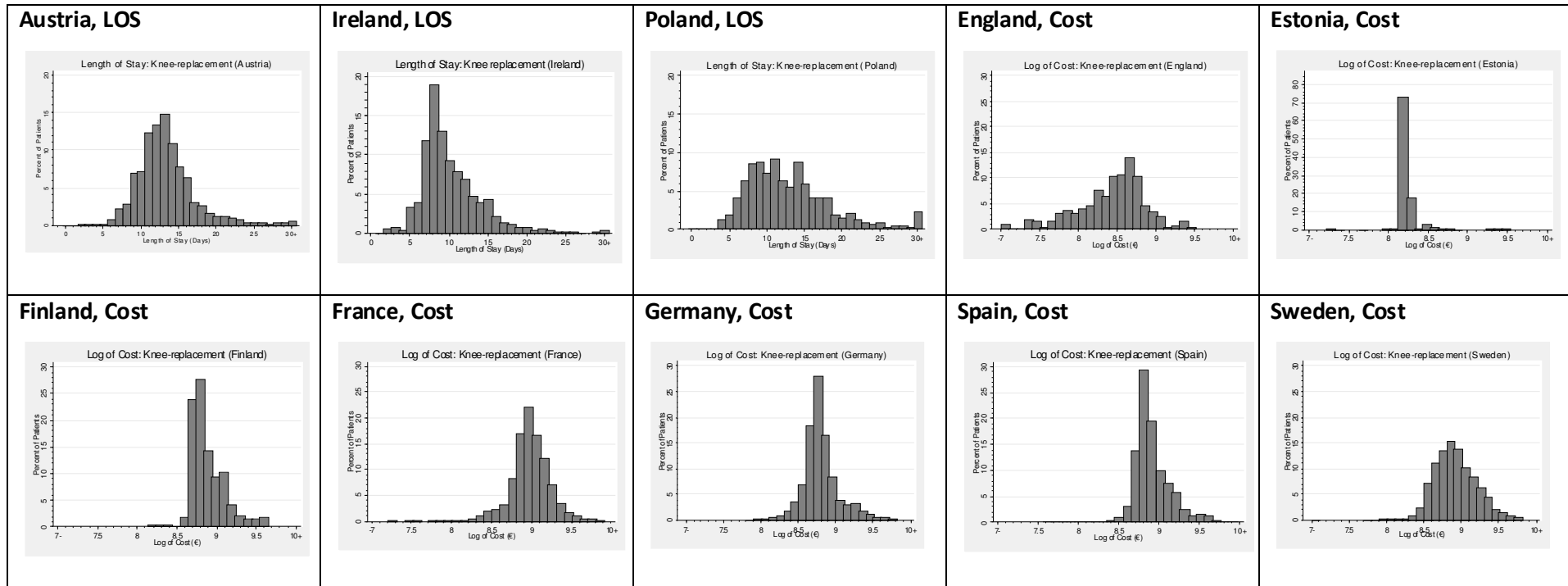
# Data and variables II

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- DRG groups with more the 1% of patient
- Age, gender
- Trans in / trans out
- Comorbidity measure (Charlson index)
- Quality variables (UTI, wound infection, adverse events)
- Episode of care specific variables:
  - Revision of knee replacement (ICD9 CM code 00.80 - 00.84, 81.55 or equivalent)
  - Blood transfusion (code 99.0x or equivalent)
  - Complications of prosthetic device (996.66, 996.67, 996.77 or equivalent)



# Histograms of cost/LOS



❑ Considerable variability in both cost and LOS across countries

- Differences in clinical practice
- Difference in cost information
- Allowing comparison within countries not across



# Descriptives I

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- ❑ LoS (days) varies from 4.2 (Finland) to 13.6 (Germany)
- ❑ Age ranged from 67.5 (Poland) to 71.9 (Spain)
- ❑ Share of males varying from 20% in Germany to 46% in Poland.
- ❑ The total number of diagnoses per patient ranged from 1.1 in Finland to 6.0 in Germany
  - differences in coding practice



## Descriptives II

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- ❑ Generally low levels of Charlson comorbidity index and surgery-related adverse events
- ❑ The rate of patient revision knee replacement in most countries ranged from 4 % to 9%, with higher values only in Germany (12%) and Austria (22%).
- ❑ The rate of blood transfusion varied substantially, ranging from 0.3% to 36%, confirming difference in both clinical and coding practices across countries.
- ❑ The rate of complications of the prosthetic device was <3% in all countries



# Analysis

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- ❑ Each partner analyzed the same models on the national data
  - patient level stage
  - hospital level (not reported)
- ❑ 3 different models:
  - **M<sub>D</sub>** Cost/LOS = f (DRGs )
  - **M<sub>P</sub>** Cost/LOS = f ( Patient variables)
  - **M<sub>F</sub>** Cost/LOS = f (DRGs , Patient variables)
- ❑ FESE regressions for Cost data (7 countries)
- ❑ Poisson model for LOS (3 countries)
- ❑ Common methodology to other Episodes of care



# Results I

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- ❑ Generally consistent across cost and LOS analyses
- ❑ DRGs are ordered according to their reimbursement rate (or tariff)
- ❑ DRG more complicated (expected results) are generally associated with higher costs
- ❑ Exception for some DRG groups in almost all countries:
  - DRG groups with low number of patient captured in the episode
  - DRG3 in Spain also includes hip replacement, spinal procedures and other musculoskeletal procedures



## Results II:

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- ❑ Higher costs are associated with:
  - Older patients
  - With more diagnoses and procedures (capturing CCs)
  - Transfers to other hospitals
  - With post-operative wound infections and adverse events
  - With blood transfusion





## Results III

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- ❑ Revisions show between a 10% and 37% higher cost
- ❑ Complication of prosthetic device around 25% more costly
- ❑ ( $M_F$ ) explanatory power ranges from 24.5% in Spain to 73% in England.
- ❑ In most countries this varies from 43% to 47% for cost
- ❑ From 30% to 50% for LoS.



# Evaluation of DRG systems in explaining variations

	R <sup>2</sup> adj/Adj_Dev_R <sup>2</sup>			
	M <sub>D</sub> (DRGs)	M <sub>P</sub> (Patient vars)	M <sub>F</sub> (full model)	M <sub>D</sub> vs M <sub>P</sub>
<b>Finland</b>	0,429	0,352	0,477	0,077
<b>England</b>	0,725	0,669	0,731	0,056
<b>Germany</b>	0,339	0,337	0,455	0,002
<b>Poland</b>	0,492	0,5	0,513	-0,008
<b>Spain</b>	0,213	0,244	0,245	-0,031
<b>Sweden</b>	0,404	0,458	0,467	-0,054
<b>Austria</b>	0,269	0,34	0,357	-0,071
<b>France</b>	0,365	0,444	0,446	-0,079
<b>Estonia</b>	0,341	0,436	0,436	-0,095
<b>Ireland</b>	0,127	0,287	0,288	-0,16



# Evaluation of DRG systems in explaining variations

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- ❑ Full model shows similar ability of patient variables model
- ❑ DRG perform better than patient characteristics?
- ❑ YES: England and Finland
- ❑ NO: Spain, Sweden, Austria, France, Estonia, Ireland
- ❑ Similar: Germany and Poland
- ❑ Important improvement for **Ireland** (no DRG for revision knee replacement)
- ❑ **England** DRG explain 72% of variation in costs
- ❑ Generally all  $M_F$  perform better (but with low improvement) as DRG system only differentiate among primary, revision and major interventions



# Conclusions and suggestions

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- ❑ Highly standardised procedure and with low levels of in-hospital complications
- ❑ Few DRG groups explain large parts of variation
- ❑ Importance of cost accounting techniques
- ❑ Ability of DRG systems related with the role of DRGs in reimbursement system
  
- ❑ Patient variables capture complications and comorbidities and revisions
- ❑ The improvement is not impressive
- ❑ Capture the outcome of the knee replacement process
- ❑ Further research:
  - Improvement of DRG in knee replacement → Evaluate the quality of the outcome and relate with reimbursement.
  - rehabilitation process?



# Forthcoming publication

HEALTH ECONOMICS

*Health Econ.* (2012)

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## PATIENT CLASSIFICATION SYSTEMS AND HOSPITAL COSTS OF CARE FOR KNEE REPLACEMENT IN 10 EUROPEAN COUNTRIES

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### ABSTRACT

Knee replacement is a common surgical procedure performed to relieve pain and disability from degenerative osteoarthritis.

This study evaluates the ability of ten European diagnosis-related group (DRG) systems to explain variations in costs or in length of stay for knee replacements. We assessed three different models in predicting variation of cost and length of stay. The first model,  $M_D$ , included only DRG groups as explanatory variables; the second,  $M_P$ , used a set of patient-level variables; and the third,  $M_F$ , included all variables from both  $M_D$  and  $M_P$ .

The total number of DRGs used to group knee replacement is low, ranging from two to six. All DRG systems except one differentiate between primary knee replacement and revision surgery. Considerable differences exist in the rate of revision surgery. There is also high variation in mean cost (from € 3809 to € 8158) and in mean length of stay (LoS) (from 4.2 to 13.6 days).

The explanatory power of DRGs varies from 21.5 to 72.5% with values of around 40% in most countries of the study. Findings suggest that DRG systems could be enhanced either by the inclusion of patient-level variables, by the use of measures of clinical outcome or by improving cost and administrative information. Copyright © 2012 John Wiley & Sons, Ltd.

**KEY WORDS:** diagnosis-related groups; hospital cost; cost analysis; length of stay; knee replacement; knee arthroplasty; revision knee replacement

