Nordic Casemix Conference 2010, Helsinki

Future demands for DRG systems – considerations based on the *Euro*DRG project

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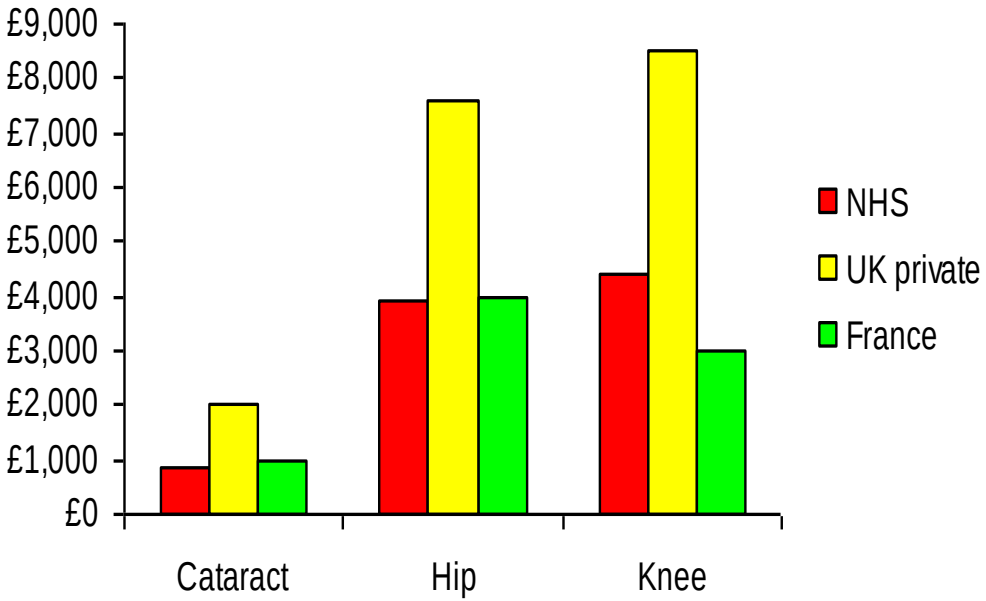
How I got interested in DRGs (2002)

- **A policy question in the 6th EU Framework Programme:**
  Why do costs of health services differ among EU countries at the micro level?

The first nine patients sent to France by the English NHS (not shown: the 40 journalists who accompanied them)



Are these data realistic?
Are they representative?
How can the differences be explained?

How I got interested in DRGs *cont'd*

- **Research questions in our successful HealthBASKET bid:**

  1. What is a "health service" and how is it defined? (Phase I -> *European Journal of Health Economics 2005*)
  2. How are prices (and underlying costs) calculated per service? (Phase II -> special issue on DRGs of *Health Care Management Science 2006*)
  3. Do prices/ reimbursement rates differ (for similar patients)? Are differences explained by systematic factors (e.g. in/exclusion of capital costs), differences in service intensity/ technologies used or costs per service? (Phase III -> *Health Economics 2008*)

Countries in HealthBASKET project

Phase I results (2005)

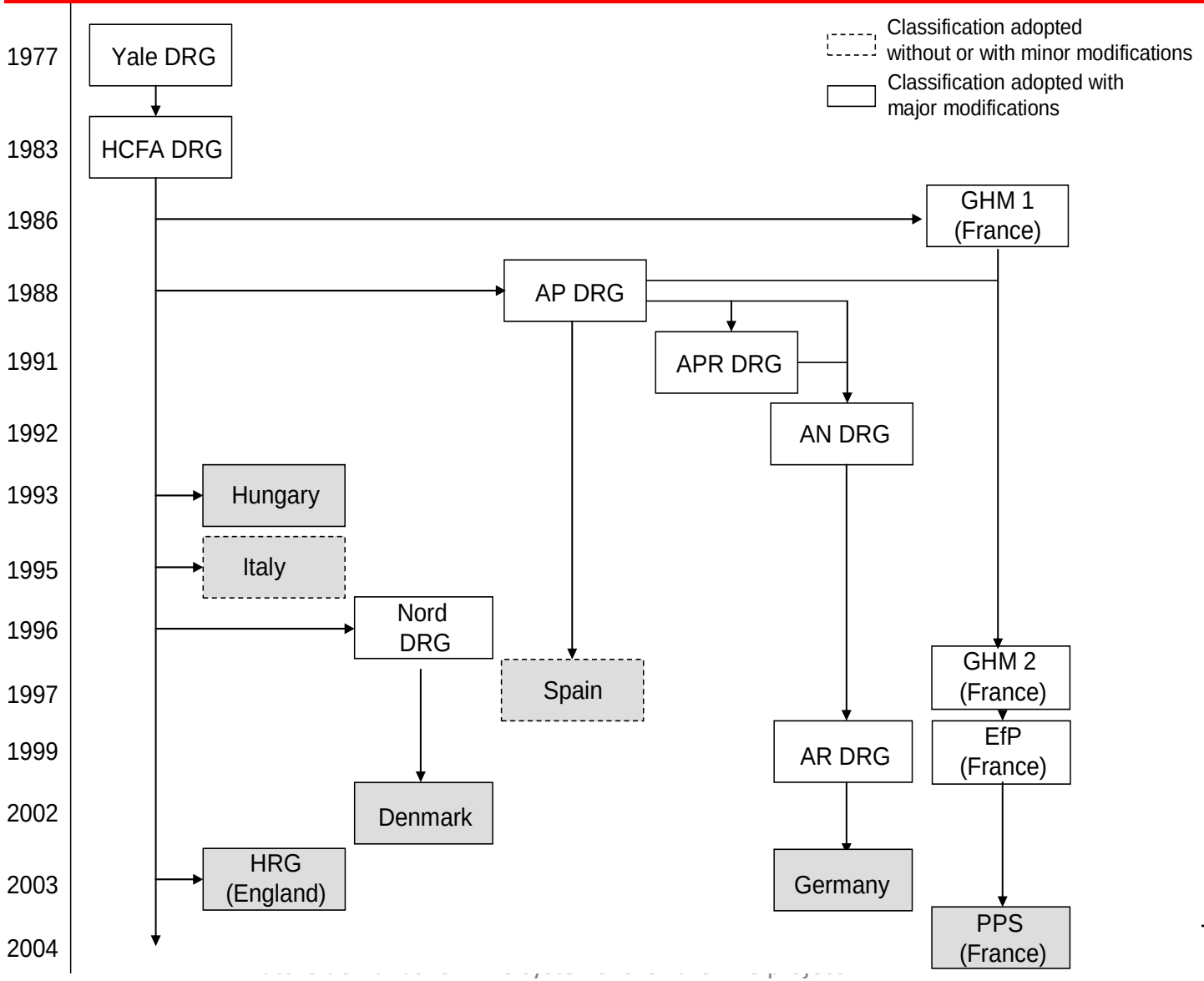
- clear trend towards a more explicit definition of benefit baskets and benefit catalogues in European health care systems (e.g. to assure equity among the regions)
- Taxonomy differs largely from country to country – even if most tend to sort ambulatory care by physician specialty and inpatient care by diagnosis and procedure (DRGs/ HRGs/ DBCs …)

→Conclusion: a uniform taxonomy ("European Classification of Health Services") to explore and describe differences (not to standardise the baskets!) is urgently needed for both practical and scientific purposes

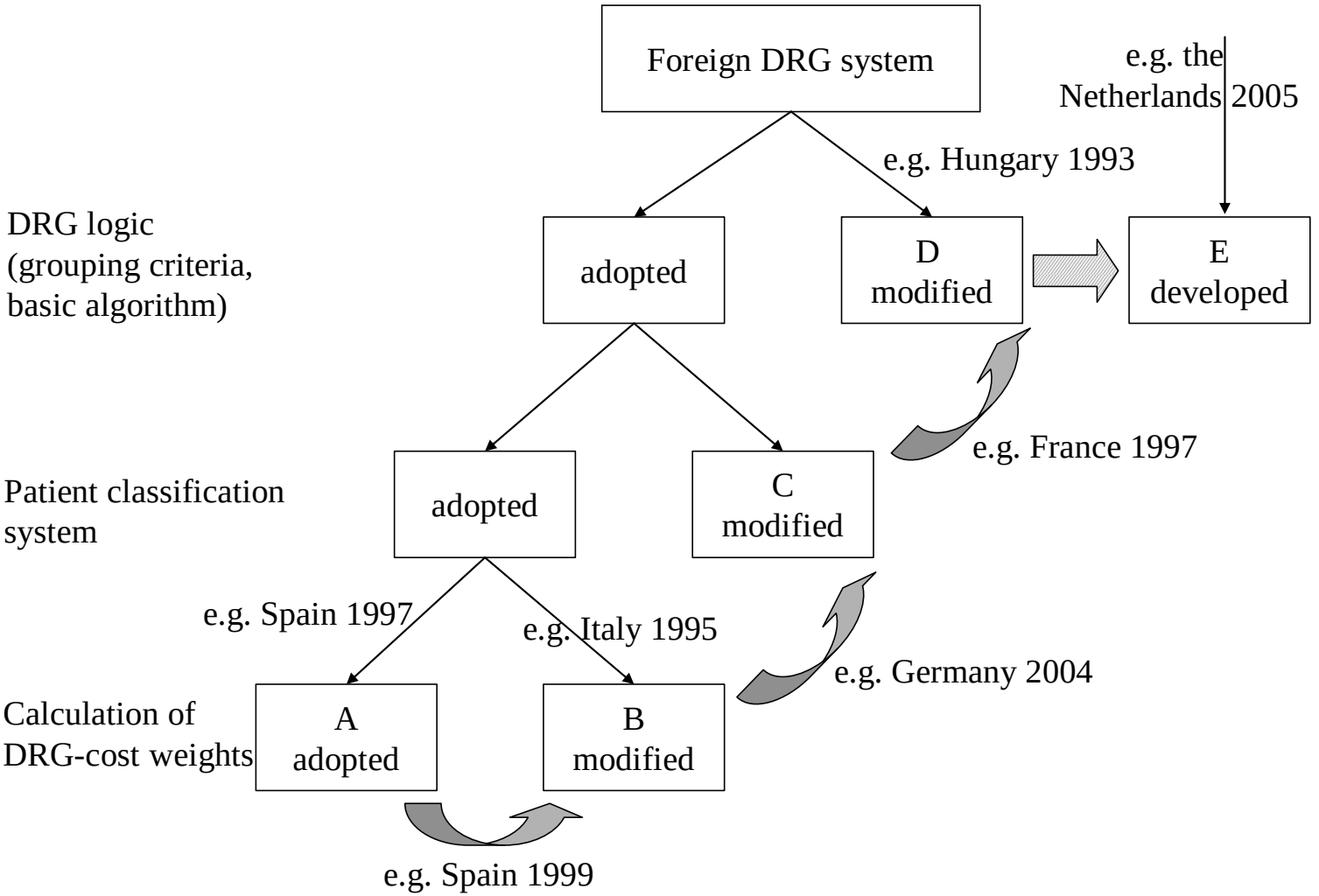
Phase II results (2006)

- Most countries have installed activity-based remuneration schemes for in- and outpatient services; often lacking for long-term care, rehabilitation etc.
- clear trend towards the use of micro-costing data (especially for inpatient services -> DRGs) to determine remuneration rates, reflecting actual costs of providers
- Problems:
  - insufficient quality of data delivered by providers
  - recommendations in methodological guidelines vary

DRG systems – one family, but often distant cousins



Import of DRG systems is common – a model to analyse adopted and modified elements



Phase II results *cont'd*

- Prerequisites of international cost comparison: mutually accepted methodological guidance (standard costing method) and reasonably good compliance with it.
- Harmonisation of methodologies not sufficient to ensure meaningful comparability; accounting systems should be coordinated and standardised
  --> serious dilemma:
  standardised "European" accounting methodology right down to provider level might be well-justified and "necessary" but enforcing one methodology conflicts with the principle of subsidiarity.

→ we used a self-developed standardised method

Phase III Objectives

- Do costs (and prices/ reimbursement rates) really differ? If yes, by how much?
- Why?
  - Systematic differences in calculation (e.g. capital costs included/ not included)?
  - Differences in technologies used or service intensity (e.g. time spent with patient)?
  - Costs per resource unit (e.g. wage differences)?

Phase III Methodology

- 10 case vignettes ("service packages") were designed around episodes of care

Need for care	Age group	Type of Care			ECHI*
Appendectomy	14-25	In-patient	Surgery	Emergency	-
Normal delivery	25-35	In-patient	Obstetrics	Elective	+
Hip-replacement	65-75	In-patient	Surgery	Elective	+
Cataract	70-75	Out-patient (day case)	Surgery	Elective	+
Stroke	60-70	In-patient	Medical	Emergency	+
AMI (PTCA)	50-60	In-patient	Medical	Emergency	+
Cough	2	Out-patient	Paediatrics/GP	Emergency	-
Colonoscopy	60-70	Out-patient	Diagnostic	Elective	+
Tooth filling	25-35	Out-patient	Dental	Emergency	+
Physiotherapy (knee)	12	Out-patient	Rehabilitative	-	-

*ECHI: related to European Community Health Indicators set (+ yes/ - no)

Phase III Methodology cont'd

- To ensure homogeneity within case vignettes *(i.e. to avoid risk adjustment)*, health status and indication of each patient was defined in detail for each vignette
- To ensure comparability across vignettes, each was divided into detailed path components e.g. diagnostic procedures, care before operation etc.
- Partners in each country documented technology use, service intensity and costs (prices) for case vignettes with data from at least 5 representative providers

→Costs (and prices) compared and differences analysed

An example: Hip replacement

Female, 65-75 years old, with hip osteoarthritis requiring hip replacement because of considerable impairment is finally (after waiting time if normal in the hospital) admitted for her first hip replacement (one side).

(= standardised severity)

The patient is without co-morbidity (i.e. expensive drugs due to treating co-morbidity should be excluded), the surgeon uses the most frequently used implant for female patients; the operation is without severe complications

(= standardised outcome)

End of case vignette: discharge (home or *to separate rehabilitation institution*).

Phase	Elements **Example: Hip replacement**	Units	No. of units used/ patient	Unit Cost	Total costs
Pre-operative (admission and planning)	*Diagnostic Procedures*				
	Imaging (e.g. X-Ray)	No.			
	Imaging (e.g. ultrasound)	No.			
	Imaging (e.g. CT)	No.			
	Laboratory (e.g. blood count)	No.			
	Laboratory (e.g. blood coagulation, C-reactive protein (CRP), etc.)	No.			
	Other (ECG, lung-function, etc.)	No.			
	Care before OP				
	Surgeon/Physician input	Patient days*			
	Nursing input	Patient days			
	Other (paramedical)	Patient days			
	Drugs, infusions, injections, etc. *Drug A, Drug B, etc.*	DD**			
Operation	*Devices (type of implant, stent, etc.) total price paid by hospital*	No.			
	OP-Team (altogether or separately)	Min.			
	Surgeon	Min.			
	Anaesthetist	Min.			
	OP-nurses etc.	Min.			
	Drugs (anaesthetics, other?)	DD			
	OP-Theatre running costs (e.g. sterilisation)***	Min.			
Wake-up room****					
Post-operative	*Intensive Care Unit*				
	Surgeon/Physician	Patient days			
	Nursing	Patient days			
	Other	Patient days			
	Drugs	DD**			
	Diagnostic Procedures (e.g. imaging, laboratory)	No.			
	Therapeutic Procedures (e.g. punctures, drainages, special wound dressing)	No.			
	Normal Ward				
	Surgeon/Physician	Patient days			

Phase III results (2007)

Example: Hip replacement

Table 2: Total cost, cost components and reimbursement of total hip replacement

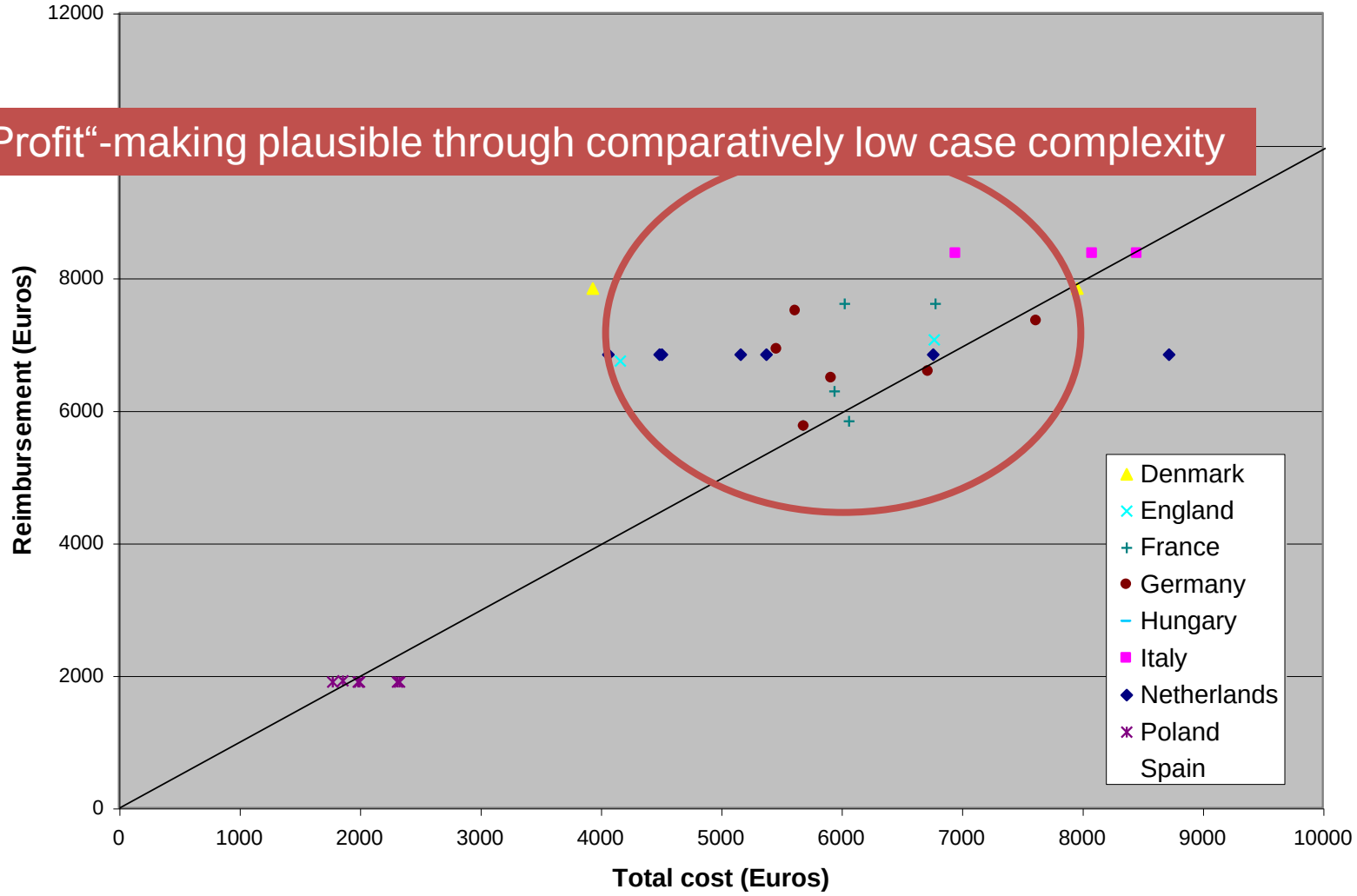
	Denmark	England	France	Germany	Hungary	Italy	Netherlands	Poland	Spain
Diagnostic Procedures									
- Imaging	€ 141.00	€ 87.95	€ 60.01	€ 79.83	€ 7.82	€ 63.37	€ 32.90	€ 33.80	€ 42.53
- Laboratory	€ 35.01	€ 5.74	€ 100.58	€ 137.00	€ 10.02	€ 58.42	€ 45.12	€ 14.00	€ 54.62
- Other	a)	€ 6.22	€ 0.00	€ 107.39	€ 2.87	€ 18.06	€ 19.07	€ 15.30	€ 2.52
Normal/Intensive Ward									
- Physician	€ 18.04	€ 450.88	€ 88.80	€ 414.40	€ 135.49	€ 171.90	a)	€ 236.62	€ 203.67
- Nursing	€ 470.98	€ 1,237.22	€ 428.14	€ 1,167.56	€ 341.15	€ 104.58	€ 538.40	€ 192.42	€ 278.19
- Other Staff	€ 111.37	€ 274.78	€ 193.11	€ 249.24	€ 0.51	€ 78.00	€ 189.64	€ 45.97	€ 0.00
- Material	a)	a)	€ 6.40	€ 129.46	a)	€ 5.78	a)	€ 16.75	€ 1.27
Operation (including wake-up room)									
- Anaesthetist / Surgeon	€ 202.04	€ 534.55	€ 728.15	€ 596.34	€ 93.25	€ 228.51	€ 669.47	€ 52.08	€ 400.16
- Nursing	€ 136.90	€ 123.47	€ 171.78	€ 283.77	€ 18.53	€ 99.57	€ 200.50	€ 9.64	€ 108.69
- Other Staff	€ 42.52	€ 0.00	€ 44.75	€ 133.18	a)	€ 11.42	€ 177.69	€ 0.00	€ 0.00
- Implant	a)	€ 657.50	€ 1,852.24	€ 963.46	€ 481.75	€ 3,416.05	€ 1,825.00	€ 978.38	€ 1,780.00
- Material	€ 115.61	€ 106.63	€ 154.54	€ 249.13	a)	€ 22.31	a)	€ 35.00	€ 0.18
Drugs	€ 59.63	€ 571.28	€ 60.99	€ 178.85	€ 72.50	€ 74.30	€ 104.12	€ 175.13	€ 46.20
Overhead	€ 4,599.14	€ 1,634.72	€ 2,211.60	€ 1,675.59	€ 129.92	€ 2,629.63	€ 1,803.01	€ 320.27	€ 680.99
% overhead of total	**77.5%**	**28.7%**	**36.2%**	**26.3%**	**10.0%**	**37.7%**	**32.2%**	**15.1%**	**18.9%**
TOTAL COST	**€ 5,932.24**	**€ 5,690.94**	**€ 6,101.09**	**€ 6,365.20**	**€ 1,293.81**	**€ 6,981.90**	**€ 5,604.92**	**€ 2,125.36**	**€ 3,599.02**
Total cost (adjusted by PPP)	**€ 4,401.10**	**€ 5,273.78**	**€ 5,679.66**	**€ 6,047.12**	**€ 2,147.05**	**€ 6,795.04**	**€ 5,328.38**	**€ 3,861.48**	**€ 3,964.99**
Reimbursement	€ 7,840.00	€ 6,905.45	€ 6,622.14	€ 6,767.36	€ 1,794.93	€ 8,963.60	€ 6,842.00	€ 1,903.17	b)

a) subsumed in overhead costs

b) hospitals are receive budget. It only partly depends on the number of cases treated.

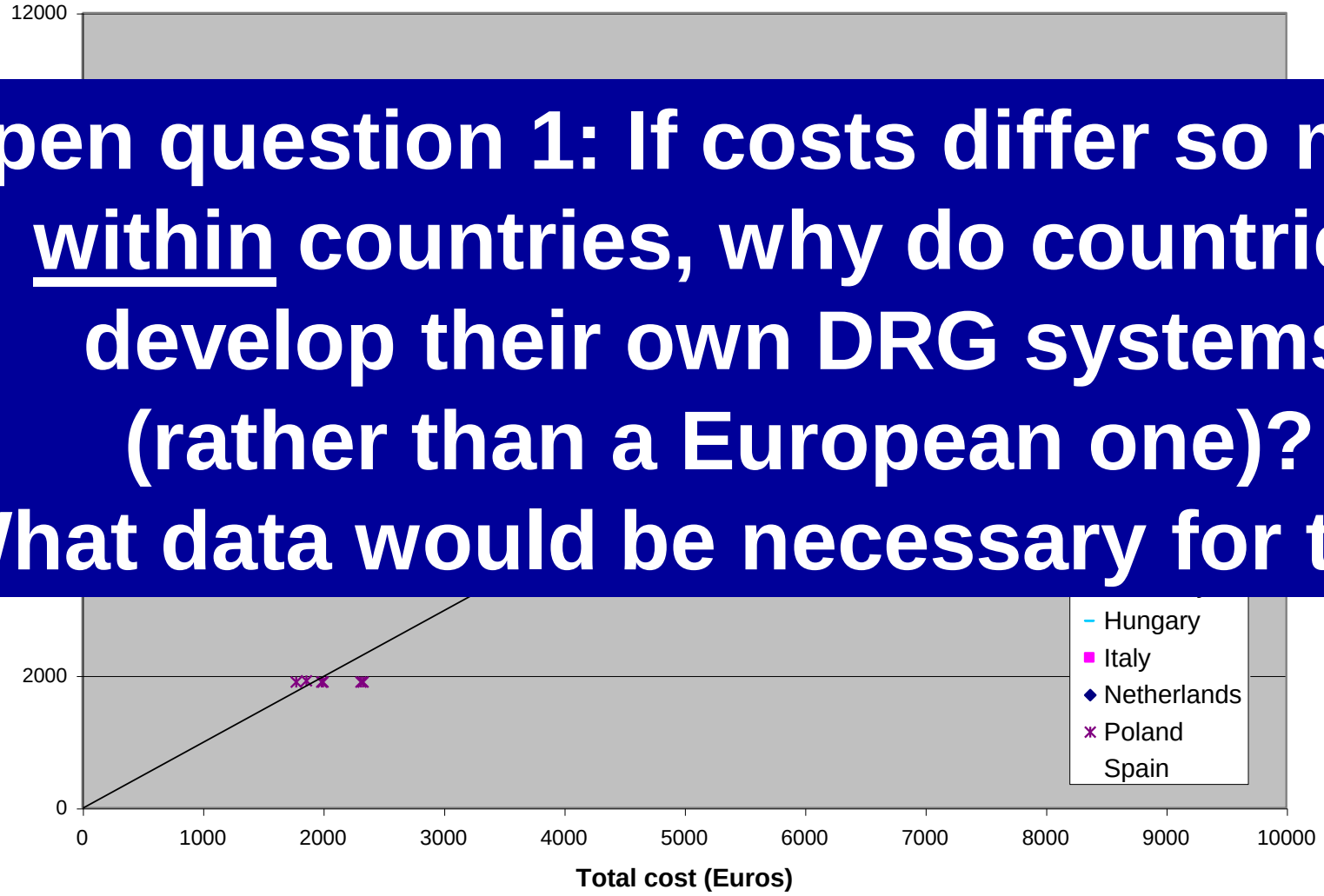
Phase III results

Example: Hip replacement



Phase III results

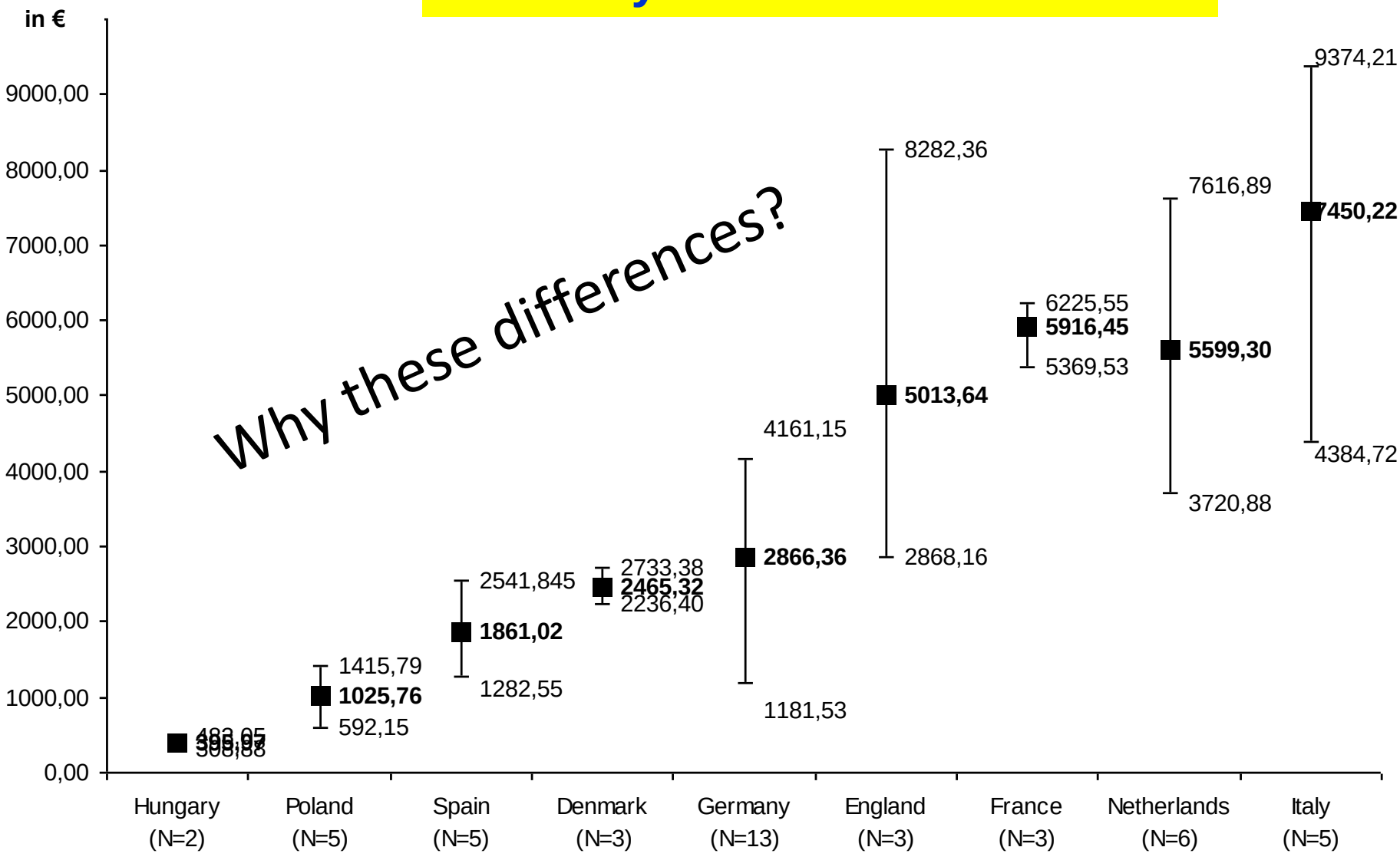
Example: Hip replacement



Open question 1: If costs differ so much <u>within</u> countries, why do countries develop their own DRG systems (rather than a European one)? What data would be necessary for this?

Phase III results

Acute myocardial infarction



Phase III results

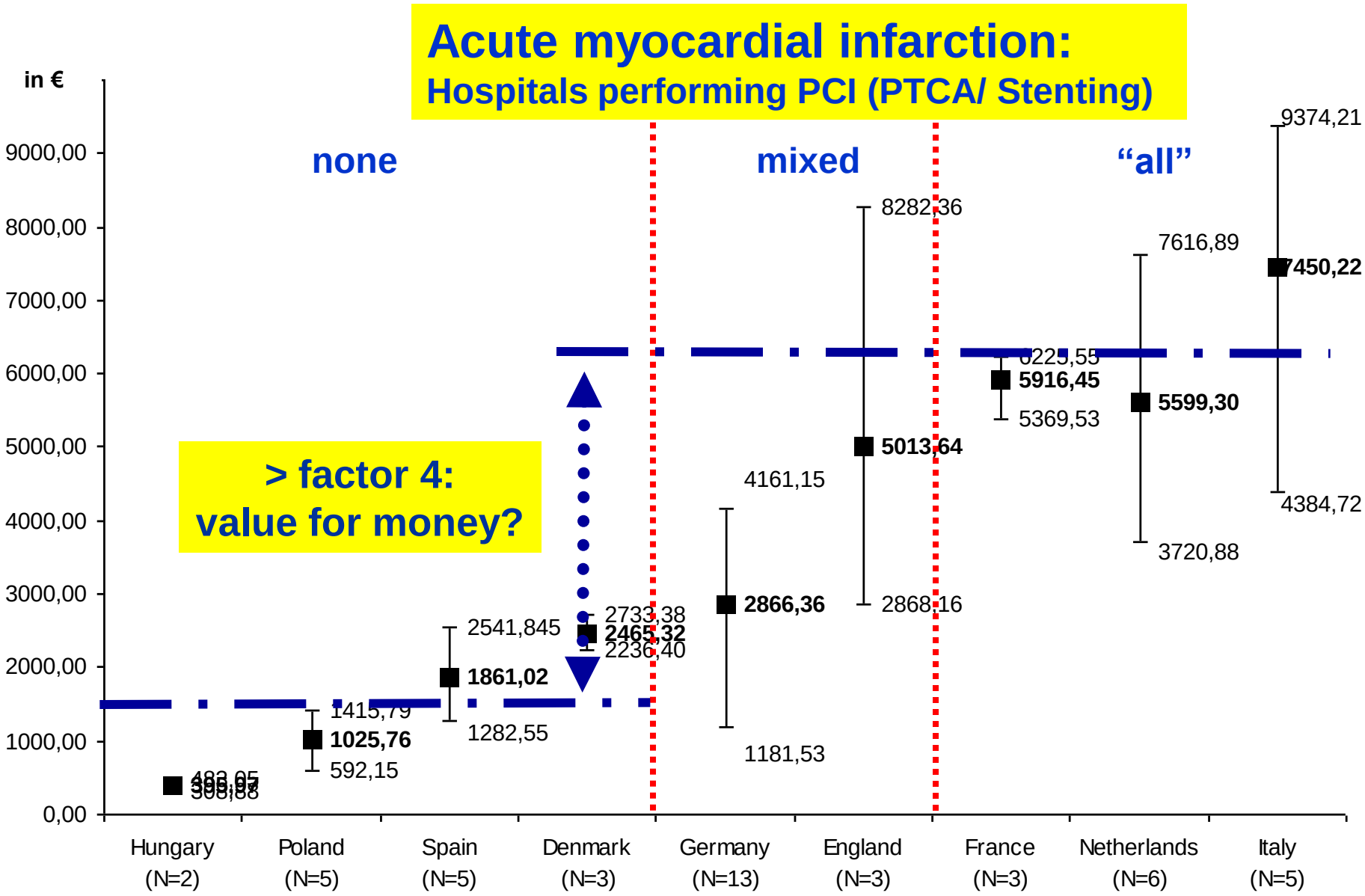
Acute myocardial infarction

Table 1. Sample Characteristics

	England	France	Germany	Netherlands	Hungary	Italy	Poland	Spain	Denmark*
Hospitals included (no.)	3	3	13	6	2	5	5	5	3
Treatment characteristics									
PTCA (%)	0.33 ± 0.58	0.95 ± 0.05	0.43 ± 0.49	0.91 ± 0.15	0 ± 0	1 ± 0	0 ± 0	0 ± 0	/
PTCA & Stenting (%)	0.33 ± 0.58	0.95 ± 0.05	0.34 ± 0.39	0.91 ± 0.15	0 ± 0	1 ± 0	0 ± 0	0 ± 0	/
Drug eluting Stents	0.05 ± 0.09	0 ± 0	0.08 ± 0.12	0.83 ± 0.41	0 ± 0	0.32 ± 0.34	0 ± 0	0 ± 0	/
Length of stay (days)	6.0 ± 0.08	6.0 ± 1.5	6.9 ± 2.1	5.7 ± 0.08	8.9 ± 2.1	7.0 ± 2.9	11.0 ± 3.0	8.2 ± 1.1	5.9 ± 2.7
Hospital characteristics									
Beds per hospital (no.)	776.3 ± 192.5	486.3 ± 148.5	436.5 ± 193.0	533.3 ± 250.3	608.5 ± 181.7	794.6 ± 312.9	359.4 ± 211.9	401.8 ± 275.6	585.3 ± 175.3
Physicians per hospital bed (no.)	0.34 ± 0.06	0.35 ± 0.04	0.22 ± 0.07	0.27 ± 0.11	0.14 ± 0.06	0.59 ± 0.03	0.27 ± 0.04	0.67 ± 0.09	0.68 ± 0.22
Nurses per hospital bed (no.)	1.56 ± 0.10	1.39 ± 0.22	0.56 ± 0.12	2.62 ± 0.84	0.79 ± 0.09	1.26 ± 0.14	0.76 ± 0.22	2.31 ± 1.37	2.18 ± 1.02
Beds per dept. (no.)	57.8 ± 0	32.0 ± 8.0	90.1 ± 22.9	26.0 ± 10.4	71.5 ± 12.0	34.6 ± 17.1	51.7 ± 4.6	57.8 ± 0	47.6 ± 22.5
Physicians per dept. bed (no.)	0.23 ± 0	0.29 ± 0.05	0.17 ± 0.06	0.22 ± 0.06	0.09 ± 0.11	0.61 ± 0.14	0.17 ± 0.05	0.23 ± 0	0.45 ± 0.14
Country characteristics									
Eurostat Purchasing Power Parities	1.0791	1.0742	1.0526	1.0519	0.6026	1.0275	0.5504	0.9077	1.3479

a) subsumed in overhead costs b) no data available * for information only; excluded from the further analysis

Phase III results



Phase III results

Acute myocardial infarction

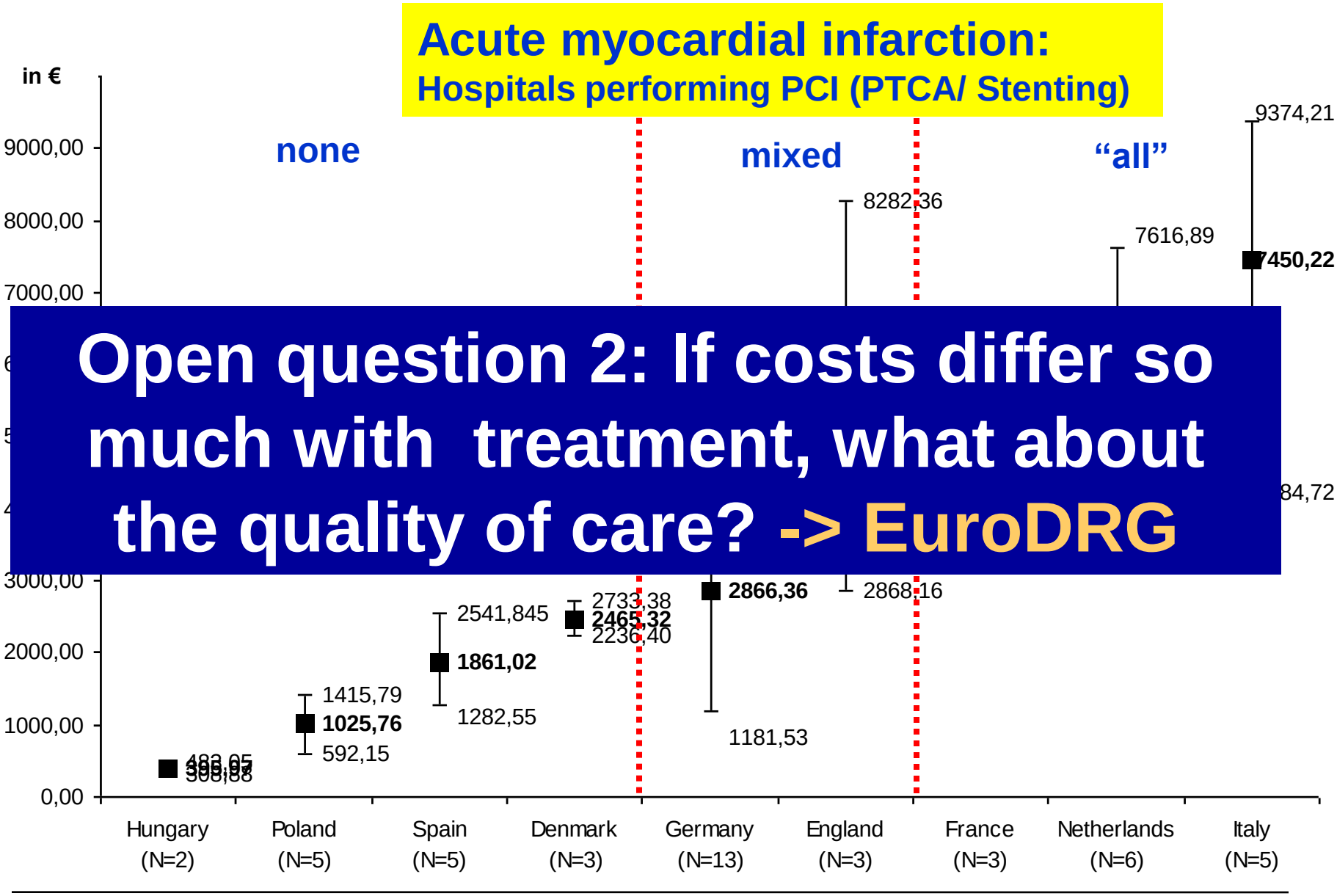
Table 3. Two-level random intercept regression model

Independent variable	Coefficient	S.E.	t-value	p-value
Treatment characteristics				
PTCA and stenting	0.5249	0.1619	3.24	0.0028***
Length of stay	0.0725	0.0238	3.04	0.0048***
Hospital characteristics				
Urbanity	0.2488	0.1025	2.43	0.0212**
Country characteristics				
PPPs	3.8327	0.6900	5.55	<.0001***

***P<0.01, **P<0.05

*** The coefficient is significant (1%)
** The coefficient is significant (5%)

Phase III results



Open question 2: If costs differ so much with treatment, what about the quality of care? -> EuroDRG

Phase III analyses show that …

- use of technology is a major explanation for certain vignettes (hip replacement, acute myocardial infarction, appendectomy …)
- skills mix and usage intensity may make a difference (normal delivery …)
- length of stay plays a role (especially if shortened by early discharge to rehabilitation; e.g. stroke)
- hospital characteristics are also important (e.g. size and urbanity)
- costs per resource unit (especially for personnel) do differ – as much or more than technology usage -> *for efficiency comparisons, adjustment of input costs necessary*

The scientific numbers in detail …

	Hip replace-ment	Stroke	Acute myocardial infarction	Normal delivery	Appen-dectomy	Cataract	Tooth filling
Technology/ procedure	** (non-cemented vs. cemented)	* (% with thrombo-lysis)	** (% of PTCA with stenting)		** (laparo-scopic vs. open surgery)	* (soft vs. hard lens)	*-** (% with imaging)
Personnel input (time)						***	
Length-of-stay		*	**	**		*	** (treat-ment time)
Hospital charcteristics							
Beds/ hospital	*				**		
Nurses/ bed					(*)		
Urbanity			*				
Setting						***	
Cost of personnel/ hour				** (nurses only)		***	
Purchasing power parities (PPP)	***	#	***		***		#

* significant at .05 level, ** significant at .01 level, *** significant at .001 level, (*) only in one model, # PPP not used as explanatory variable but to adjust costs as dependent variable

Development of Episode-specific Purchasing Power Parities
→ Definition of homogeneous cost categories

- material costs
- drug costs
- physician costs
- nursing costs
- costs related to diagnostic procedures

} Constitute > 50% of total costs

Care episode	Country								Average
	Germany	England	France	Hungary	Italy	Netherlands	Poland	Spain	
Hip	0.68	0.66	0.60	0.90	0.61	0.61	0.83	0.81	0.71
AMI	0.73	0.68	0.74	0.76	0.55	0.85	0.73	0.74	0.72
Appendectomy	0.64	0.41	0.39	0.68	0.45	0.62	0.46	0.76	0.55
Delivery	0.78	0.43	0.39	0.40	0.34	0.64	0.63	0.78	0.55
Stroke	0.64	0.32	0.52	0.52	0.34	0.39	0.57	0.76	0.51

Average adjusted costs per case by country and care episode

Care episode/ Conversion approach	Country							
	Germany	England	France	Hungary	Italy	Netherlands	Poland	Spain
Hip								
Exchange rate	6,365	5,691	6,101	1,294	6,982	5,605	2,125	3,599
GDP per head	6,365	5,372	5,985	4,251	7,771	5,016	9,866	4,929
GDP PPP	6,365	5,551	5,979	2,260	7,152	5,609	4,065	4,174
Medical care PPP	6,365	5,146	6,245	2,782	5,709	5,633	5,121	4,269
ESPPP	6,365	5,646	7,880	4,979	6,924	7,687	5,334	5,770
AMI								
Exchange rate	2,866	5,014	5,916	396	7,450	5,599	1,026	1,861
GDP per head	2,866	4,732	5,803	1,301	8,292	5,011	4,762	2,549
GDP PPP	2,866	4,891	5,798	692	7,632	5,603	1,962	2,158
Medical care PPP	2,866	4,533	6,056	852	6,092	5,627	2,472	2,208
ESPPP	2,866	2,403	2,728	2,060	4,804	2,481	2,154	2,006
Appendectomy								
Exchange rate	1,922	2,037	2,027	469	1,632	1,898	466	594
GDP per head	1,922	1,923	1,988	1,541	1,816	1,698	2,164	813
GDP PPP	1,922	1,987	1,986	819	1,672	1,899	891	688
Medical care PPP	1,922	1,842	2,074	1,008	1,334	1,907	1,123	704
ESPPP	1,922	2,203	2,872	1,362	2,246	1,979	2,429	1,454
Delivery								
Exchange rate	2,365	1,638	2,107	342	1,534	762	400	572
GDP per head	2,365	1,546	2,067	1,124	1,707	682	1,857	783
GDP PPP	2,365	1,598	2,065	597	1,571	763	765	663
Medical care PPP	2,365	1,481	2,157	735	1,254	766	964	679
ESPPP	2,365	3,868	4,751	5,239	4,226	2,552	2,538	2,257
Stroke								
Exchange rate	3,456	6,123	4,337	628	4,588	6,872	1,238	1,932
GDP per head	3,456	5,779	4,255	2,065	5,106	6,150	5,746	2,645
GDP PPP	3,456	5,972	4,250	1,098	4,700	6,877	2,367	2,240
Medical care PPP	3,456	5,536	4,440	1,352	3,751	6,907	2,983	2,291
ESPPP	3,456	5,378	3,859	3,220	5,072	4,473	3,337	2,486

Care episode/	Country							
GDP PPP	3,456	5,972	4,250	1,098	4,700	6,877	2,367	2,240
Medical care PPP	3,456	5,536	4,440	1,352	3,751	6,907	2,983	2,291
ESPPP	3,456	5,378	3,859	3,220	5,072	4,473	3,337	2,486

Open question 3: Does this adjustment hold with better data? Euro-DRG: (1) routine cost and activity data for broader patient categories and (2) hospital benchmarking club. If yes, has more emphasis to be put on exogeneous factors (such as wages) when using DRGs for reimbursement? Could this lead to a European system with differing base rates (as in US)?

Health Economics

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Issue Edited by Reinhard Busse, Jonas Schreyögg, Peter C. Smith

Editorials

Variability in healthcare treatment costs amongst nine EU countries - results from the *Health*BASKET project (p S1-S8)

Reinhard Busse, Jonas Schreyögg, Peter C. Smith

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SPECIAL FEATURES

Best Paper Award

… taking up the open questions, based on the observation that costs differ due to three groups of factors:

(1) Patient characteristics, i.e. main diagnosis, age, sex, secondary diagnoses (upon admission)

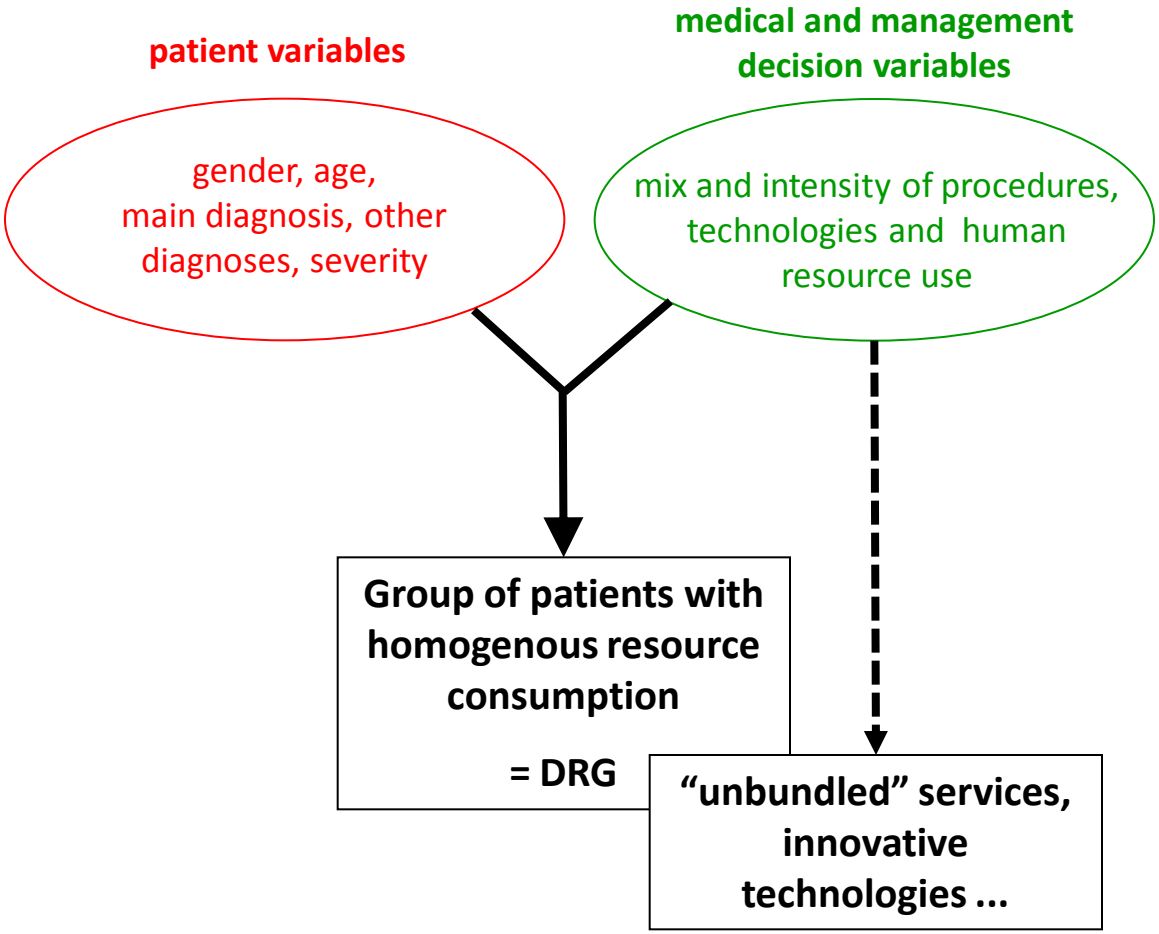
(2) Medical/ treatment variables, i.e. procedures/ technologies used, type of ward (e.g. intensive care), intensity of inputs (e.g. personnel), length of stay, secondary diagnoses (-> complications)

between (2) and (3): activity levels

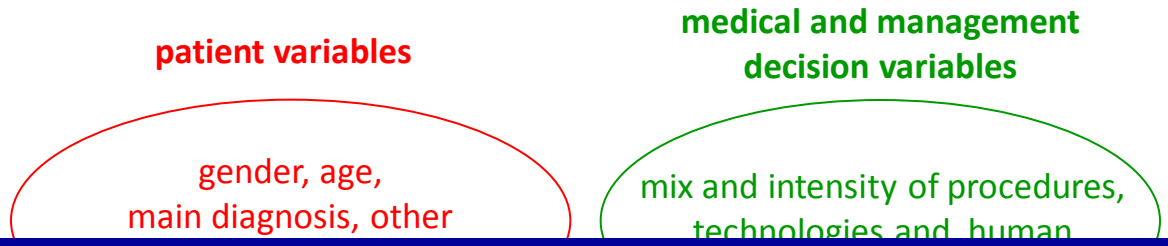
(3) Exogenous factors
- at hospital level: size (beds, personnel), emergency room, teaching status
- at regional/national level: wage level, costs of other inputs

Countries in (HealthBASKET and) EuroDRG projects

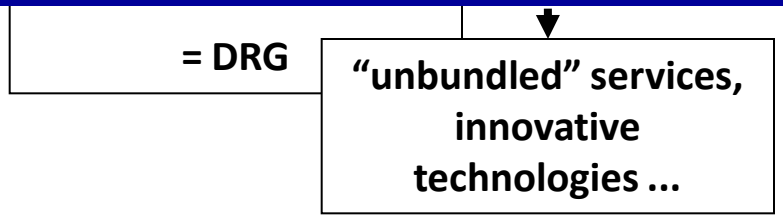
Understanding the role of the 3 factors in cost differences and price setting (1)



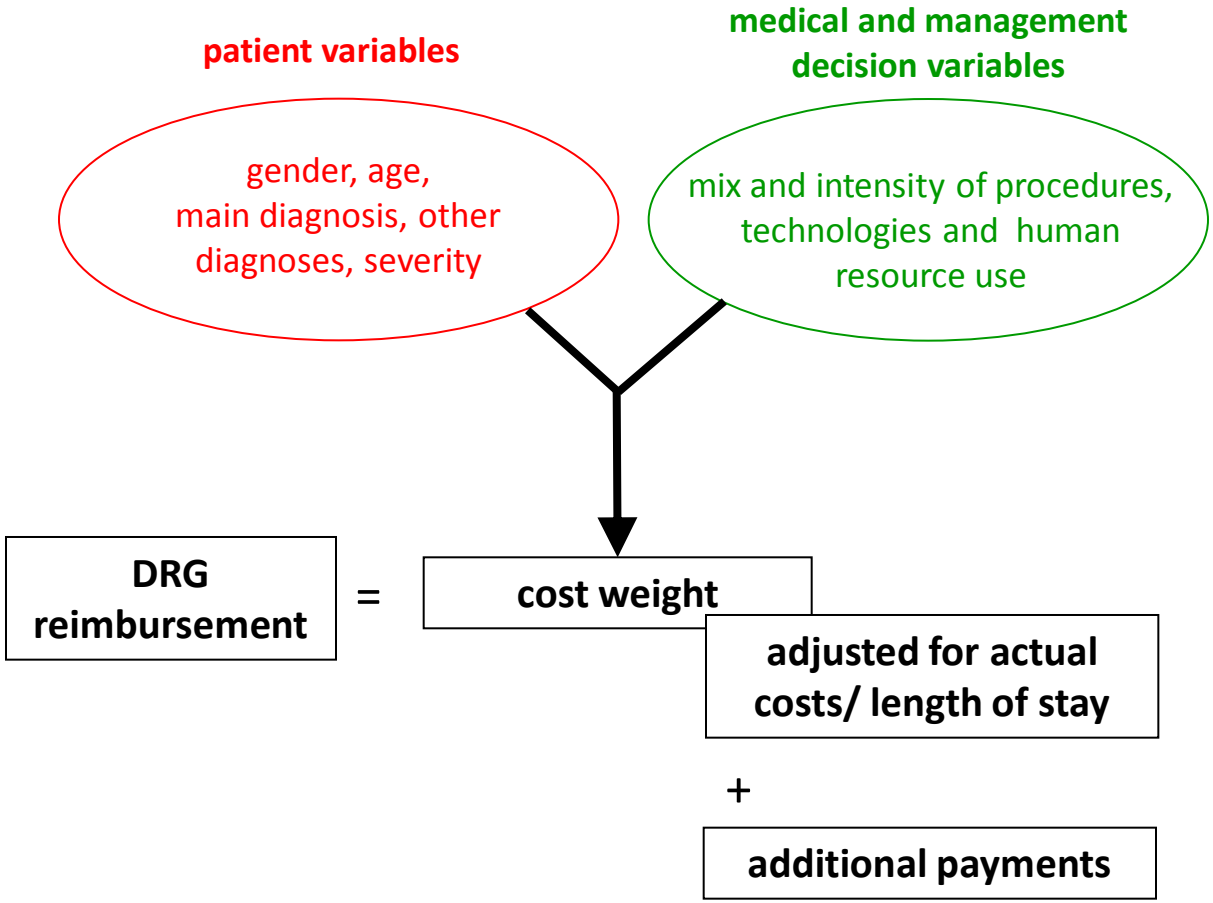
Understanding the role of the 3 factors in cost differences and price setting (1)



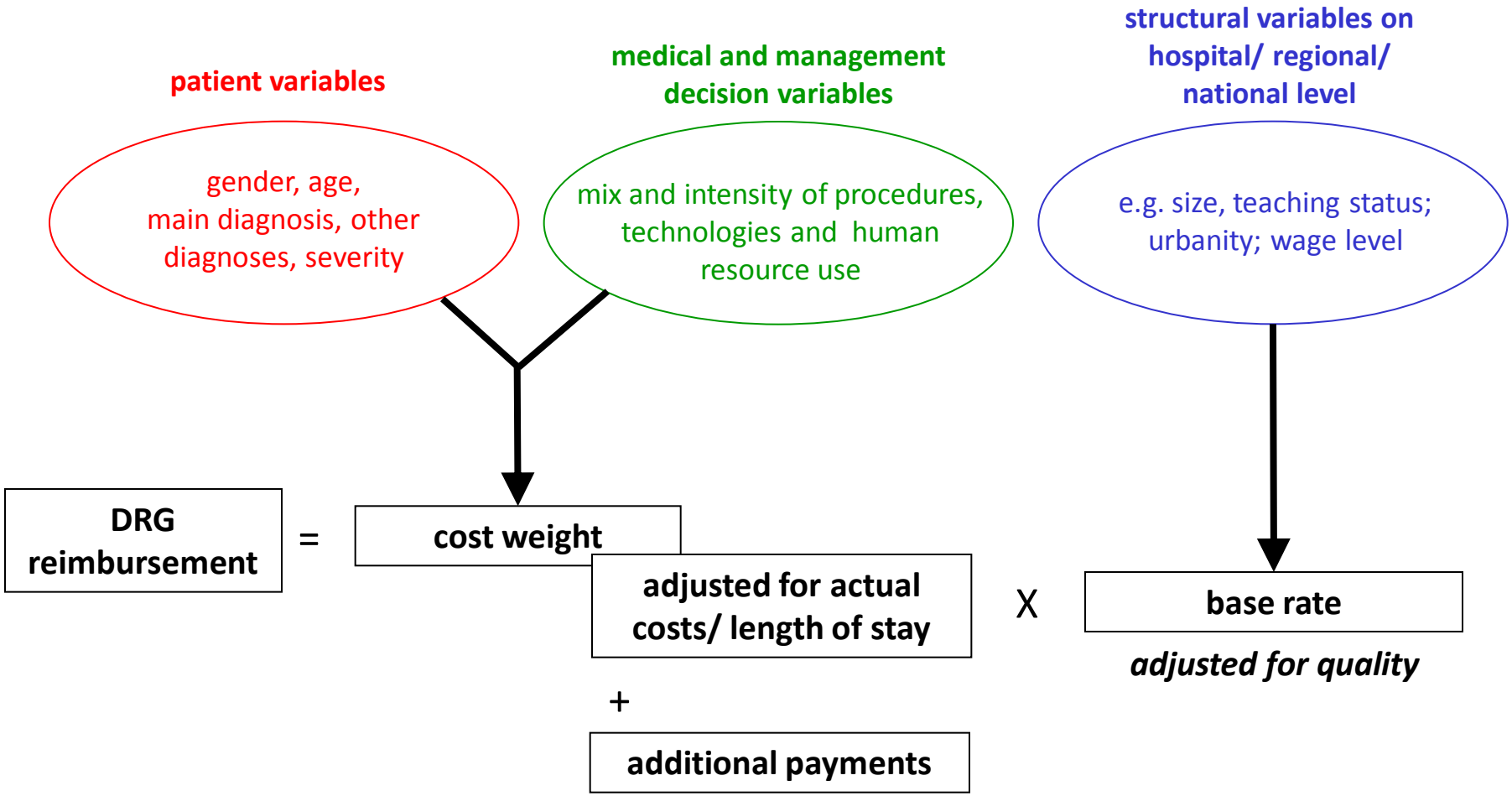
Open question 4: How can we assure that effective – but more expensive – innovations are integrated into provision (but not the ineffective ones)?



Understanding the role of the 3 factors in cost differences and price setting (2)



Understanding the role of the 3 factors in cost differences and price setting (3)



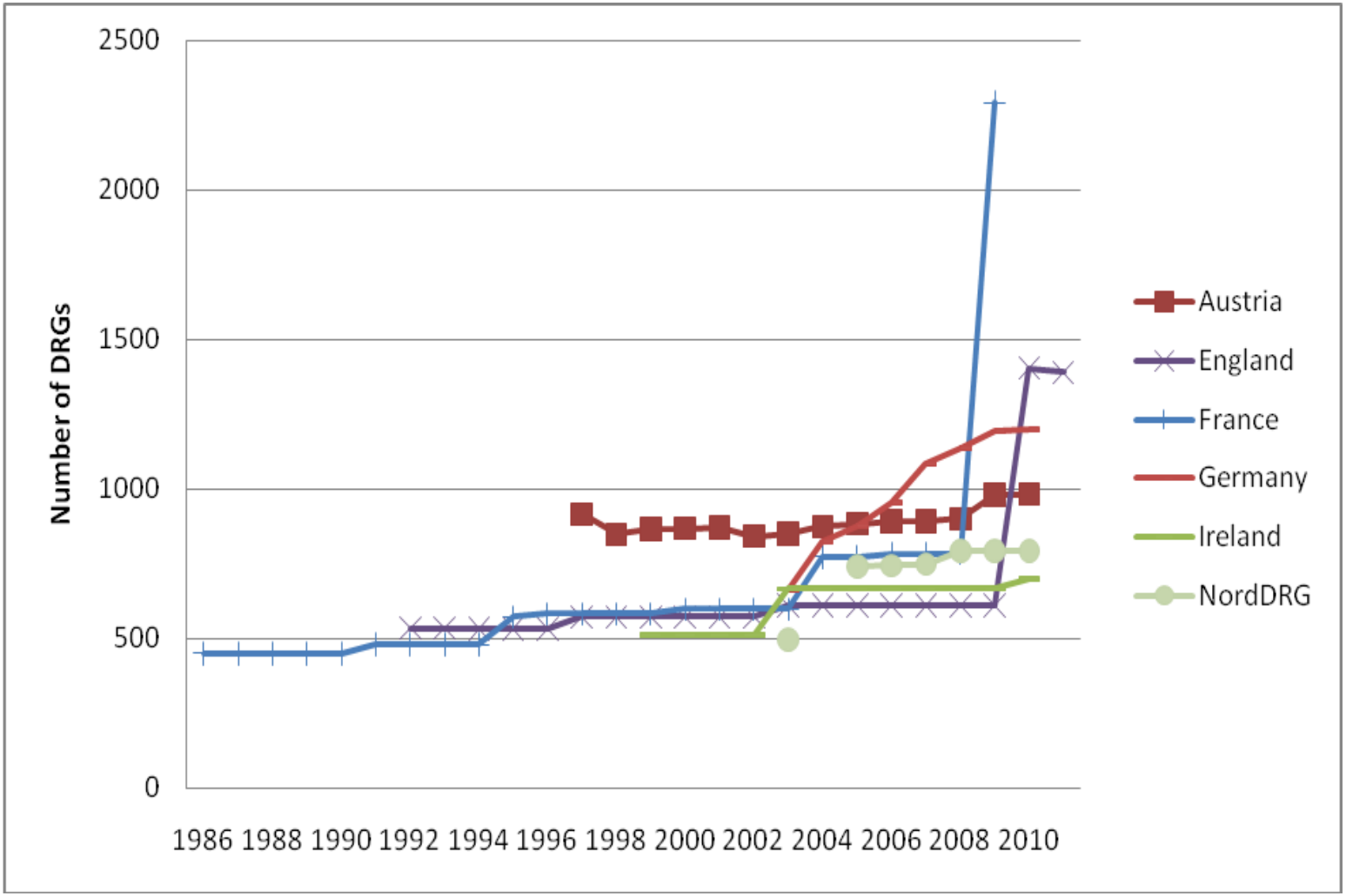
The research programme

Phase I (2009 until now)

- Description of DRG systems, updates and usage for patient classification and reimbursement across countries
- Detailed description of grouping algorithm and cost weights for 10 episodes of care
- Analysis of commonalities and differences
- Literature review on effects in regard to quality and efficiency

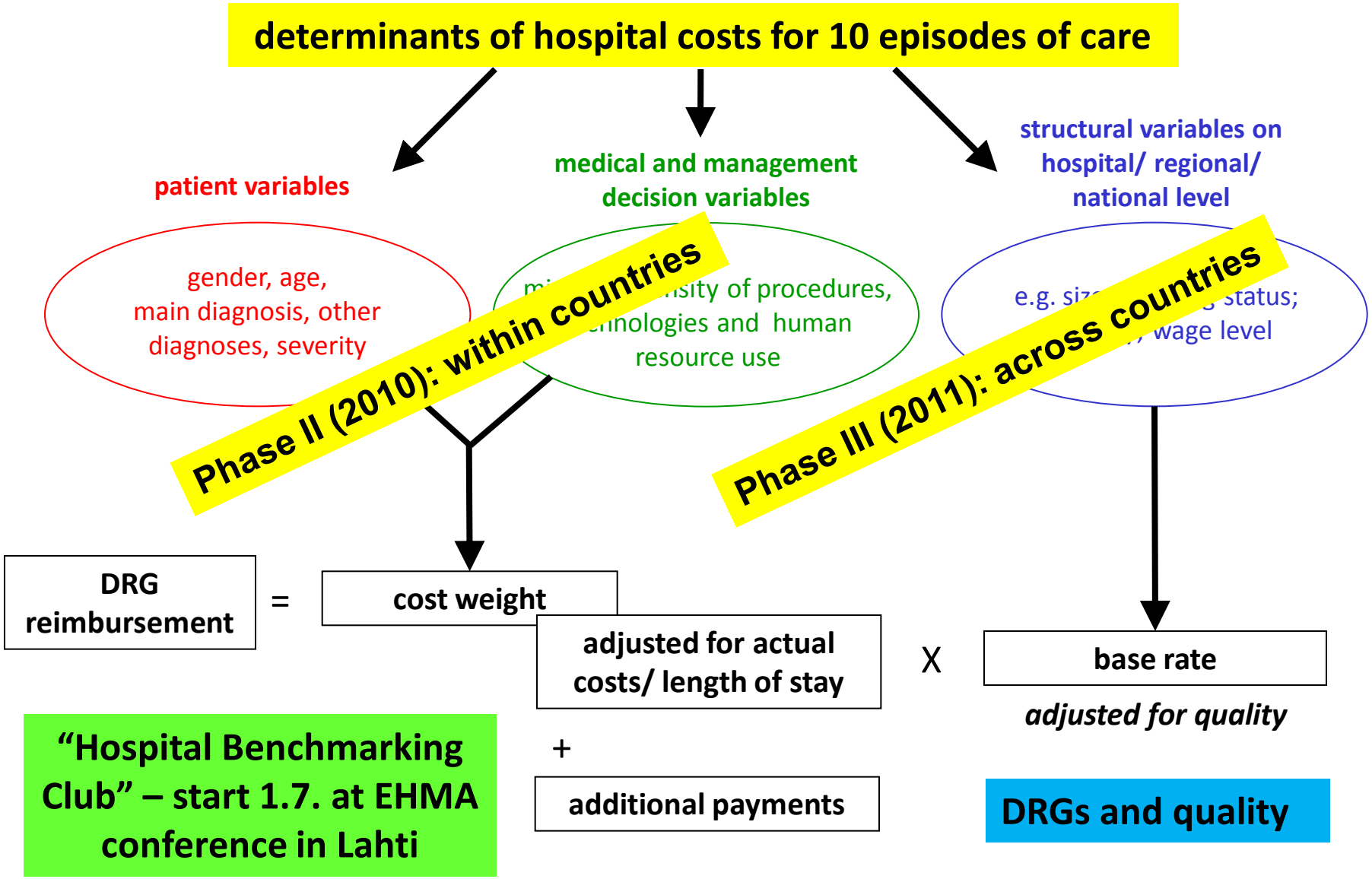
→ Book on DRGs in Europe (Open University Press early 2011) with chapters on patient classification systems, cost accounting, DRGs for reimbursement/ avoiding unintended consequences, efficiency, quality, innovations in DRG systems + country chapters

A glimpse at phase I results: number of DRGs



MDC (US)	Description	EE	FI	SW	PT	ES	FR	DE	EI	Engl	PL
0	Pre-MDC						26 (Transpl)	Pre (A)	A	X	
1	Nervous System	1	1	1	1	1	1	1 (B)	B	A	A
2	Eye	2	2	2	2	2	2	2 (C)	C	B	B
3	Ear, Nose, Mouth and Throat	3	3	3	3	3	3	3 (D)	D	C	C
4	Respiratory System	4	4	4	4	4	4	4 (E)	E	D	D
5	Circulatory System	5	5	5	5	5	5	5 (F)	F	E	E (card) Q (vasc)
6	Digestive System	6	6	6	6	6	6	6 (G)	G	F	F
7	Hepatobil. System and Pancreas	7	7	7	7	7	7	7 (H)	H	G	G
8	Musculosk. Syst. & Connect. Tissue	8	8	8	8	8	8	8 (I)	I	H	H
9	Skin, Subcut. Tissue and Breast	9	9 30	9 30	9	9	9	9 (J)	J	J	J
10	Endocrine, Nutrit. & Metab. System	10	10	10	10	10	10	10 (K)	K	K	K
11	Kidney and Urinary Tract	11	11	11	11	11	11	11 (L)	L	L	L
12	Male Reprod. System	12	12	12	12	12	12	12 (M)	M		
13	Female Reprod. System	13	13	13	13	13	13	13 (N)	N	M	M
14	Pregnancy, Childb. and Puerperium	14	14	14	14	14	14	14 (O)	O	N	N
15	Newborn and Other Neonates	15	15	15	15	15	15	15 (P)	P	P	
16	Blood, Bl.Form. Org. & Immunol.	16	16	16	16	16	16	16 (Q)	Q	Q	S
17	Myeloproliferative DDs	17	17	17	17	17	17	17 (R)	R	S	
25	HIV	25	18	18	24	24	25	18A (S)	S/T	W	
18	Infectious and Parasitic DDs	18			18	18	18	18B (T)			
19	Mental DDs	19	19	19	19	19	19	19 (U)	U	T (res.)	-
20	Alcohol/Drug Use or Ind. Mental Ds	20	20	20	20	20	20	20 (V)	V		-
24	Multiple Significant Trauma	24	24	24	25	25	24	21A (W)	W/X	V	-
	Injuries, Poison & Toxic Eff.										

The research programme



Final conference regarding policy conclusions in November 2011 in Berlin:

- Are hospital services and costs across European countries really so different to justify different systems for patient classification and cost weights? Could cost differences not be handled through base rate adjustments (as in the US)?
- What do we know regarding the effects on hospital efficiency and quality of service delivery under DRGs?

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