

The ability of DRG systems to explain variations in resource consumption



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- Why do costs/LoS vary for patients who are receiving the same treatment?
- How much of the variation is captured by:
 - The **DRG** to which they are allocated
 - Other **patient and treatment** characteristics
 - The **hospital** in which they are treated
- Do some DRG systems have greater explanatory power than others?

- Analysis of routine patient-level data
 - Costs or LoS for patients having the particular episode of care
 - Diagnostic and treatment details for all these patients
- Analysis of the hospitals in which patients were treated
- Comparison of explanatory power of DRGs and patient characteristics

Comparison: Cost vs. LoS

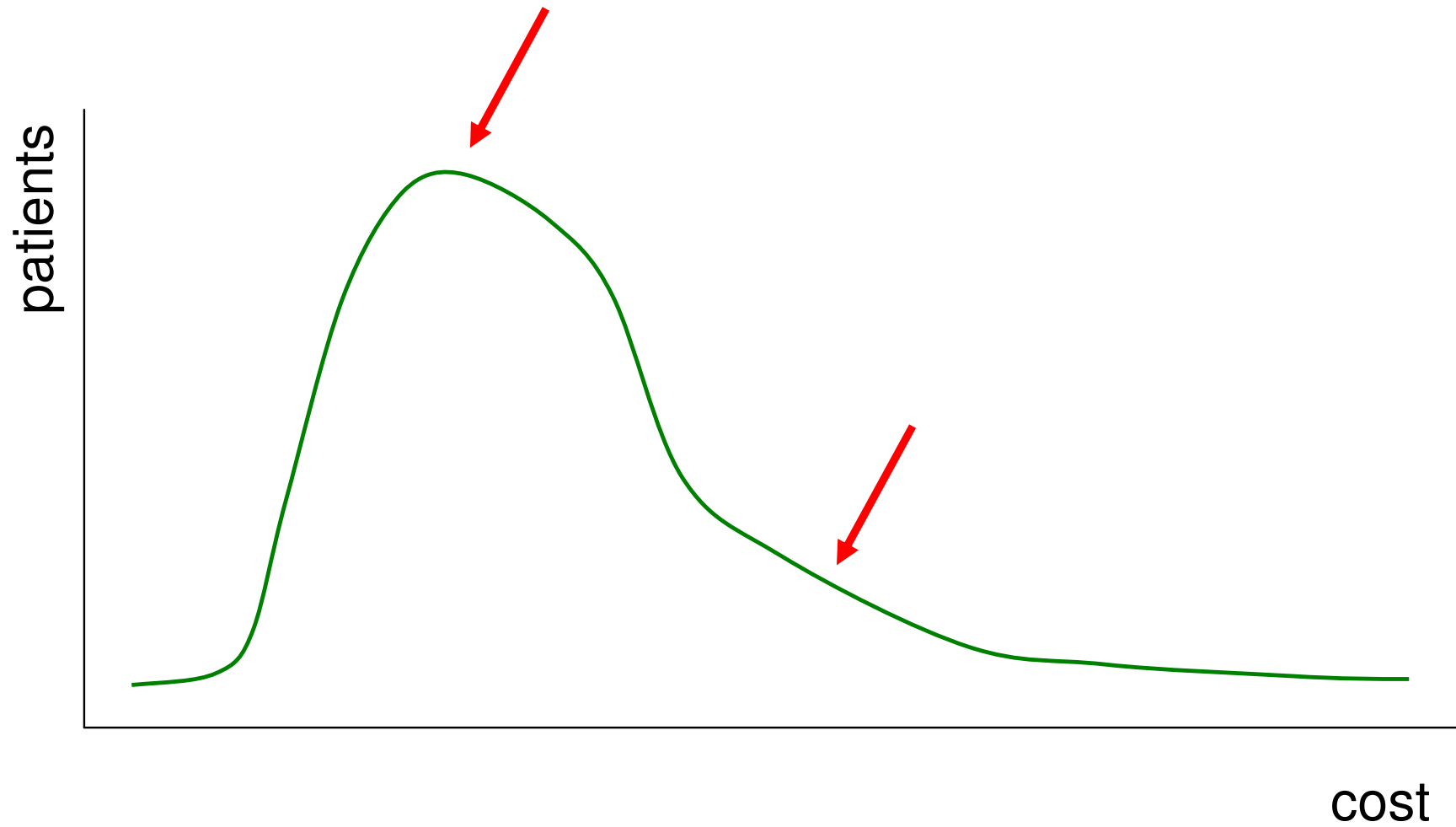
Cost

- Advantages
 - Reflects resource use
 - Is unit of interest
- Disadvantages
 - Comparison difficult
 - Differences in cost accounting

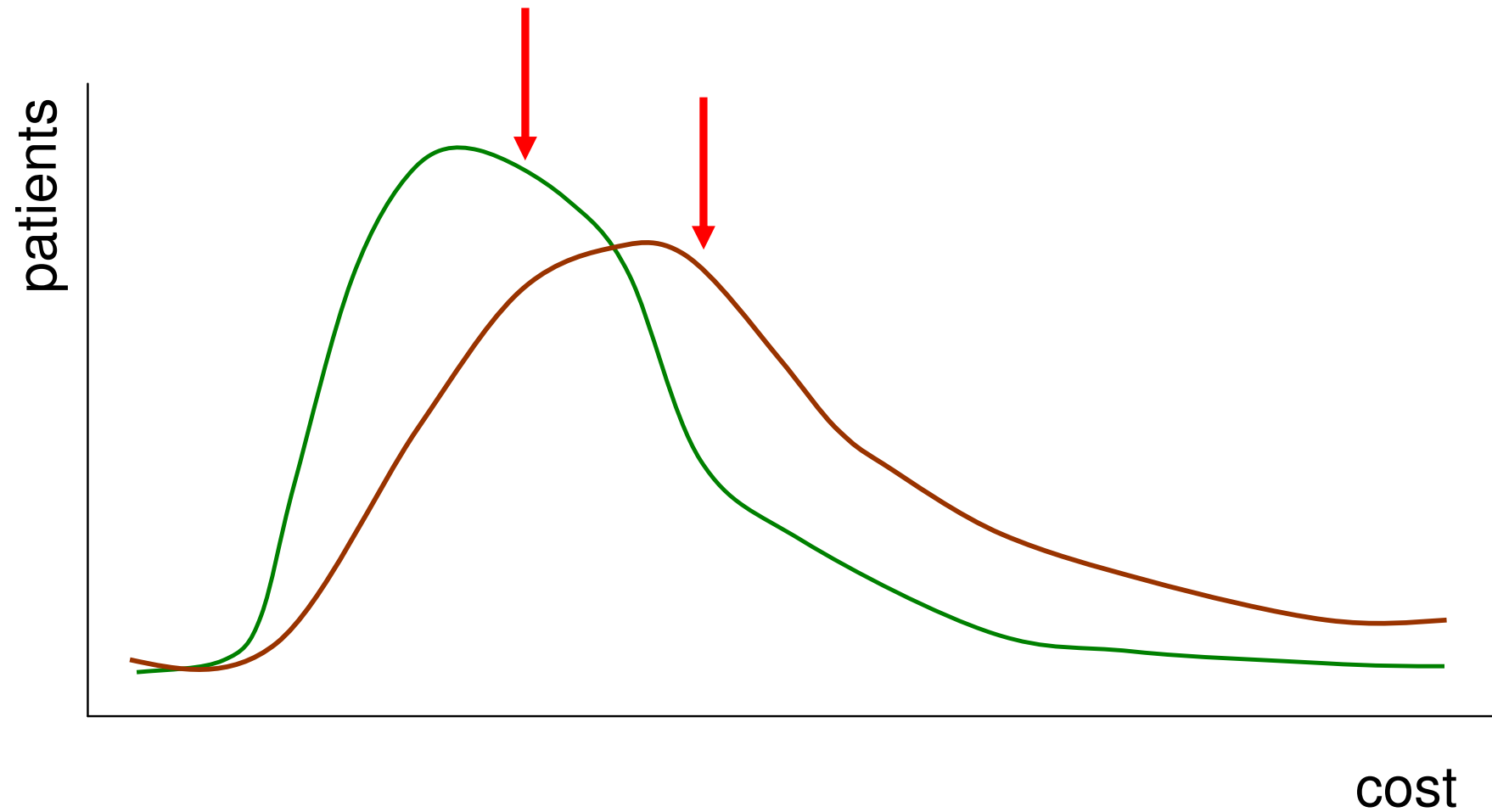
LoS

- Advantages
 - Simple definition
 - LoS=discharge – admission
 - International comparable
- Disadvantages
 - Imperfect proxy for cost

Distribution of costs



Distribution of costs



Methods: cost equation

- Why do some patients have different costs than others?

$$\ln c_{ij} = \alpha + \beta^d \mathbf{d}_{ij}^d + \beta^p \mathbf{x}_{ij}^p + u_j + \varepsilon_{ij}$$

↑
Log cost
patient i
in hospital j

↑
DRGs

↑
Patient-level
variables

↑
Hospital
effect

Analysing variation

- What explains resource use among patients?

[A] Cost = f(DRGs, Patient variables, Hospital) + error

[B] LoS = f(DRGs, Patient variables, Hospital) + error

Methods: LoS equation

- Why do some patients have different LoS than others?

$$\cancel{\ln c}_{ij} = \alpha + \beta^d \mathbf{d}_{ij}^d + \beta^p \mathbf{x}_{ij}^p + u_j + \varepsilon_{ij}$$

$$f(\text{los}_{ij}) = \alpha + \beta^d \mathbf{d}_{ij}^d + \beta^p \mathbf{x}_{ij}^p + u_j + \varepsilon_{ij}$$



LoS patient i
in hospital j

Methods: LoS equation

LoS is count data

Need to apply count data models

In most cases, Poisson distributed

$$\mu_{ij} = \mathbb{E}[y_{ij}^s \mid \mathbf{d}_{ij}, \mathbf{x}_{ij}, \mathbf{h}_j] = \mathbb{V}[y_{ij}^s \mid \mathbf{d}_{ij}, \mathbf{x}_{ij}, \mathbf{h}_j]$$

In some cases, Negative Binomial distribution (NB2 in Cameron & Trivedi 1998)

$$\omega_{ij} = \mathbb{V}[y_{ij}^s \mid \mathbf{d}_{ij}, \mathbf{x}_{ij}, \mathbf{h}_j] = \mu_{ij} + \alpha \mu_{ij}^2$$

Hospital effects

- Fixed effects in Poisson / NegBin Regression are a different concept
- Include hospital dummy variables instead (deviation coding)
- Estimates, u_j interpretable like fixed effects in cost analyses

Methods: LoS equation

Why do some patients have different LoS than others?

$$\mu_{ij} = E[y_{ij}^s \mid \mathbf{d}_{ij}, \mathbf{x}_{ij}, \mathbf{h}_j] = \exp(\alpha + \boldsymbol{\beta}^d \mathbf{d}_{ij}^d + \boldsymbol{\beta}^p \mathbf{x}_{ij}^p + u_j h_j)$$

Interpretation: Coefficients can be interpreted as percent change

Methods: LoS equation

Goodness of fit measures

- Cost: Adjusted R^2
 - Interpretation: explained variance (adjusted by number of factors)
- LoS: Adjusted Deviance R^2
 - Natural extension / generalisation
 - sum of squared deviance residuals
- Possible other measures: Pseudo R^2 , AIC, BIC

Patient-level variables

- Age and gender
- Type of admission (emergency)
- Whether transferred to/from hospital
- Counts of diagnoses and procedures
- Specific diagnoses and procedures
- Charlson and other co-morbidities
- OECD Patient safety indicators
- Urinary tract and wound infections
- Discharged dead or alive

Evaluating DRGs

- Are DRGs better than patient characteristics at explaining costs?

[1] Cost = f(DRGs, Patient variables)

[2] Cost = f(DRGs)

[3] Cost = f(Patient variables)

- Yes: if $R^2[2] > R^2[3]$

Methods: hospital effects

- Why is the average cost/LoS of treating patients in one hospital higher than in another?

$$\hat{u}_j = \alpha_o + \sum_{m=1}^M \gamma_m z_j + \mu_j$$

↑
Estimated
hospital
effect for
hospital j

↑
Hospital variables

Hospital variables

- Teaching status
- Ownership status
- Volume
- Specialisation
- Adverse Events

Issues to bear in mind

- Complementary not substitute way to evaluate DRG systems
- Important differences in national coding and accounting practices
 - Eg recording of secondary diagnoses
 - Should not pool data from different countries
- No-one knows the true costs of treatment!

- Some DRG systems have higher explanatory power than others
 - Scope for refinement, but not necessarily more groups
- Should there be a EuroDRG?
 - What is the variation in medical practice?
 - Great similarities in underlying architecture and data (ICD)
 - Local ownership

Further details



<http://www.eurodrg.eu/>