Hospital Performance Evaluation in Portugal
The Case of the "Hospitais SA"

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Overview

1. Setting the scene

2. Objectives

3. Data/Methods

4. Results

5. Conclusions

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1.1 Setting the scene

- The reform process in the Hospital Sector
  - Hospital Corporatization
  - Public Private Partnerships – Project Finance Initiatives
  - The Performance Evaluation Movement

- The Patient Classification Systems Utilization and Goals
  - DRGs and hospital funding
  - Applications: Quality (mortality, complications and re-admissions); Efficiency (costs and length of stay); Appropriateness of Admissions

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2.1 Objectives

Objective 1: comparison between **Severity** and **Complexity**

Objective 2: comparison between **Efficiency** and **Effectiveness**

2002, 31 hospitals

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3.1 Data

| 2002	SPA (n=51)	SA (n=31)
Number of admissions	517492	432951
Admissions per bed[1]	38,43	40,43
Mortality rate (%)	4,24	4,37
ALOS	6,70	6,53
Complexity index	1,05	1,05
Severity index	1,01	1,06
Cost per admission[1] (EUR)	4440	4503

[1] SPA (n=50)

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3.2 Data

9 high-frequency groups of diseases[2]:

- Central nervous system (CN)
- Cardiovascular and heart (CV)
- Gastrointestinal (GI)
- Hepatobiliary (HB)
- Musculoskeletal (MS)
- Endocrine and metabolic (ND)
- Renal (RN)
- Respiratory (RS)
- Vascular (other than heart) (VS)

[2] as defined by Disease Staging

51% 49%

9 groups considered Other groups
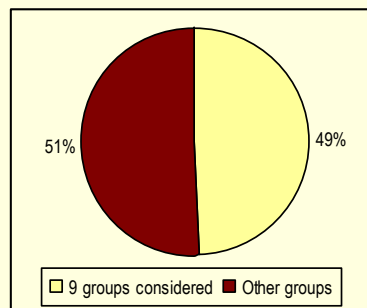
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3.3 Data

- Medical cases only

	Surgical	**Medical**
Number of admissions	78254	**134143**
Complexity	1.93	**0.97**
Severity	0.59	**2.38**
ALOS	8.22	**8.31**
Mortality rate (%)	2.58	**9.68**

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3.4 Methods

DISEASE STAGING	
INPUTS	OUTPUTS
□ ICD diagnosis & procedure codes □ Patient sex □ Age □ Discharge status	□Primary Disease category □ Secondary Disease category □ Severity Substages
□ Principal Disease Category and Stage □ Number and severity of co-morbid conditions □ Age and sex □ Procedure performed □ Admission source (transfer) □ Admission type (emergency)	Scales □ Length of stay □ Resource use □ Mortality □ Complications □ Repeated admissions

Recalibration of Disease Staging scales, for Portugal
- Length of stay
- Mortality

Expected values, for Portugal

□ **Length of stay**

□ **Mortality**

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3.5 The Recalibration Process In Portugal - Mortality Models

- Fit one logistic regression for each DRG on the surgical group
- Fit one logistic regression for each Disease Staging principal disease category (PDXCAT) on the non-surgical group

- $Y = a + b * logit(p)$, where "Y" is the observed mortality; "p" is the Disease Staging predicted mortality for each patient and $logit(p) = Log(p/(1-p))$

- Check the goodness of fit and c-statistic for each DRG and PDXCAT

- Recalibration of the predicted mortality (also by surgical and non-surgical admissions)
  - New predicted mortality = $1 / \{ 1 + exp [-a - b * logit(p)]\}$

3.6 The Recalibration Process in Portugal – Length of Stay

- Use Disease Staging Software to get LOS Scale for each patient
- If admission date = discharge date, then set LOS = 1
- Identify LOS outliers for each DRG
  - Outlier threshold = $exp \{log(Q1) - 1.5 * [log(Q3) - log(Q1)]\}$, where Q1 is the first quartile and Q3 is the third quartile and LOS is an outlier if LOS < Outlier threshold
  - Outlier threshold = $exp \{log(Q3) + 1.5 * [log(Q3) - log(Q1)]\}$, where Q1 is the first quartile and Q3 is the third quartile and LOS is an outlier if LOS > Outlier threshold
- Run the LOS regression for each DRG
  - Log(observed LOS) = $a + b * log (LOS Scale)$
- Check the goodness of fit for each equation
- Recalibration of the LOS Scale
  - Calculate predicted LOS for cases
  - Predicted LOS = $f * exp \{a + b * log(LOS Scale)$, where "f" is a retransformation factor called the smearing estimate. "F" = average (exponentiated residuals from the regression equation).
  - New LOS Scale = 100 * (predicted LOS / mean predicted LOS)

3.7 Methods

OBJECTIVE 1 – comparison between Severity and Complexity

- Index of **Complexity** - measured by DRGs (relative weigth)

- Index of **Severity** – measured by Disease Staging (expected mortality)

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3.8 Methods

OBJECTIVE 2 - comparison between Efficiency and Effectiveness

- **Efficiency index**: comparison between observed and expected LOS, with a z-score

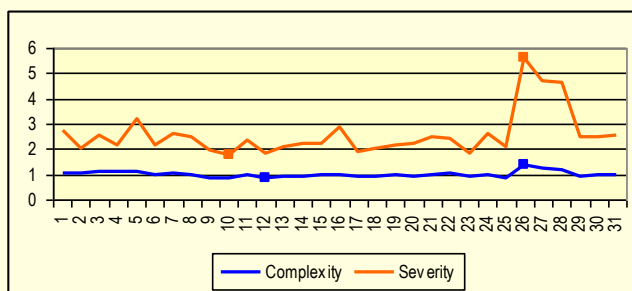- **Effectiveness index**: comparison between observed and expected number of deaths, with a z-score

- z-score = $\dfrac{\text{Observed value} - \text{Expected value}}{\text{Standard Deviation (SD)}}$

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Results

Comparison between **Severity** and **Complexity**
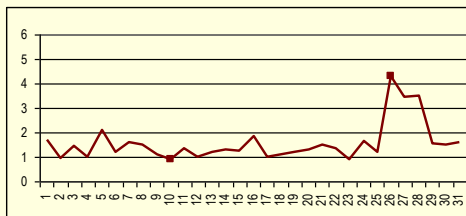

4.1 Severity and Complexity indexes

	Severity	Complexity
Average	2,38	0,97
SD	0,89	0,12
CV	0,35	0,12

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4.2 (Severity index – Complexity index)

Pearson correlation S/C	0,85**

(Severity - Complexity)	
Maximum	4,30
Minimum	0,88
Average	1,56
SD	0,79
CV	0,51

** sig < 0,01
*   sig < 0,05

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4.3 (S– C), per group of diseases

	All	CN	CV	GI	HB	MS	ND	RN	RS	VS
Pearson	0,85**	0,67**	0,49**	0,94**	0,93**	0,73**	0,36*	0,94**	0,79**	0,47**
Average	1,56	2,04	1,30	1,34	0,97	0,06	1,13	0,94	2,44	0,48
CV	0,51	0,28	0,48	0,86	0,97	11,26	0,39	0,80	0,38	1,65

Similar

Different

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4.4 Comparison between Severity and Complexity - Conclusions

- Severity index is higher than complexity index, for all 31 hospitals

- Hospitals are more homogeneous in complexity than severity

- Severity and complexity index are correlated

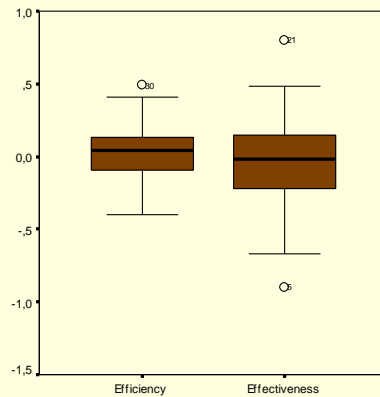- Analysis for each group of diseases may show different results

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Results

Comparison between **Efficiency** and **Effectiveness**
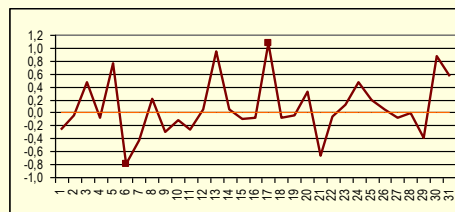
5.1 Efficiency and Effectiveness indexes

5.2 (Efficiency– Effectiveness)

Pearson correlation EFC/EFN	n.s.

Efficiency – Effectiveness	
Maximum	1.07
Minimum	-0.79
Average	0.07
SD	0.44
CV	6.05

5.3 (EFC-EFN), per group of diseases

	All	CN	CV	GI	HB	MS	ND	RN	RS	VS
Pearson	n.s.	n.s.	n.s.	n.s.	n.s.	-0,46*	n.s.	n.s.	n.s.	0,62**
Average	0,07	0,07	0,12	0,10	-0,11	0,05	0,12	-0,01	0,08	-0,18
CV	6,05	6,71	4,66	4,95	-4,05	18,92	5,37	-76,41	7,27	-3,59

Similar
Different

5.4 EFC vs EFN: Hospital analysis – smaller and larger differences[3]

	All	CN	CV	GI	HB	MS	ND	RN	RS	VS
1	EFC		↓		EFC	EFC		↑		↑
5	↑			↑	↑		↑		↑	
6	EFC	EFC		EFC		EFC	EFC		EFC	
7	EFC		EFC	EFC		↑				↑
13	EFN	EFN	EFN			EFN			EFN	
17	EFN	EFN		EFN			EFN	EFN		
19		EFC	↑	↑	↑		↑			EFN
21			↓	↓	↓		↓	EFC		↓
30	EFN	EFN			EFN	EFN			EFN	↓

Less than Q_1 in EFC, More than Q_3 in EFN

Less than Q_1 in EFN, More than Q_3 in EFC

Less than Q_1 in EFC, Less than Q_1 in EFN

More than Q_3 in EFN, More than Q_3 in EFC

[3] only hospitals with 5 or more filled cells are presented (12 excluded)

5.5 (EFC-EFN), per group of diseases, excluding outliers

	All	CN	CV	GI	HB	MS	ND	RN	RS	VS
Pearson	n.s.	n.s.	n.s.	n.s.	n.s.	-0,46*	n.s.	n.s.	n.s.	0,62**
Pearson w/o outliers	0,48*	n.s.	n.s.	0.52**	0.42*	n.s.	n.s.	n.s.	0.41*	0.64**

Similar
Different

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5.6 Comparison between Efficiency and Effectiveness - conclusions

☐ Hospitals are more homogeneous in efficiency than in effectiveness

☐ There is no correlation between efficiency and effectiveness, for all admissions and for 7 out of 9 groups of diseases

☐ Excluding some hospitals (outliers), 5 groups of diseases show a correlation between efficiency and effectiveness

☐ There are large differences between and within hospitals in their effectiveness/efficiency ratio

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5.7 Hospital performance evaluation in Portugal - conclusions

- There are no conflicts between complexity and severity in this group of hospitals

- For medical admissions the severity index is larger than complexity index and the hospitals are less homogeneous in severity

- This group of hospitals shows a better performance in effectiveness than in efficiency and the hospitals are less homogeneous in effectiveness

- There are no conflicts between efficiency and effectiveness, even though the correlation for most of the conditions it is not significant

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5.8 Hospital performance evaluation in Portugal – next steps

- Re-admissions: observed vs. expected values

- Complications: observed vs. expected values

- Efficiency: observed vs. expected costs

- Appropriateness of admissions: early and late admissions

- Increase period of analysis (before/after 2002)

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Questions?