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Management Schemes in the Public Catalan Hospital System

Vicente Ortún-Rubio
Universitat Pompeu Fabra & CRES

Miquel Serra-Burriel
Universitat de Barcelona & CRES

Anton-Giulio Manganelli
Universitat Pompeu Fabra & CRES

***Abstract*— *Background*: The Results Centre (CdR) of the Integrated Public Use Healthcare System of Catalonia (SISCAT) is a comprehensive network of public information about healthcare utilization and results at all levels. The aim of the present study is to explore the CdR associations between different domains of activity and health outcomes and the different management schemes present in the public system.**

***Methods*: We performed several linear regression models with panel data from all SISCAT hospitals N=66 for the period 2012-2015 on general indicators of adequacy, safety, effectiveness, efficiency and economic outcomes over management system. We control for geographic fixed-effects, time trends, activity and patient complexity to overcome unobservables.**

***Results*: We find several statistically significant associations between activity, health outcomes and management scheme. We only find differences between Direct Public Management (ICS1) and Consortiums and Public Companies (ICS2) in readmission rates for diabetes episodes. Other Public companies (ICS3) are only associated with lower readmission rates for chronic obstructive pulmonary disease readmission rates. Private-for-Profit hospitals are associated with poorer adequacy measured as cesarean section rate, and longer length of stay for femoral neck fracture and acute myocardial infraction than other management forms. There are structural associations for some of the selected indicators that are potentially explained by the network structure.**

***Discussion* : This study provides suggestive evidence on the potential associations between management schemes and hospital activity and outcomes indicators in the SISCAT public healthcare provision system for the 2012-2015 period, these results were not sensible to the robustness checks performed.**

I. Background

The introduction in 2011 of the Results Centre (CdR) of the Integrated Public Use Healthcare System of Catalonia (SISCAT), is often seen as a success in terms of accountability and benchmarking. However, there have been few studies carried on exploring the variability of activity and results within the system, except for the usual head to head comparisons on specific domains of activity. The aim of this study is to explore the CdR dataset and assess the variability of five hospital activity domains with special focus in management schemes.

The Catalan public health system is a complex network of primary care centers, hospitals, mental health and long-term care centers. 56.05% of the public healthcare budget is devoted to hospital care and the proportion increases when taking into account health care transportation and emergencies to 60.21%. Staff expenditure accounts for 48.10% of the hospital budget. This implies that 28.96% of the total public healthcare budget goes to hospital employees salary.

It is paramount, then, to explore associations between hospital care health outcomes and management schemes as a first step towards objectively evaluating the influence of management on outcomes. Section II describes the methodology used in the analysis, section III describes data structure and summary statistics, section IV presents the results of the analysis and section V concludes in a discussion of the findings.

II. Methodology

In this observational retrospective study, due to the nature of the data, no causal inference can be performed.[1]

Thus, we explore the associations between five dimensions with several indicators of hospital activity:

- Adequacy: *c-section rate, rate of emergency admissions and rate of emergency room admissions.*
- Safety: *mortality at discharge and mortality at discharge for selected diseases.*
- Effectiveness: *30 day readmission rate for: diabetes, chronic heart congestion and chronic obstructive pulmonary disease.*
- Efficiency: *Average length of stay for: all hospitalizations, acute myocardial infraction and femoral neck fracture*[2]

[1]The data used in this study is freely available here: CdR

[2]Data available for 2014-15

- Economic: *contract amount, indebtedness, liquidity, profitability and solvency.*

We classified each hospital according to their management scheme:

- Direct Public Management (ICS): *Catalan Health Institute* (**ICS1**)
- Consortiums and Public companies: *Non-civil servant management model, public stakeholders* $>$ 50% (**ICS2**)
- Other Public companies: *public stakeholders* $<$ 50% (**ICS3**)
- Private Non for-Profit (**PNFP**)
- Private for-Profit (**PFP**)

We performed a multivariate linear regression model for each of the above mentioned domains exploring its association with the management forms. Multivariate linear regression models assume that the value we observe in one variable (the dependent variable) are explained linearly by values of the independent variables and a coefficient term. The coefficient given to each variable, i.e. the impact that each independent variable has on the dependent one, is mathematically found by the software by minimising the sum of the squares of the distances between the fitted values of the dependent variable and the values observed. For example, when the dependent variable is the rate of Cesarean sections and the coefficient of "management ICS2" is -3.354 (Table VI), it means that being a ICS2 hospital lowers the rate of cesarean sections by 3.354 pp, ceteris paribus.

The reason why we performed a regression model instead of just comparing the means across management forms is that management forms can be correlated with factors we want to control for which, otherwise, would bias the results. For example, if we only took the mean values for mortality at discharge without taking into acccount the different casemix that the hospitals of each management forms face, we might conclude that hospitals in a given management form are worse than those in another form just because they face the most difficult cases. Therefore, while we present mean values in the descriptive statistics, we perform a regression analysis in order to take these confounding factors into acccount.

In order to do this, we controlled for time trends, geographical distribution, activity and severity of patients in terms of casemix. In order to introduce management schemes into the regression models we use a set of dummy indicators for each of the above mentioned schemes using as a baseline **ICS1**.

A. Empirical Specification

$$Y_{it} = \alpha + \beta_1 M_{it} + \beta_2 A_{it} + \beta_3 C_{it} + \epsilon + \tau_t + \upsilon_{itr} \quad (1)$$

The empirical specification, equation (1), of our regression models contains; constant term α, specific management scheme intercept β_1, activity coefficient β_2 in terms either of conventional hospitalizations and surgical hospitalizations, casemix coefficient β_3, regional fixed effects ϵ, dummy time intercepts τ and error term υ. The objective of this specification is to control for all other factors, temporal, geographic, volume and complexity in order to have as less biased associations as possible. However, no causality claims are possible in this setup, nor are the objective of the present study.

III. Data

A. Sample Selection

Even though All SISCAT hospitals were included in the sample $N = 66$, only data from 2012 to 2015 was used due to a major change from 2011-2012 in terms of the selected published variables.

8 (12.12%) hospitals were identified as **ICS1**, 20 (30.3%) as **ICS2**, 8 (12.12%) as **ICS3**, 24 (36.36%) as **PNFP** and 6 (9.09%) as **PFP**.

In terms of volume, **ICS1** hospitals had on average around 20,000 conventional hospitalizations, **ICS2** 10,500, **ICS3** 6,700, **PNFP** 6,700 and **PFP** 7,200. In 2015, there was a total of 829,577 discharges at SISCAT hospitals, 24% were attended at **ICS1**, 25.1% at **ICS2** while the rest, 50.9% at **ICS3, PNFP** and **PFP**.

B. Descriptive Statistics

The Catalan hospital system (SISCAT) comprises a wide variety of hospitals alongside management schemes. However, there are some patterns worth mentioning. Overall, direct public management centers **ICS1** give assistance to both greater number of inpatients with significantly higher levels of casemix.

TABLE I
SISCAT Adequacy Descriptive Statistics, 2012-2015

Statistic	N	Mean	St. Dev.
% C-Sections	188	24.741	10.634
% Inpatients ER	252	63.196	17.882
% ER visits admitted	216	11.072	9.045

Selected adequacy indicators for SISCAT hospitals are associated first with clinical practice for a routine procedure (% cesarean sections) and second with patient management within the hospital (% of inpatients coming from the ER room and % of ER visits admitted). Table 1 shows mean and st. dev. of the three indicators. C-sections rate mean is around 24.7% , well above the 10-15% WHO threshold, above which, no health benefit can be inferred. There is also a high degree of variance in the sample, with a st. dev. of 10.6% highlighting the variance in medical practice that can be found in Catalan hospitals.

TABLE II
SISCAT SAFETY DESCRIPTIVE STATISTICS, 2012-2015

Statistic	N	Mean	St. Dev.
Mortality at discharge	227	10.031	3.579
Mortality at discharge*	242	8.477	2.810

**Selected diseases*

Safety indicators reflect a low degree of variability when compared to the adequacy indicators, suggesting much more homogeneous results than in adequacy indicators. The mean rate for mortality at discharge is around 10% for the whole sample and around 8.5% for selected diseases. Mortality at discharge is a highly endogenous variable, meaning that centers who attend patients with worse health will have higher mortality rates.

TABLE III
SISCAT EFFECTIVENESS DESCRIPTIVE STATISTICS, 2012-2015, READMISSION RATE AT 30 DAYS

Statistic	N	Mean	St. Dev.
Diabetes %	175	6.801	4.427
ICC %	218	13.699	3.885
Selected diseases %	230	9.831	3.250
COPD %	217	16.026	4.429

Table III represents 30-day readmission rates for specific diseases. There is a substantial degree of variability across indicators, the coefficient of variation ranges from 65% for diabetes to 27% for COPD.

Table IV represents average length of stay for all admissions, acute myocardial infraction (AMI) and femoral neck fracture. There is a high degree of variation for all admissions average length of stay with a coefficient of variation around 78%.

TABLE IV
SISCAT EFFICIENCY DESCRIPTIVE STATISTICS, 2012-2015, AVERAGE LENGTH OF STAY (DAYS)

Statistic	N	Mean	St. Dev.
All admissions	126	6.191	4.88
Myocardial infraction	113	7.414	1.57
Femoral neck fracture	124	10.15	3.77

TABLE V
SISCAT ECONOMIC DESCRIPTIVE STATISTICS, 2012-2015

Statistic	N	Mean	St. Dev.
Debt %	212	73.400	27.453
Liquidity ratio	212	123.434	68.151
Profitability %	244	0.769	4.838
Solvency	212	165.945	103.827
Public ontract	247	63,399M	77,512M

The selected economic indicators described in table V include % of debt to assets, liquidity ratio, % profitability as ROI, solvency and public contract amount in millions of Euros.

IV. RESULTS

A. Adequacy

For adequacy indicators, after controlling for regional (spatial), time trends, activity and casemix we find statistically significant associations between management scheme and rate of cesarean sections, emergency admissions and admitted emergencies.

Cesarean section rates are associated with a 4.98% increase in ICS3 centers with respect to ICS1 & 2 ($p < 0.1$), a 5.08% decrease in PNFP ($p < 0.05$) and a 11.31% increase in PFP ($p < 0.01$) centers. These result suggest the influence of management schemes in obstetric clinical practice. The R^2 value for this model explains a substantial degree of variation (0.563) highlighting the goodness-of-fit of the model.

Emergency admissions and admitted emergencies regressions show an association between management schemes and inpatient management. For % of emergency admissions, with respect to ICS1, there is only one statistically significant pattern with management scheme for PFP -15.21%. These results, however, can only be interpreted as the marginal pathway within the system. Casemix distribution across management schemes differs substantially and thus, more severe cases are rather treated at ICS1 and ICS2 highly specialized hospitals than at smaller hospitals with distinct management schemes. Goodness-of-fit for both models is low compared with the C-section model.

B. Safety

Results for safety models, measured as mortality at discharge for all and selected diseases, suggest little influence of management schemes in mortality. Casemix is by far the most influential predictor alongside volume of surgical admissions. The association is statistically significant in both models for both variables. Casemix is positively associated with mortality and surgical volume negatively, suggesting scale returns on safety for hospitals who perform greater amounts of surgery. In terms of management, the only statistically significant schemes are PNFP and PFP in selected diseases. PFP is negatively associated 1.72% ($p < 0.05$) and PNFP positively 1.17% ($p < 0.1$), however, due to the already mentioned endogeneity, this can only be interpreted as potential patient risk selection or transfer between hospitals. Goodness of fit for both models, R^2, is 27.2-33.7% respectively.

C. Effectiveness

Effectiveness measured as hospital readmission rates at 30 days is also strongly associated with casemix. Management system is in general not associated with any of the disease-specific readmission rates at 30 days with exception of ICS2 for diabetes and ICS3 for COPD. ICS2 is associated negatively with in hospital readmission rates, 2.43% ($p < 0.05$), suggesting a more effective approach with diabetic patient management. ICS3 is positively associated with COPD 30 day readmission rates 3.23% highlighting potential worse management of respiratory diseases.

D. Efficiency

Efficiency measured as length of stay in days for all admissions and NOF is greatly associated with casemix, however, it is not associated with AMI. In terms of the statistically significant associations between length of stay and management schemes, for all hospitalizations none is and for NOF and AMI, PFP hospitals have respectively an average increase of 3.72 ($p < 0.05$) and 1.22 days ($p < 0.1$). This results suggests inpatients in PFP hospitals stay longer than other centers for femoral neck fracture and acute myocardial infraction.

E. Economic Indicators

Economic performance and determinants of hospitals by ownership is a controversial issue due to the multiplicity of objectives across firms.

The first regression model aims at predicting the public contract economic amount controlling for the abovementioned factors plus the internal SISCAT hospital level categorization ranging from level 1 to levels 4, 4a, 4m. The goodness of fit of the model measured as R^2 and adjusted R^2 is around 95%, even though the external validity of the results is lacking, our objective is to describe the Catalan reality in terms of financing. The only management scheme that is statistically significant for the models is PFP hospitals, which on average, have a contract 26.8 ($p < 0.01$) Million Euros less than other schemes.

Figure 2 is a plot of the predicted amounts vs. observed amounts, it also suggests that for a very few of selected centers they are either under financed or over financed by significant amounts. This result is important as it suggests some degree of arbitrariness in financing of public health services within the SISCAT system.

Profitability model results reflect the diversity of financial incentives in the public-private system structure. There is no difference between ICS, ICS2 and ICS3. PNFP are associated with an increase of 2.55% ($p < 0.1$) in profitability and PFP hospitals are associated with an increase of 3.5% ($p < 0.01$). Solvency and debt have no statistically significant association with management scheme, however, the overall level of debt-to-assets in the system is around 111.87%. In terms of liquidity, PNFP have a strong association around 43.30% above average, which again reflects the system structure.

V. Robustness Checks

In order to provide additional robustness to the analysis we replicate the above mentioned methodology and empirical specification but collapsing **ICS2** and **ICS3** into one unique category. The main differences are stated below:

- Adequacy, for cesarean section rates, there is a non-statistically significant decrease in the coefficients both of **PFP** and **PNFP** and a significant decrease in adjusted predictive power measured as adjusted R^2. Other outcomes are unaffected by the change in classification.
- Safety, there are no statistically significant changes in the results.

- Effectiveness, there are no statistically significant changes in results, except for the coefficient of **ICS3**, which is collapsed into **ICS2** which is no longer statistically significant for COPD.
- Efficacy, there are no statistically significant changes with respect to the prior management classification.

VI. Discussion

In this exploratory data analysis we tested for associations between five different management schemes and outcomes in the Catalan public healthcare system. Despite of geographic variation, time trends, activity and casemix, management scheme understood as ICS1, ICS2, ICS3, PNFP and PFP we find significant associations between those and the selected proxy indicators.

Overall, between ICS1 and ICS2 hospitals the only statistically significant difference lays in the readmission rate at 30 days being around a 3% lower for ICS2 hospitals and the % of emergency admissions being around 6.8% lower for ICS2 hospitals, however, due to the distribution of casemix between ICS1 and ICS2, this difference could be explained by the simple fact that ICS1, on average, treat more complex patients as highlighted in figure 1. ICS3 hospitals are in fact smaller but represent the majority of hospitals within the SISCAT system, they are associated with a lower level of adequacy for cesarean sections, an increase above average around 4.8%. In terms of effectiveness measured as readmission rates, they present an increase around 3.2% for COPD.

PNFP centers perform significantly well in c-sections compared to all other hospitals, however, in terms of mortality at discharge for selected diseases they perform poorly than average. In economic terms, they have the highest liquidity ratio almost 43% above average, which is consistent with their non-for-profit status. PFP centers perform poorly in adequacy specially with cesarean sections and length of stay.

Of the 48 possible associations between management schemes and outcomes, only 11 were found. Hence, 22.92% of the analyzed hospital outcomes were associated with different management schemes, suggesting some degree of influence of management over hospital activity and outcomes.

Limitations

The nature of the data allows us only to test for correlation between parameters, no claims of causal inference can be done. The hospital network configuration and the natural flows of patients across centers can bias results, hence, all results must be interpreted cautiously.

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Primary Care Extension

Since the introduction in 2011 of the CdR, reported primary care centers outcomes have been varying. Hence, data availability to create a similar dataset to the one built for the hospital exercise is lacking. However, there are several outcomes being present for the period 2013-2015. Our objective is to explore the association between management schemes at primary care centers and outcomes.

Methods and Data

There are 366 SISCAT primary care centers in Catalonia for which we were able to obtain consecutive waves from 2013 to 2015 in the following indicators:

- Mean cost per patient treated with: non-insulin antidiabetic medication, statins and antidepressant medication.
- Infant vaccination coverage %.
- Pharmaceutical prescription quality index.[3]
- Potentially avoidable hospitalizations (/1,000) for: all causes, MPOC and CHF.

We identify two management schemes being present at primary care centers, Direct Public Management **ICS** and the rest, **no ICS**. We use the same econometric empirical specification:

$$Y_{it} = \alpha + \beta_1 M_{it} + \beta_2 A_{it} + \beta_3 C_{it} + \epsilon + \tau_t + v_{itr} \quad (2)$$

Being M_{it} in this case a dummy variable with **ICS** as the baseline level, A_{it} the referenced population of the center and the number of yearly visits, C_{it} the percentage of population older than 75 years old as a proxy of complexity, ϵ regional fixed-effects and τ_t dummy time intercepts.

Results

All analyzed outcomes were statistically associated with management scheme after controlling for activity, complexity, time trends and regional fixed-effects. Mean cost per treated patient was higher for non-**ICS** centers, 8.91 euros for non-insulin anti-diabetics, 1.51 for statins and 3.01 for antidepressants. Infant vaccination coverage was 1.83% lower for non-**ICS** centers. Pharmaceutical prescription quality was 8.44 points lower for non-**ICS** centers. Potentially avoidable hospitalizations was significantly lower in non-**ICS** centers; 0.751 for all causes, 0.336 for COPD and 0.191 for AMI.

Discussion

Results suggest that non-**ICS** primary care centers do spend more than **ICS** centers per patient and achieve better health outcomes as highlighted by the decrease in Potentially avoidable hospitalizations.

[3] AQUAS, CdR

APPENDIX

This Appendix shows more technical material, such as the distribution of casemix and contract amount across management forms, the coefficient estimates of the regressions, the Kernel density estimates, the LOESS estimates and the dataset missing map. Figure 1 shows how the casemix is distributed across management forms: we clearly see that the most difficult cases are in the public sector, especially in ICS1. Figure 2 shows the observed contract amount and the predicted amount, where each point is a hospital-year observation. Tables IV to X are the regression coefficients of the management forms (the control variables are included in the regression but omitted from these tables) and tables XI to XIV are the robustness check regressions. Table XV represents the regression results for Primary Care Centers.

Figures 3 to 6 are the kernel density estimates of four types of admissions. Kernel density estimation is a smoothing feature used in finite sample population to estimate the probability density function in a non-parametric way (i.e. no assumption on the underlying distribution is made, allowing for the maximum freedom in estimating it). The way to read it is that, at any point in the horizontal axis, the probability that the variable is below it is the area until that point. Figures 7 to 30 are the LOESS estimates of the specified variables. These graphs show where each variable is, depending on the management form, and shows an interval within which the values of the variable are expected to be. Finally, Figure 31 shows the missing data in the dataset (the yellow entries) with respect to the complete entries (the red ones).

Abbreviations:

- CHF, Chronic Heart Failure
- Selected Diseases, acute myocardial infraction, stroke, femoral neck fracture, gastrointestinal bleeding and cirrhosis.
- COPD, Chronic Obstructive Pulmonary Disease
- NOF, Femoral Neck Fracture
- AMI, Acute Myocardial infractions

Fig. 1. Casemix Distribution by Management Scheme, SISCAT (2012-2015)

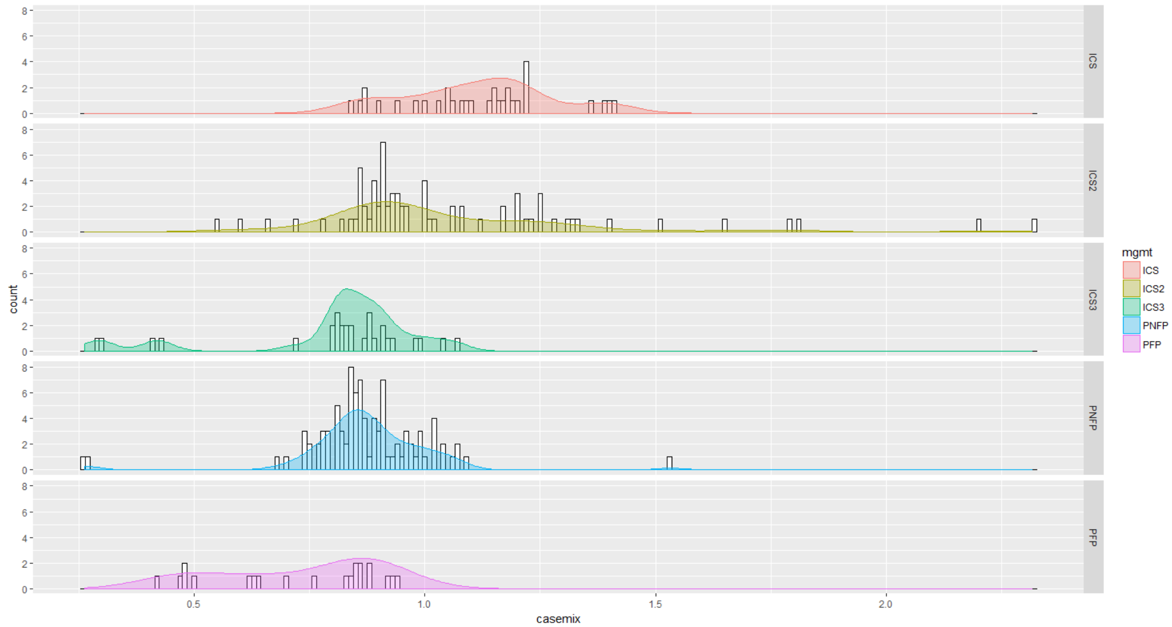

Fig. 2. Observed v.s. Predicted Public Contract Amount, (2012-2015)

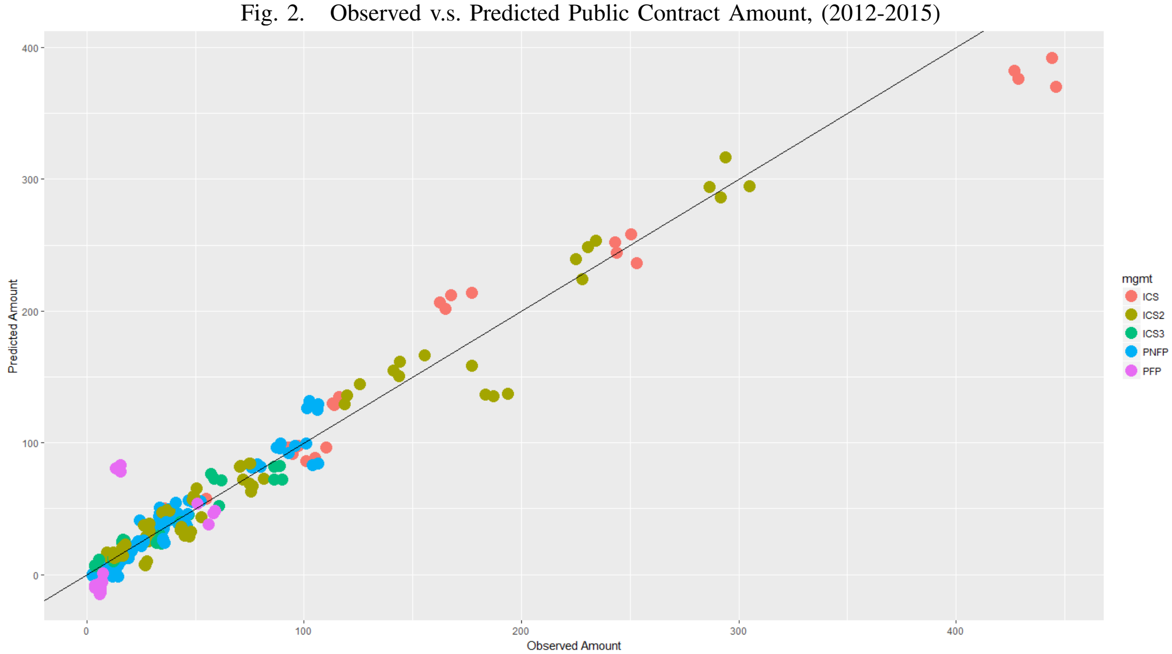

TABLE VI

ADEQUACY REGRESSION MODELS, 2012-2015

	Dependent variable:		
	% of Cesarean Sections	% Emergency Admissions	% Admitted Emergencies
	(1)	(2)	(3)
Management ICS2	−3.354	−2.047	−0.939
	(2.335)	(3.897)	(2.228)
Management ICS3	4.984*	−3.615	−1.373
	(2.633)	(4.762)	(2.705)
Management PNFP	−5.086**	−4.962	−2.453
	(2.422)	(4.156)	(2.353)
Management PFP	11.314***	−15.213***	−4.657
	(3.068)	(5.201)	(3.332)
Observations	186	250	216
R^2	0.563	0.228	0.115
Adjusted R^2	0.519	0.172	0.040
RSE	7.326 (df = 168)	16.339 (df = 232)	8.865 (df = 198)
Note:			*p<0.1; **p<0.05; ***p<0.01

TABLE VII

SAFETY REGRESSION MODELS, 2012-2015, MORTALITY AT DISCHARGE

	Dependent variable:	
	All diseases	Selected diseases
	(1)	(2)
Management ICS2	0.420	0.719
	(0.796)	(0.581)
Management ICS3	−0.922	0.240
	(1.004)	(0.730)
Management PNFP	0.922	1.165*
	(0.873)	(0.637)
Management PFP	−1.731	−1.716**
	(1.101)	(0.796)
Observations	217	232
R^2	0.272	0.337
Adjusted R^2	0.202	0.278
RSE	3.204 (df = 197)	2.382 (df = 212)
Note:		*p<0.1; **p<0.05; ***p<0.01

TABLE VIII

EFFECTIVENESS REGRESSION MODELS, 2012-2015, HOSPITAL READMISSION RATES % AT 30 DAYS

	Dependent variable:			
	Diabetes	CHF	*Selected Diseases*	COPD
	(1)	(2)	(3)	(4)
Management ICS2	-2.429^{**}	-0.959	-0.713	0.760
	(1.050)	(0.901)	(0.718)	(0.990)
Management ICS3	-2.108	1.712	0.838	3.231^{**}
	(1.297)	(1.143)	(0.913)	(1.264)
Management PNFP	-1.178	0.380	-0.527	1.448
	(1.144)	(0.997)	(0.775)	(1.105)
Management PFP	1.293	0.457	-1.404	0.803
	(2.104)	(1.506)	(1.073)	(1.734)
Observations	174	209	223	208
R^2	0.278	0.221	0.270	0.214
Adjusted R^2	0.189	0.142	0.202	0.135
RSE	3.991 (df = 154)	3.617 (df = 189)	2.903 (df = 203)	4.008 (df = 188)
Note:				*p<0.1; **p<0.05; ***p<0.01

TABLE IX

EFFICIENCY REGRESSION MODELS, 2014-2015, LENGTH OF STAY

	Dependent variable:		
	All	NOF	AMI
	(1)	(2)	(3)
Management ICS2	0.546	0.568	0.512
	(1.564)	(1.380)	(0.538)
Management ICS3	1.734	1.694	0.132
	(1.964)	(1.760)	(0.681)
Management PNFP	2.318	1.813	0.619
	(1.701)	(1.465)	(0.593)
Management PFP	0.416	3.717^{**}	1.221^{*}
	(2.039)	(1.724)	(0.705)
Observations	122	109	120
R^2	0.280	0.198	0.167
Adjusted R^2	0.186	0.078	0.056
Residual Std. Error	4.468 (df = 107)	3.666 (df = 94)	1.536 (df = 105)
Note:			*p<0.1; **p<0.05; ***p<0.01

TABLE X

ECONOMIC INDICATOR REGRESSION MODELS 2012-2015

	Dependent variable:				
	Contract Amount	Profitability	Solvency	Debt	Liquidity
	(1)	(2)	(3)	(4)	(5)
Management ICS2	2.426	1.346			
	(4.433)	(1.194)			
Management ICS3	−5.202	1.256	−8.178	−0.532	0.537
	(5.430)	(1.451)	(26.718)	(7.060)	(16.396)
Management PNFP	−6.448	2.545*	18.395	6.294	43.301***
	(4.923)	(1.330)	(19.339)	(5.110)	(11.868)
Management PFP	−26.811***	3.498**	−18.944	10.641	4.580
	(5.375)	(1.525)	(29.828)	(7.881)	(18.304)
Observations	247	243	211	211	211
R^2	0.956	0.191	0.208	0.209	0.308
Adjusted R^2	0.951	0.106	0.115	0.117	0.227
Residual Std. Error	17.082 (df = 223)	4.583 (df = 219)	97.848 (df = 188)	25.854 (df = 188)	60.046 (df = 188)
Note:					*p<0.1; **p<0.05; ***p<0.01

TABLE XI

V2 ADEQUACY REGRESSION MODELS, 2012-2015

	Dependent variable:		
	% of Cesarean Sections	% Emergency Admissions	% Admitted Emergencies
	(1)	(2)	(3)
ICS2	−0.417	−2.487	−1.067
	(2.281)	(3.714)	(2.109)
PNFP	−4.760*	−4.910	−2.445
	(2.511)	(4.146)	(2.347)
PFP	9.981***	−15.026***	−4.594
	(3.162)	(5.168)	(3.306)
Observations	186	248	216
R^2	0.527	0.213	0.136
Adjusted R^2	0.479	0.155	0.061
RSE	7.624 (df = 168)	15.884 (df = 230)	8.764 (df = 198)
Note:			*p<0.1; **p<0.05; ***p<0.01

TABLE XII

V2 SAFETY REGRESSION MODELS, 2012-2015, MORTALITY AT DISCHARGE

	Dependent variable:	
	All diseases	Selected diseases
	(1)	(2)
mgmtICS2	0.067	0.594
	(0.763)	(0.556)
mgmtPNFP	0.979	1.195*
	(0.875)	(0.635)
mgmtPFP	−1.587	−1.654**
	(1.100)	(0.791)
Observations	217	232
R^2	0.264	0.335
Adjusted R^2	0.197	0.279
RSE	3.214 (df = 198)	2.380 (df = 213)
Note:		*p<0.1; **p<0.05; ***p<0.01

TABLE XIII

V2 EFFECTIVENESS REGRESSION MODELS, 2012-2015, HOSPITAL READMISSION RATES % AT 30 DAYS

	Dependent variable:			
	Diabetes	CHF	*Selected Diseases*	MPOC
	(1)	(2)	(3)	(4)
ICS2	−2.336**	−0.273	−0.321	1.384
	(0.990)	(0.877)	(0.694)	(0.958)
PNFP	−1.191	0.264	−0.601	1.343
	(1.140)	(1.012)	(0.779)	(1.116)
PFP	1.311	0.175	−1.579	0.637
	(2.096)	(1.526)	(1.077)	(1.750)
Observations	174	209	223	208
R^2	0.278	0.192	0.257	0.194
Adjusted R^2	0.194	0.115	0.191	0.117
RSE	3.979 (df = 155)	3.674 (df = 190)	2.923 (df = 204)	4.049 (df = 189)
Note:				*p<0.1; **p<0.05; ***p<0.01

TABLE XIV

V2 EFFICIENCY REGRESSION MODELS, 2014-2015, LENGTH OF STAY

	Dependent variable:		
	los	los_fem	los_icc
	(1)	(2)	(3)
ICS2	0.842	0.814	0.420
	(1.504)	(1.340)	(0.518)
PNFP	2.243	1.706	0.651
	(1.694)	(1.456)	(0.589)
PFP	0.270	3.567**	1.273*
	(2.024)	(1.709)	(0.699)
Observations	122	109	120
R^2	0.277	0.193	0.163
Adjusted R^2	0.189	0.082	0.061
RSE	4.458 (df = 108)	3.659 (df = 95)	1.532 (df = 106)
Note:			*p<0.1; **p<0.05; ***p<0.01

TABLE XV

REGRESSION MODELS PRIMARY CARE

	Dependent variable:							
	cost diab.	cost statins	cost antidep.	Infant Vac.%	Pharm. quality	Avo. hosp.	Avo. hosp. COPD	Avo. hosp. AMI
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2014	−3.572***	4.277***	6.661***	2.845***	−0.679	0.100	0.009	0.023
	(1.003)	(0.490)	(0.775)	(0.607)	(1.083)	(0.183)	(0.062)	(0.068)
2015			3.674***	2.717***		0.658***	0.149**	0.175***
			(0.775)	(0.625)		(0.183)	(0.062)	(0.068)
Region 1	−3.212	−0.253	−3.909	2.321	11.669***	1.705***	0.458**	1.036***
	(3.908)	(1.912)	(2.463)	(1.948)	(4.220)	(0.581)	(0.196)	(0.215)
Region 2	−1.286	3.020	−5.219**	−4.526**	4.996	0.294	0.189	−0.043
	(4.138)	(2.024)	(2.608)	(2.092)	(4.468)	(0.615)	(0.207)	(0.228)
Region 3	9.200**	3.430*	5.060**	2.558	3.187	1.483**	0.258	0.553**
	(3.998)	(1.956)	(2.521)	(2.027)	(4.317)	(0.595)	(0.200)	(0.220)
Region 4	−1.377	0.011	−7.665***	−0.490	9.938**	0.401	0.095	0.216
	(4.048)	(1.980)	(2.553)	(2.013)	(4.371)	(0.603)	(0.203)	(0.223)
Region 5	8.865**	−3.233	3.853	3.666*	−3.506	−1.226*	0.408*	−0.025
	(4.228)	(2.068)	(2.656)	(2.110)	(4.565)	(0.627)	(0.211)	(0.232)
Region 6	5.748	−0.884	−4.872*	2.108	0.817	−3.880***	−0.890***	−1.233***
	(4.679)	(2.289)	(2.951)	(2.350)	(5.053)	(0.697)	(0.235)	(0.258)
no ICS	**8.905*****	**1.508****	**3.011*****	**−1.830*****	**−8.435*****	**−0.751*****	**−0.336*****	**−0.191*****
	(1.326)	(0.649)	(0.809)	(0.665)	(1.432)	(0.191)	(0.064)	(0.071)
population	0.0001	−0.0005***	−0.0001	−0.0001	0.0002	−0.0003***	−0.0001***	−0.0001***
	(0.0002)	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.00002)	(0.00001)	(0.00001)
visits	0.00002	0.00002	0.00000	−0.00002*	−0.0001***	0.00004***	0.00001***	0.00001***
	(0.00003)	(0.00001)	(0.00002)	(0.00001)	(0.00003)	(0.00000)	(0.00000)	(0.00000)
% older than 75	0.003	−0.224**	0.287**	−0.231**	0.088	0.350***	0.050***	0.171***
	(0.211)	(0.103)	(0.132)	(0.107)	(0.228)	(0.031)	(0.010)	(0.012)
Constant	64.576***	41.571***	82.504***	89.666***	46.514***	6.285***	1.468***	0.960***
	(4.770)	(2.334)	(3.036)	(2.404)	(5.151)	(0.716)	(0.241)	(0.265)
Observations	732	732	1,096	984	732	1,096	1,096	1,096
R^2	0.157	0.211	0.165	0.113	0.150	0.312	0.199	0.341
Adjusted R^2	0.143	0.198	0.155	0.102	0.136	0.304	0.190	0.333

Note: *p<0.1; **p<0.05; ***p<0.01

Fig. 3. *Kernel density estimates* Admissions by legal form, (2012-2015)

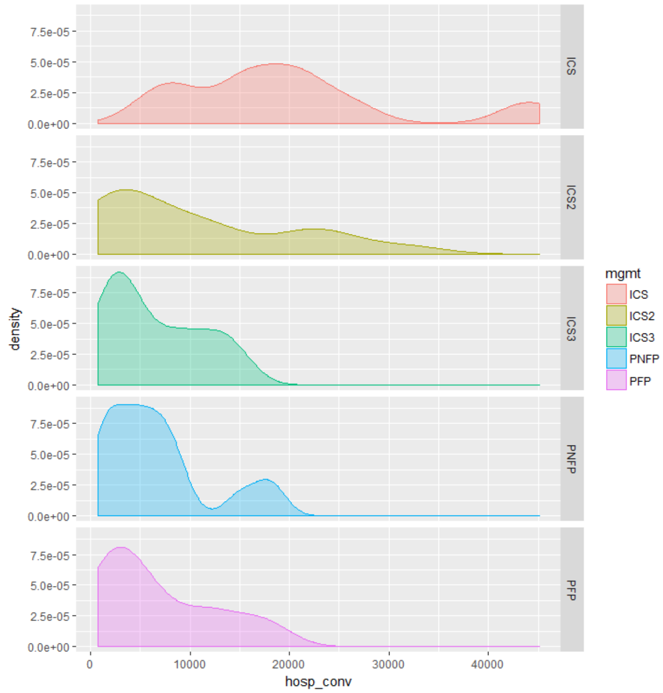

Fig. 5. *Kernel density estimates* Surgical Admissions by legal form, (2012-2015)

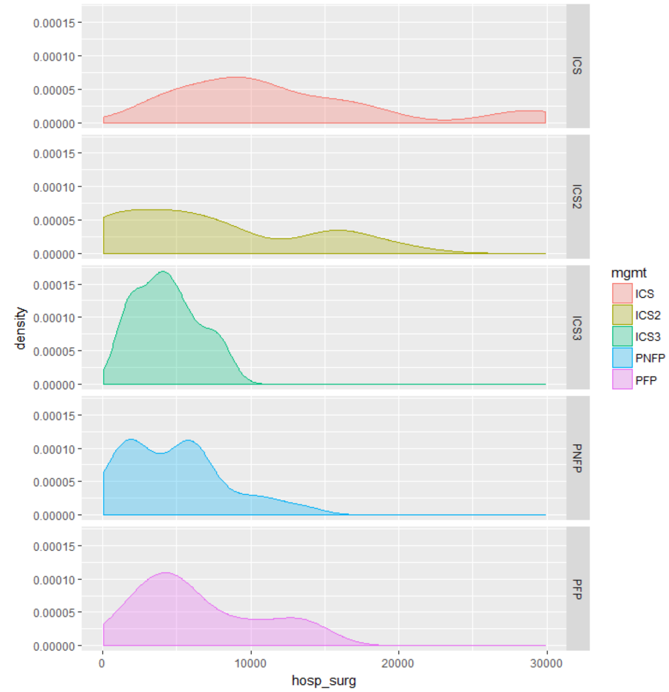

Fig. 4. *Kernel density estimates* Medical Admissions by legal form, (2012-2015)

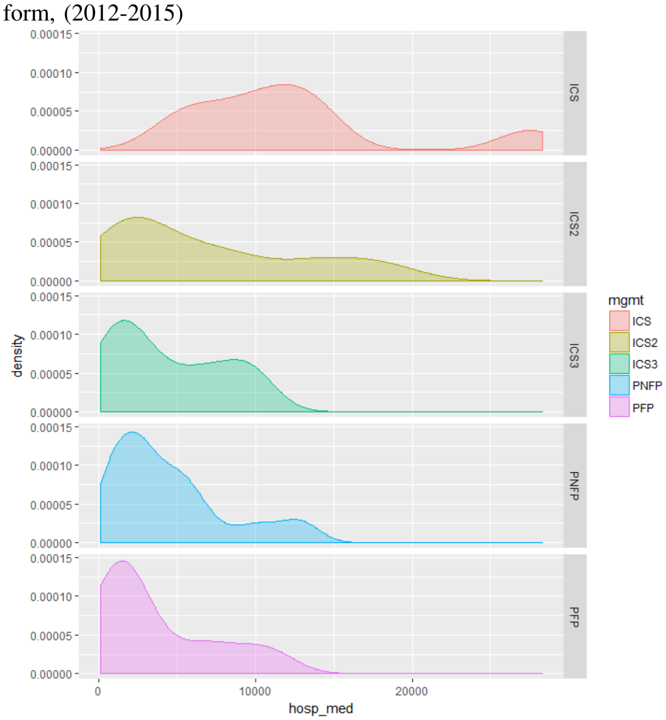

Fig. 6. *Kernel density estimates* Ambulatory Surgical Admissions by legal form, (2012-2015)

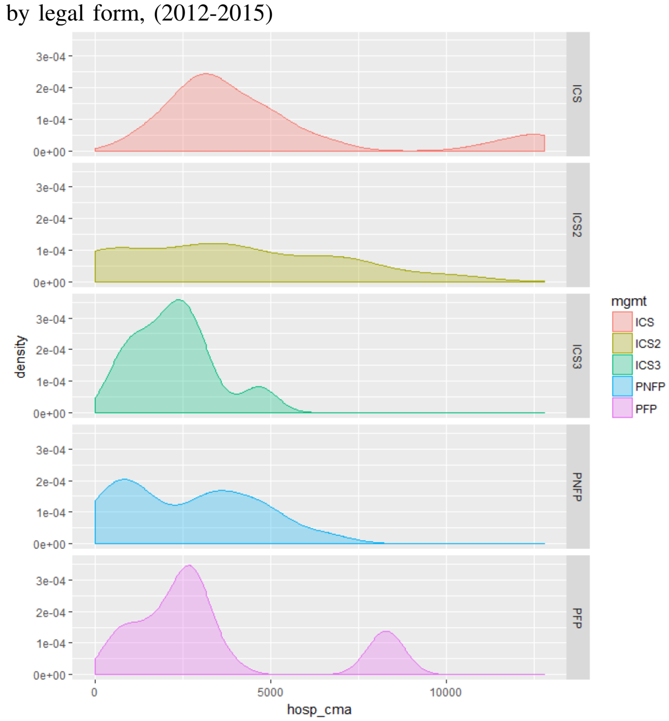

Fig. 7. *LOESS estimates* C-section rates by legal form, (2012-2015)

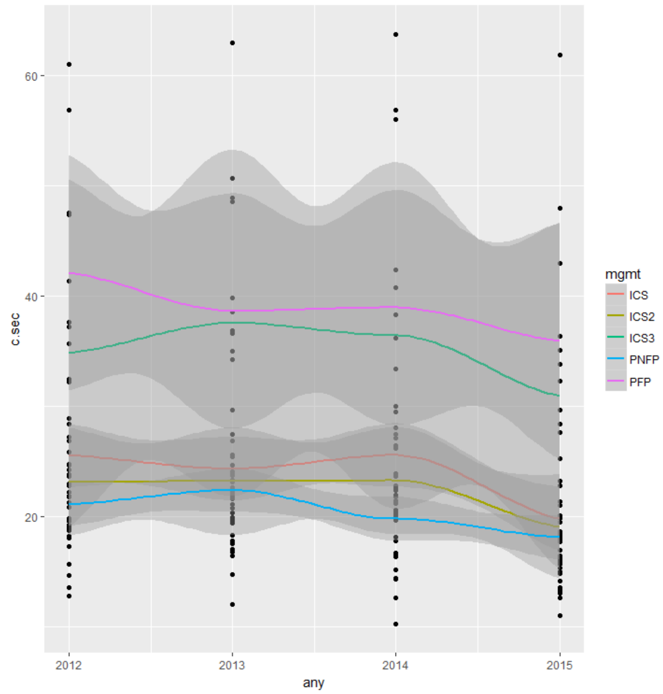

Fig. 8. *LOESS estimates* C-section rates by hospital level, (2012-2015)

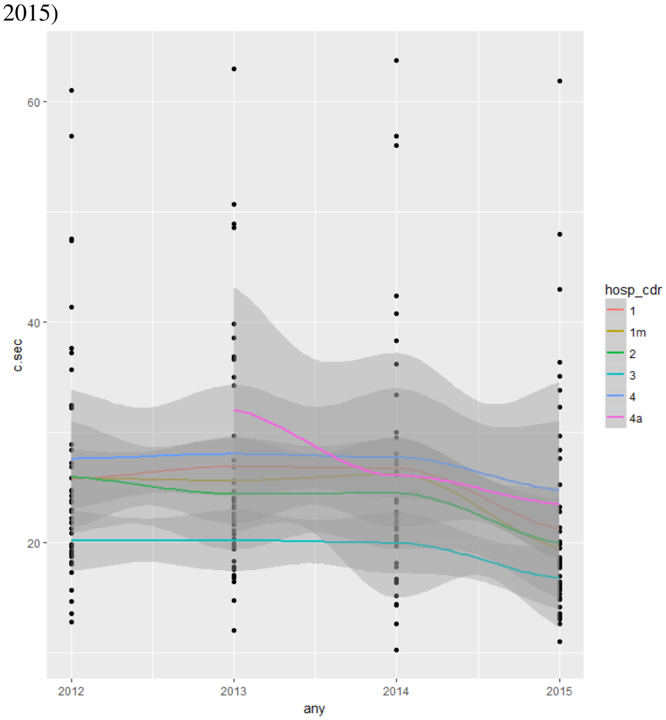

Fig. 9. *LOESS estimates* Casemix rates by legal form, (2012-2015)

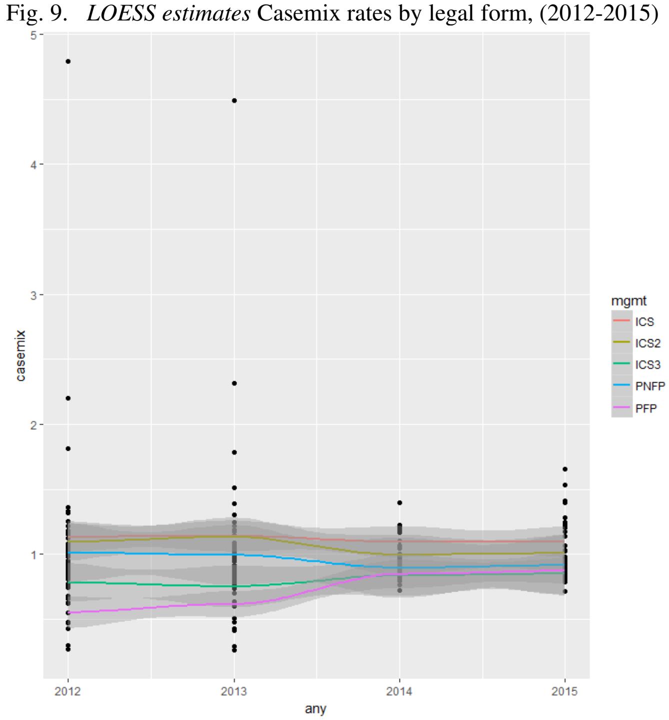

Fig. 10. *LOESS estimates* Casemix rates by hospital level, (2012-2015)

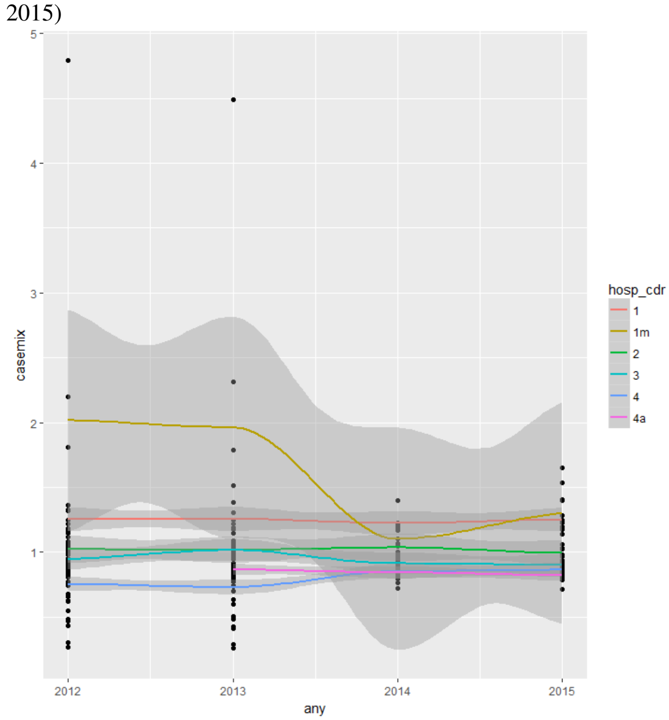

Fig. 11. *LOESS estimates* % of inpatient emergencies by legal form, (2012-2015)

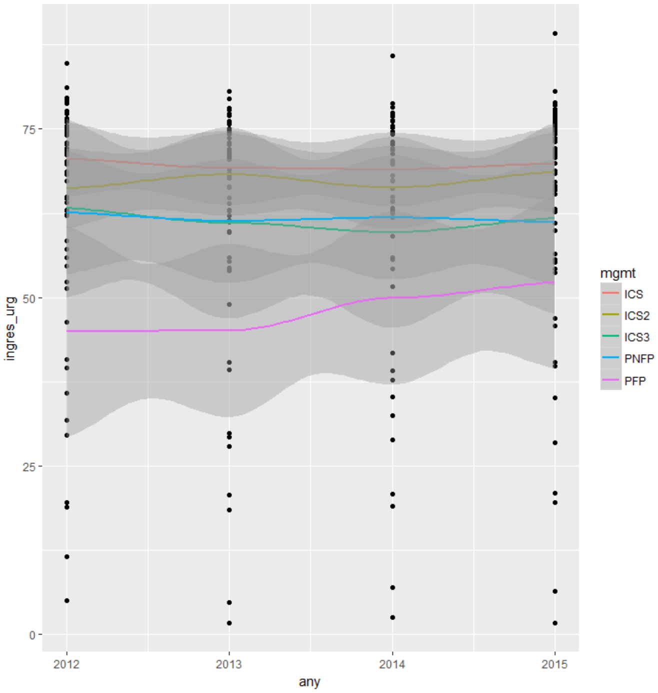

Fig. 12. *LOESS estimates* % of inpatient emergencies by hospital level, (2012-2015)

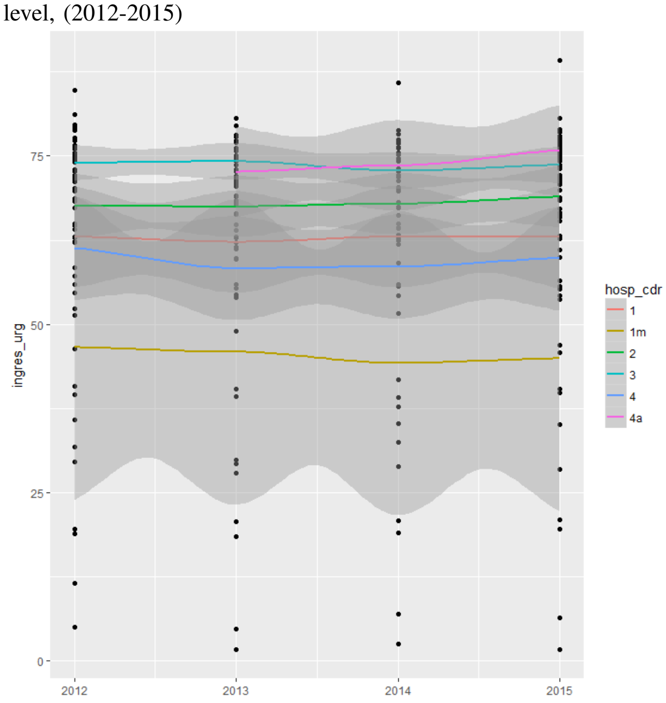

Fig. 13. *LOESS estimates* Mortality at discharge by legal form, (2012-2015)

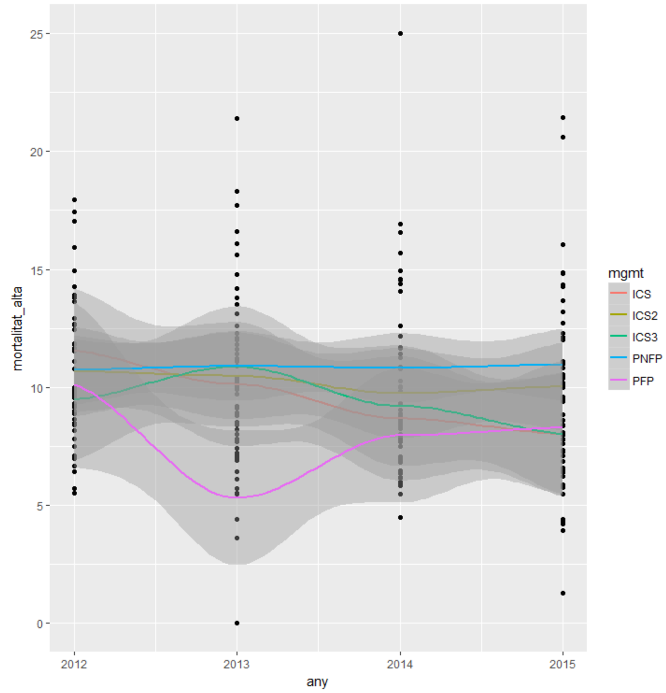

Fig. 14. *LOESS estimates* Mortality at discharge by hospital level, (2012-2015)

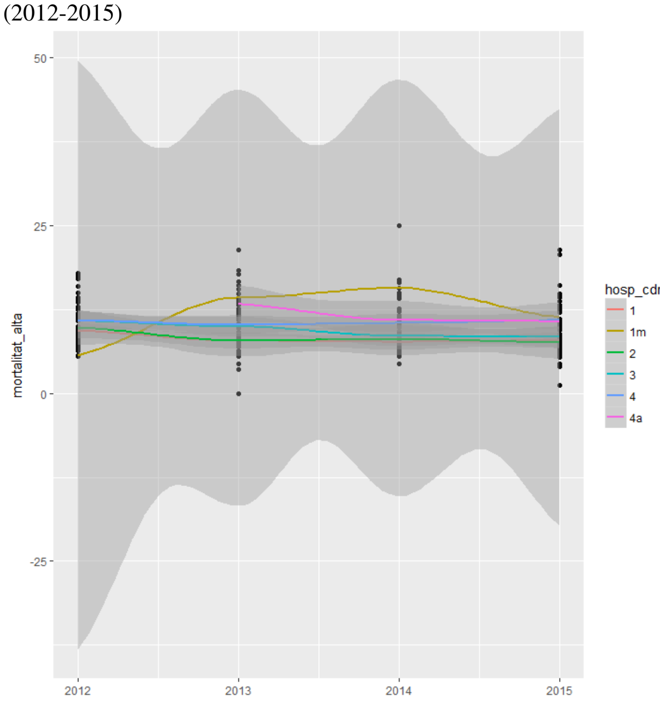

Fig. 15. *LOESS estimates* Mortality at discharge by legal form, selected diseases, (2012-2015)

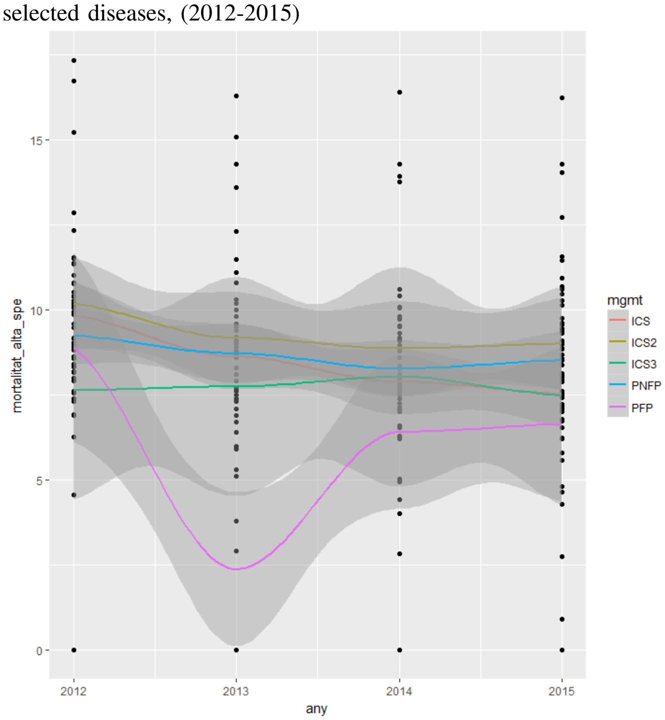

Fig. 16. *LOESS estimates* Mortality at discharge by hospital level, selected diseases, (2012-2015)

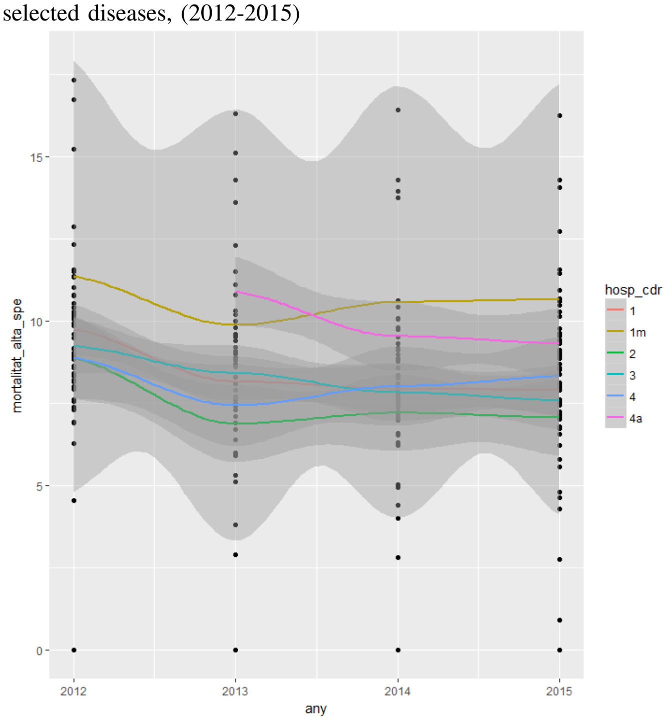

Fig. 17. *LOESS estimates* Hospitalizations conventional by legal status, (2012-2015)

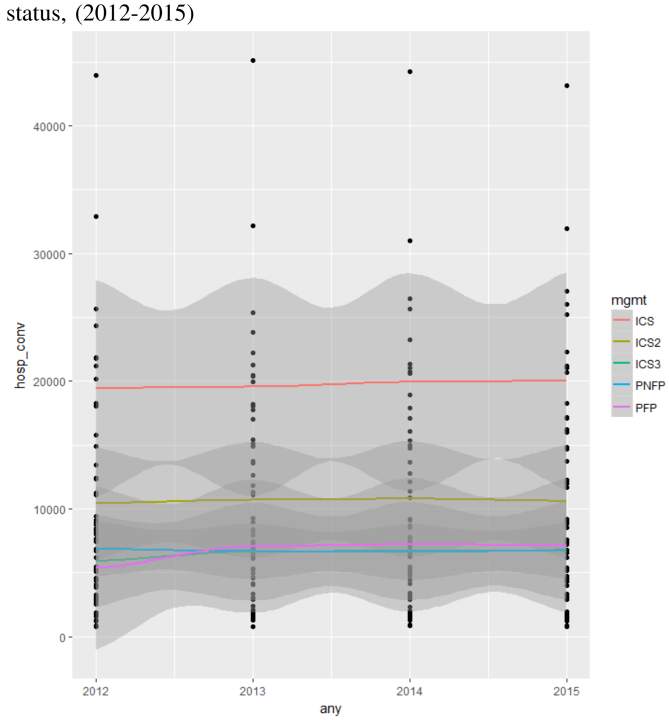

Fig. 18. *LOESS estimates* Hospitalizations conventional by hospital level, (2012-2015)

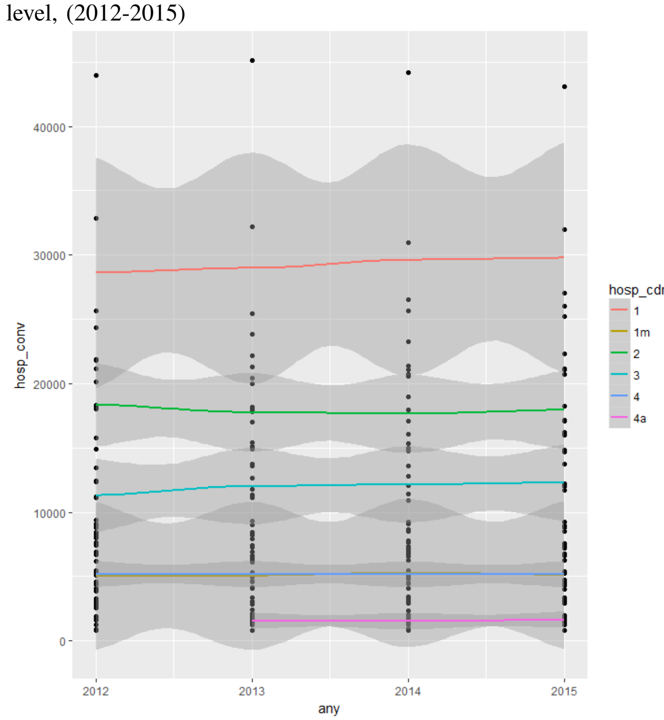

Fig. 19. *LOESS estimates* Medical Hospitalizations by legal status, (2012-2015)

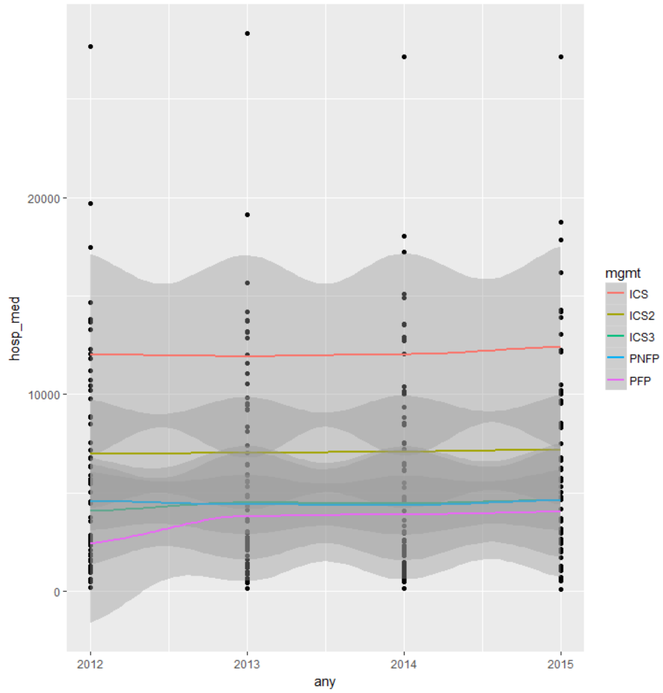

Fig. 21. *LOESS estimates* Surgical Hospitalizations by legal status, (2012-2015)

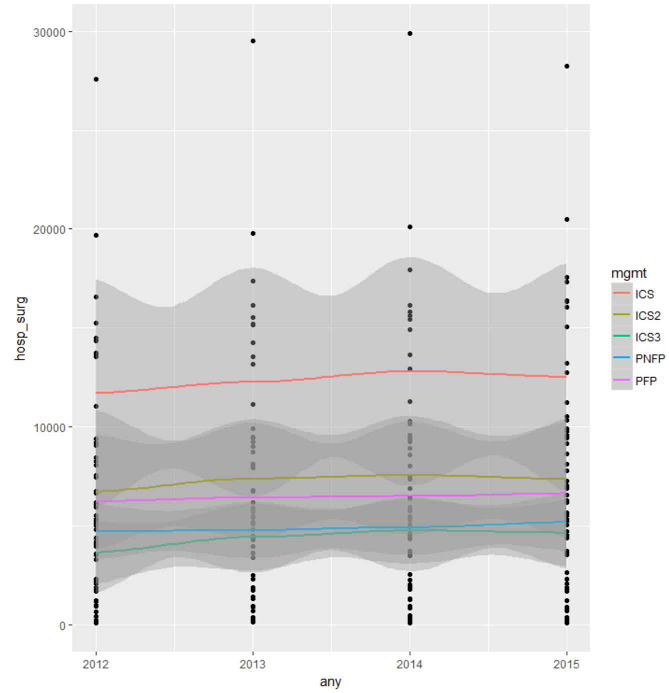

Fig. 20. *LOESS estimates* Medical hospitalizations by hospital level, (2012-2015)

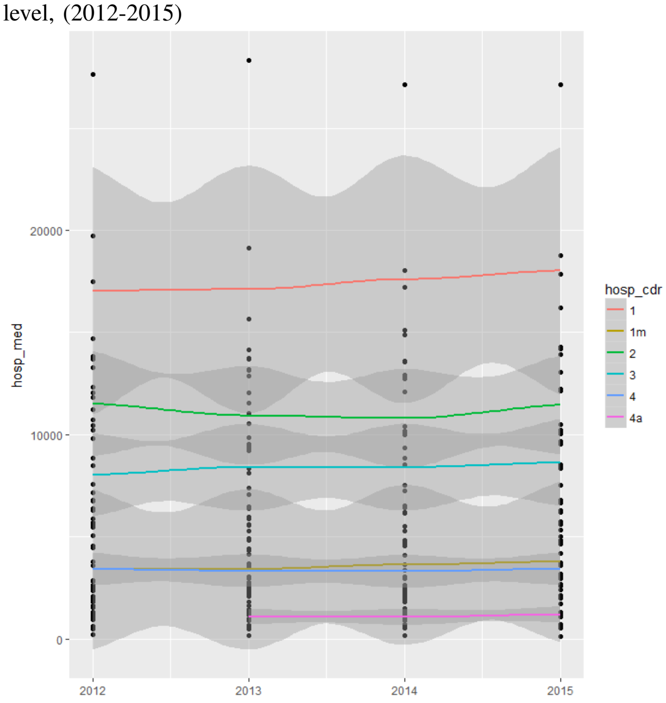

Fig. 22. *LOESS estimates* Surgical hospitalizations by hospital level, (2012-2015)

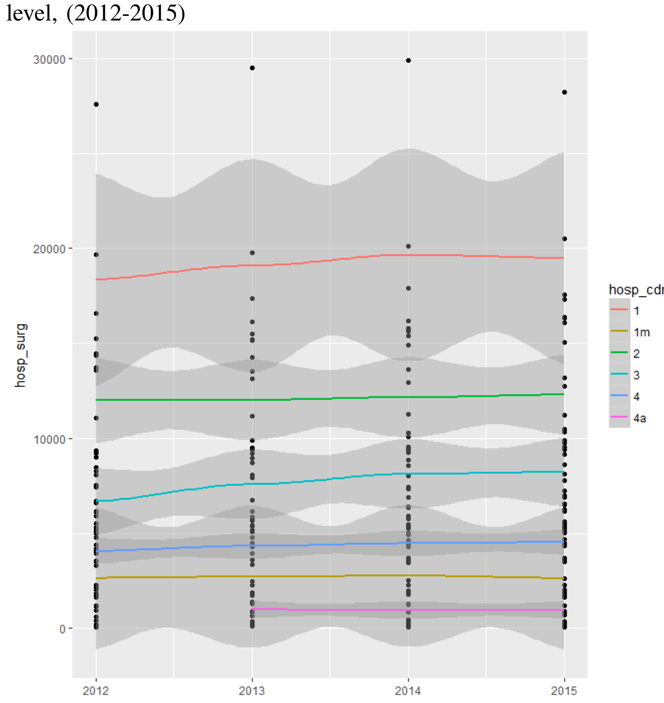

Fig. 23. *LOESS estimates* CMA Hospitalizations by legal status, (2012-2015)

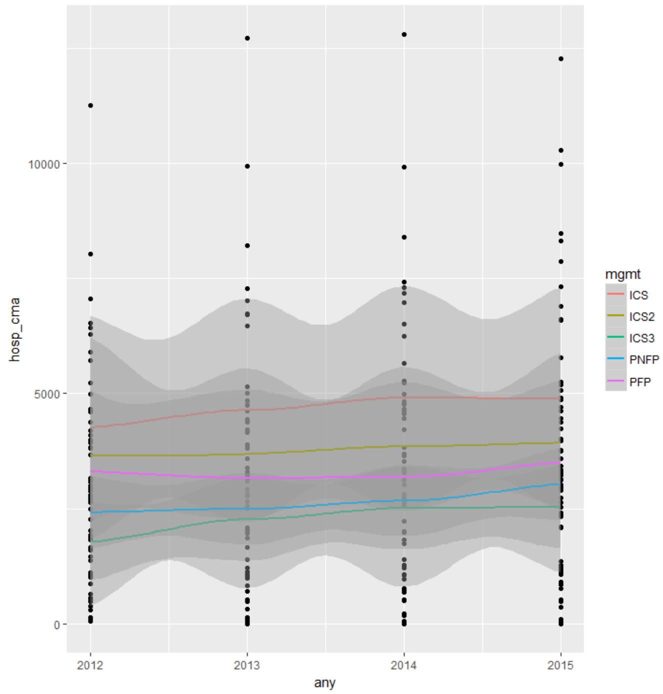

Fig. 25. *LOESS estimates* Diabetes related readmissions by legal status, (2012-2015)

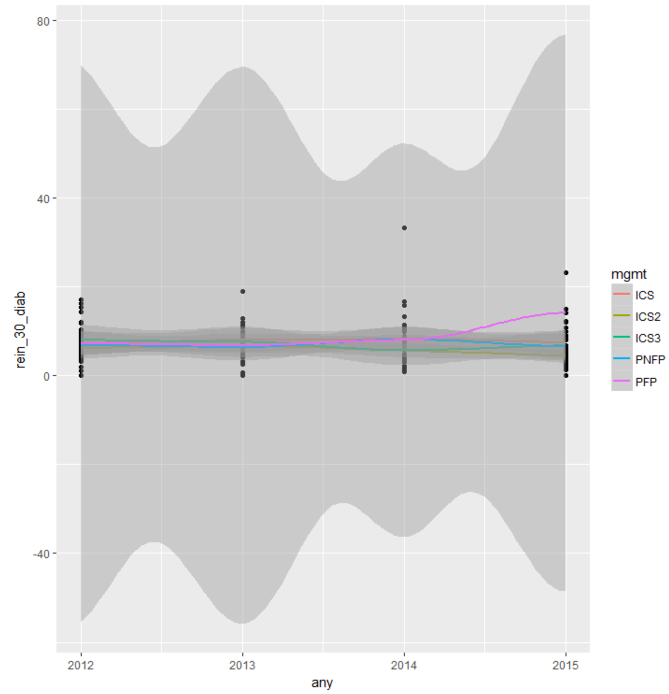

Fig. 24. *LOESS estimates* CMA hospitalizations by hospital level, (2012-2015)

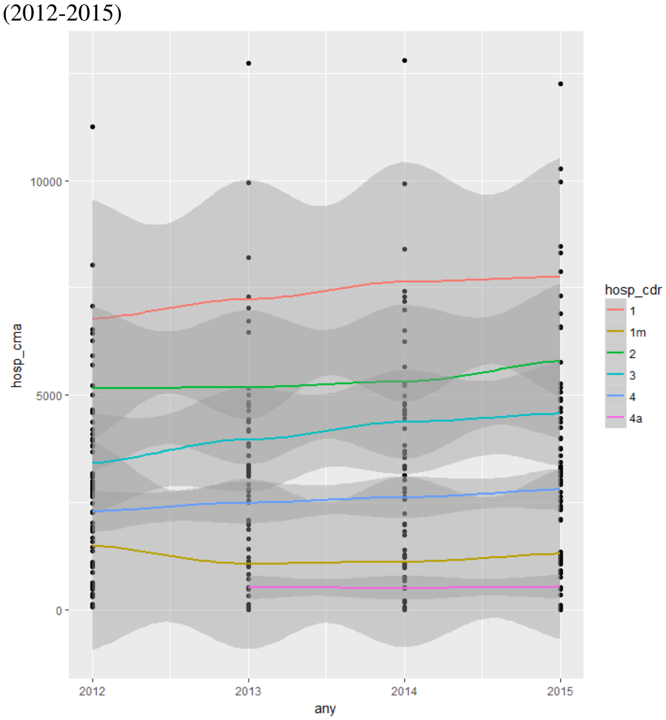

Fig. 26. *LOESS estimates* COPD related readmissions by legal status, (2012-2015)

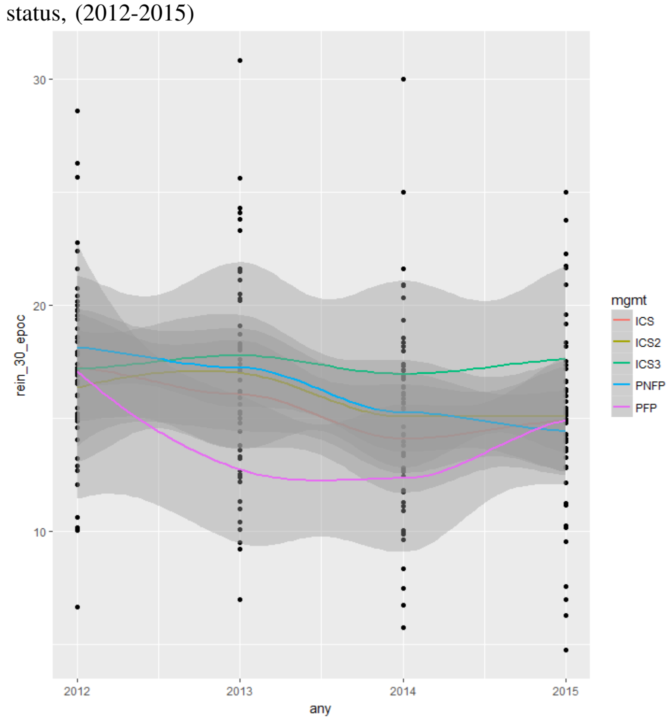

Fig. 27. *LOESS estimates* AMI related readmissions by legal status, (2012-2015)

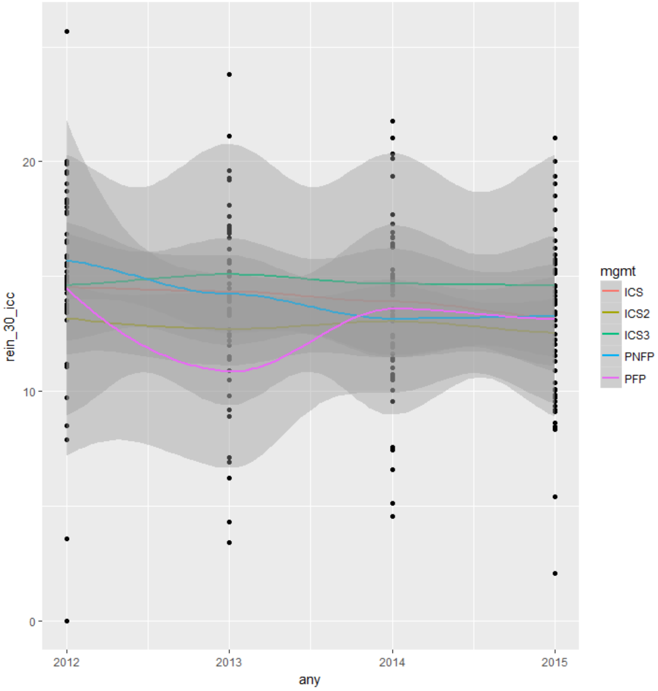

Fig. 28. *LOESS estimates* Specialty related readmissions by legal status, (2012-2015)

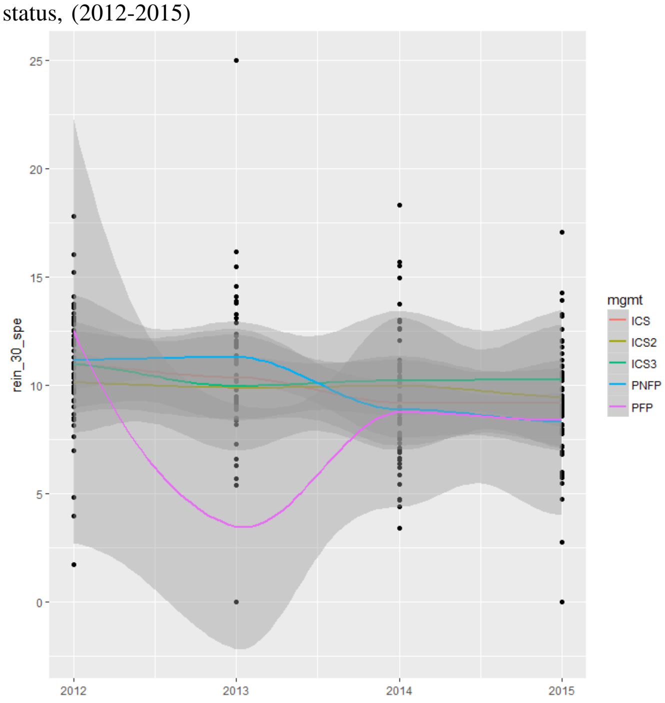

Fig. 29. *LOESS estimates* % of emergency admissions, by legal status (2012-2015)

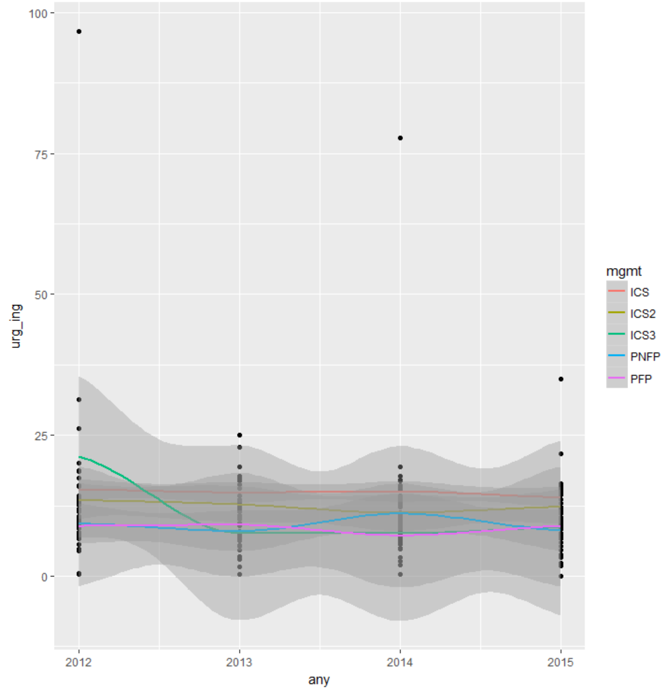

Fig. 30. *LOESS estimates* % of emergency admissions, by hospital level, (2012-2015)

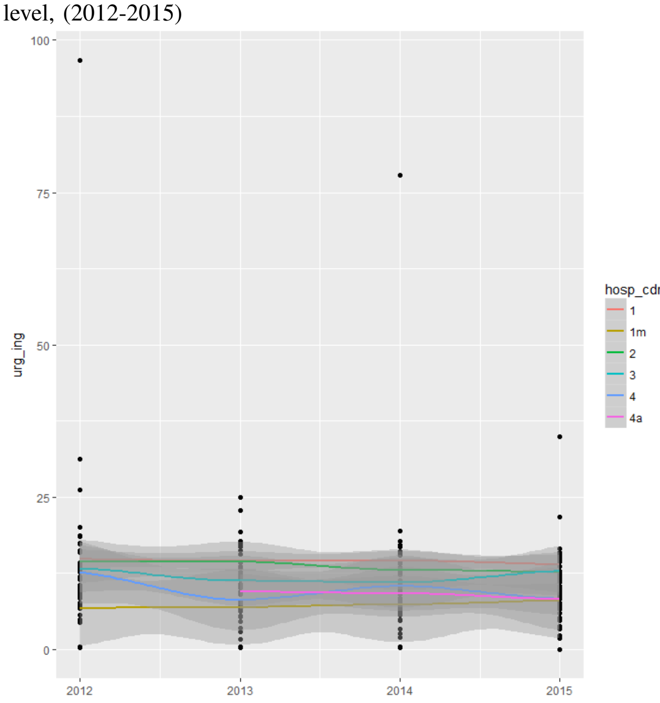

Fig. 31. Dataset Missing Map