The Impact of Hospital Mergers: an Assessment of the Recent Mergers in the Lisbon and Tagus Valley Area

C. N. Mendes

Biomedical Engineering
Instituto Superior Técnico

Abstract: Recently, Portugal faced a severe economic crisis that had consequences in the health sector. The implementation of measures that lead to the reduction of health care public expenses and better efficiency in the use of the resources available has become even more important than before. Hospital mergers are believed to be part of the solution to this problem and Portugal has, in the last decade, even before the crisis, implemented a considerable number of mergers. It is important then to verify if this measure has been successful. Through the use of a difference-in-differences estimation, this paper analyses the results of three mergers in the Lisbon and Tagus Valley area under four different perspectives: quality, access, health care performance and economic and financial performance. The results obtained point to some improvements in health care performance indicators, as well as in access performance indicators. In the case of economic and financial performance, the results are mixed, with no definitive conclusion. Due to lack of data, quality performance was not sufficiently evaluated.

Key-words: Health, hospital mergers, expenditure, efficiency, performance.

1. Introduction

Over the last few years, Portugal has faced a severe economic crisis that led to the implementation of various austerity measures to different sectors. The health sector was no exception, and health expenditure decreased. In this situation, it becomes relevant to study and implement policies that aim to reduce or contain cost while maintaining or increasing efficiency. One such policy is hospital mergers, where a number of hospitals are placed under the same management team and is generally regarded has a policy to increase efficiency, particularly in terms of cost-reduction, by taking advantage of economies of scale and scope (Barros et al., 2011).

Dafny and Lee (2015) define a “good” merger as “one that increases the value of health care by reducing costs, improving outcomes, or both, thereby enabling providers to generate and respond to competition”. As the authors mentioned, in the case of the US health system mergers are usually regarded as a way to give providers higher price negotiation power and reduce competition. In their review of hospital mergers in the US, they conclude that the most consistently documented result of a merger was higher prices, especially when the hospitals involved were in close proximity. Furthermore, they also conclude that the success or failure of a merger is mostly dependent on the actions of the leaders of the health care institutions (Dafny & Lee, 2010).

Markham and Lomas (1995), in their review of multi-hospital arrangements, concluded that, overall, evidence related to economic gains in mergers is mixed and it is difficult to assess the trade-off between benefits, such as cost savings, improved utilization of resource capacity and reduced waiting lists, and disadvantages, like increased financial cost to create the new entity, loss of managerial and organizational identity, and insecurities of human resources. Mostly, they reach the conclusion that an important determinant of the balance of the trade-off is the process adopted in the implementation of the merger (Markham & Lomas, 1995). An article by Lee and Alexander (1999) adds that the adopted process may also have great implication on employee morale, productivity and on relations with physicians and the community. Both articles explicitly state that there is a need for further research on the actual outcomes observed and which relate directly to the merger, or in other terms, are merger-specific (Lee & Alexander, 1999).

As was previously mentioned, hospital mergers are seen as a way to take advantage of economies of scale and scope and there have

been a number of articles that analyse if these economies are present in a merger, or if they are being correctly and fully taken advantage of.
Overall, there are considerable mixed results in the success of hospital mergers independently of the country or health system in question.
In the last decade, even before the crisis, Portugal has implemented several hospital mergers across the country. Still, there are not many studies on the success of mergers in the context of a national health service, and the few that are available report mixed results. Carreira (1999) was able to determine that there are economies of scale in small size hospitals and substantial presence of economies of scope (Carreira, 1999), while Barros and Sena (1999) reported diseconomies of scale in three hospital units created before 1999, where an increase in expenses was not complemented by an increase in productivity (Barros & Sena, 1999). Menezes et al. (2006) concluded that there are high variable costs in hospitals that operate from different infrastructures (hospital centers) (Menezes et al.,2006). Gonçalves and Barros (2013) detected the existence of economies of scale in three auxiliary clinical services, Clinical Pathology, Medical Imaging and Physical Medicine and Rehabilitation, as well as some evidence of economies of scope. Finally, (Veigas, 2014) attempted to evaluate this case, though the use of a fixed effects model and the difference in differences estimator on the hospitals´ financial performance and efficiency. The study considered twelve mergers in the period between 2004 and 2011, and concluded that the mergers resulted in decrease in efficiency and no results, positive or negative, on the financial performance.
This paper examines the impact of hospital mergers in the Lisbon and Tagus Valley area on health care delivery efficiency and costs. The hospital centers' considered are similar in terms of number of beds, volume of outbound sick and case-mix index, and cover close to the same demographic area. The aim of this paper is to identify if these recent mergers have contributed to an increase in the hospitals' efficiency, with regard to a number of different indicators. The indicators selected cover quality, access, health care, and economic and financial performance. With these four areas it is possible to have a relatively complete view of what the impact of the merger is. Although this is a small sample size case, it can be indicative of improvements in merging hospitals at the regional level. Hospital mergers are considered a success if they improve efficiency, that is, reduce expenditure while maintaining quality health care delivery.
A differences-in-differences method is applied to three hospital centers located in the Lisbon and Tagus Valley region that went through a merging process between 2005 and 2014. This method should be able to detect, for each indicator, what the effect of the merger was, when compared to a control group. A fourth hospital center will also be analyzed through the Mann-Whitney test, against a control group composed of an individual hospital that never merged. In order to complement the results and access the evolution of each indicator over time, a descriptive analysis will also be performed. The data used in the analysis was collected from publicly available documents in each hospital's website, as well as the ACSS website and its recently implemented monitoring platform.
Overall, the results obtained point to some improvements in health care performance indicators, as well as in access performance indicators. In the case of economic and financial performance, the results are mixed, with no definitive conclusion. Due to lack of data, quality performance was not sufficiently evaluated.

2. Methodology

2.1. Treatment and control groups

In this study three Hospital Centers were considered and used in the treatment groups. The control group was composed of a single district hospital. The analysis considers a 10 year period, from 2005 to 2014. There are three treatment groups, each with one Hospital Center and the treatment corresponds to the process of merger that each institution went through.
Treatment group 1 is composed by the "Centro Hospitalar Médio Tejo" (CHMT), and has the particularity of being an entity that has undergone the merger before the observed time period. This group was selected to try to identify any medium-term benefits of a merger. The CHMT, Public Business Entity (PBE), was created in 2005 and the Hospital Center integrates three hospitals: the Dr. Manoel Constância Hospital in Abrantes, the Nossa Senhora da Graça in Tomar, and the Rainha Santa Isabel Hospital in Torres Novas. The three hospitals are at a distance of around 30 to 35 km from each other.
Treatment group 2 is composed by the "Centro Hospitalar Barreiro-Montijo" (CHBM). The CHBM,

PBE, was created in 2009 and resulted from the merger of Nossa Senhora do Rosário Hospital (NSRH), PBE, in Barreiro, and Montijo District Hospital (HM), in Montijo. This entity went through a process of merger half way into the observed time period.

Treatment group 3 is composed by the ”Centro Hospitalar do Oeste” (CHO), which like the previous group, went through a process of merger during the observed time period. The CHO, a Public Administrative Sector (PAS) entity, was created in 2012 and resulted from the merger of the “Centro Hospitalar Torres Vedras” (CHTV) and the “Centro Hospitalar Oeste Norte” (CHON). The CHTV was created in 2001 and integrates the Torres Vedras District Hospital and the Dr. José Maria Antunes Junior Hospital (Barro). The CHON was created in 2009 and integrates the “Centro Hospitalar Caldas da Rainha” (CHCR), composed of 2 different hospitals, the Peniche Hospital (HP) and the Alcobaça Hospital (HA). The latter integrates the CHON but not the CHO. So the CHO is currently composed of 5 hospital units: Caldas da Rainha Hospital Unit, Caldas da Rainha Termal Hospital Unit (previously CHCR), Peniche Hospital Unit, Torres Vedras District Hospital Unit and Barro Hospital Unit (this last two were, previously, the CHTV).

This group has the particularity of having two different mergers in a 10 year period. . Both of this mergers will be analyse, with the first one being designated as treatment group 3 (CHON).

The control group is composed of the Santarem District Hospital that was created in 1985 and became a PBE hospital in 2005.

The four entities in question are relatively similar, in terms of capacity, population and production, with the main differences being that CHO covers almost 300 thousand inhabitants while the other three cover closer to 200 thousand inhabitant and CHBM has lower volume of outbound sick when compared with the other three in the same time period. In terms of the case-mix index the entities considered have similar values.

2.2. Selected Indicators

The analysis performed was based on four groups of indicator: Health Care Performance, Economic and Financial Performance, Access Performance and Quality Performance.

Health Care Performance:

1. **Average length of stay:** average of the number of days of hospital stay of outbound sick in a certain time period. It is calculated by:
2. **Occupancy Rate:** relation between the total number of days in the hospital and hospital capacity. By hospital capacity it is meant, nº of beds x 365 days.
3. **Percentage of outpatient surgery:** percentage of outpatient surgery, i.e. same-day surgery, in the total of programmed surgeries.
4. **Percentage of return to hospital after release in 30 days:** percentage of patients that had to return to the hospital and had to be hospitalized in a time period of 30 days.
5. **Percentage of hospital stay over 30 days:** percentage of hospitalized patients that remain in the hospital for a length of time higher than 30 days.

Economic and Financial Performance:

1. **Percentage of expenses with staff in the total of operating income:** percentage of expenses with staff in the total of operating income.
2. **Percentage of expenses with ESP in the total of operating income:** percentage of expenses with external services provider (ESP) in the total operating income.
3. **Percentage of expenses with CGSMC in the total of operating income:** percentage of expenses with the cost of goods sold and materials consumed (CGSMC) in the total of operating income.
4. **Ratio of Operating costs and Operating income:** value of the ratio between the Operating costs and the Operating income.

Access Performance:

1. **Percentage of 1st appointment in the total of appointments**: indicates the percentage of appointments that are 1st appointment in all appointments of all of the specialties.

Quality Performance:

1. **Pressure ulcer prevalence rate:** pressure ulcers, also known as bedsores, are areas of the skin that break down due to continuous applied pressure or rubbing and one

of the causes for this condition is a prolonged stay in bed. Patients that have to be hospitalized are more susceptible to get pressure ulcer. It becomes the responsibility of the health professionals to insure that patients do not get pressure ulcers. The pressure ulcer prevalence rate is calculate as the percentage of number of patients with pressure ulcers in the total number of admitted patients in the time period.

2. Nosocomial infection rate (infection associated with central catheter placement): infection that appears in the patient and which cause was the insertion of a central catheter (foreign body). The presence of an infection could indicate an inadequate handling of the medical equipment. The nosocomial infection rate is calculated as the percentage of the number of catheter related bloodstream infection in the total number of days with the venous central catheter.

3. Post-surgery hip bone fracture rate: A hip fracture is a break in the upper quarter of the femur bone. The extent of the break depends on the forces that are involved. Since the facture requires surgery to fix, if a patient breaks the hip bone after an unrelated surgery it means an additional expense that could be considered avoidable. This rate is calculated as the percentage of number of patients with post-surgery hip-bone fracture in the total of patients that underwent surgery during the time period.

4. Percentage of births by caesarean section: A caesarean section is a surgical procedure in which one or more incisions are made through a mother's abdomen and uterus to deliver the baby, and it is often performed when a vaginal delivery would put the baby's or mother's life or health at risk. The WHO considers the rate of 10% and 15% to be ideal for caesarean sections since 1985 (WHO, 2015). This indicator is calculated as the percentage of number of births by caesarean section in the total number of births.

2.3. Statistical analysis

In this study the Difference in Differences (DiD) estimation was used to determine the impact of the merger on each of the indicators used, in two of the treatment groups. Since CHMT merger occurred at the start of the period considered, this technique could not be applied. Instead, for this case, a Mann-Whitney U test, which is a non-parametric test for the comparison of two independent samples, was applied in association with a descriptive analyses of the evolution over time in order to detect improvement. In this test, for each observation of a sample 1, it is necessary to count the number of times this first value wins over any of the observations in sample 2, or, in other words, the number of times the first value is larger than any observation in sample 2. In case of a tie, the score for the count is 0.5. The sum of wins and ties will result in the value for U (mean rank) for sample 1. Finally, the process is repeated in order to determine the value for the U of sample 2. The null hypothesis, H_0, is described has the distributions of both observations being equal (Fay & Proschan, 2010).

The DiD is a statistical technique used to estimate treatment effects by comparing the pre- and post-treatment differences in the outcome of a treatment and a control group. In other words, it compares the average change over time in the outcome variable for the treatment group with the same average for the control group. The formulation for the method is (Pischke, 2015):

$$Y_{it} = \alpha_i + \lambda_t + \rho D_{it} + X'_{it}\beta + \varepsilon_{it}$$

Where, α_i represents individual fixed effects (no change over time), λ_t is the time fixed effect, X_{it} is the time-varying covariates, ε_{it} represents the error term, D_i the treatment and Y_i the outcome.

The goal is then to estimate the effect of D_i on Y_i.

The main assumption in this method is that, for people with the same pre-treatment trends in the outcome, the trend in the treatment and control groups would have continued the same way as before in the absence of treatment.

One way to use the method is to use the straightforward approach, where we have:

$$D_iD = (Y_{treat,post} - Y_{treat,pre}) - (Y_{control,post} - Y_{control,pre});$$

With $(Y_{treat,post} - Y_{treat,pre})$ being the difference in the treatment group before and after the treatment and $(Y_{control,post} - Y_{control,pre})$ being the difference in the control group before and after the treatment affects the previous group.

Another way to estimate the DiD is to use regressions and, in this case, we can control for covariates and obtain standard errors for the treatment effect to see if it is significant. In this

paper, we will apply both methods, and the formulation adopted was:

- **Method 1**

$$DiD = (Y_{merger,post} - Y_{merger,pre}) - (Y_{control,post} - Y_{control,pre});$$

- **Method 2 (regression)**

$$Y_{it} = \beta_1 + \beta_2 (merger_i) + \beta_3 (time_t) + \rho(merger_i \times time_t) + \varepsilon_{it}$$

Where, $merger_i$ is a dummy variable, equal to one if in the treatment group, zero otherwise; $time_t$ is a dummy variable, equal to one if post treatment, zero otherwise and ρ is the D_iD estimator.

It is important to consider that in this paper, for each test, we are dealing with a small sample which can result in high uncertainty in estimation. If we consider that we are just identifying the parameters and not making inferences, we can just focus on interpreting the results obtained in method 1 and use method 2 to confirm the DiD estimator (Wooldridge, 2007).

Another consideration is that in most studies that used the DiD method, the regression was constructed to include other variables that could be influencing the result. For this paper, we will use the basic regression, on one hand, due to the reason mention above, and on the other because we are comparing one-to-one, which makes easier to infer if other factors (ex: CMI, nº beds, number of outbound patients etc.) are a possible justification for any differences/similarities in the results.

Finally, in three of the indicators selected, percentage of return to hospital in 30 days, percentage of hospital stay over 30 days and percentage of births by caesarean section, the only data available was of the last two years, 2013 and 2014. In these particular cases, the Kruskal-Wallis test was applied. The Krustal-Wallis test by ranks is a non-parametric method that extends the Mann-Whitney U test when there are more than two groups or samples. It is used for testing whether samples have the same distribution and it can compare two or more independent samples of equal or different sizes. The null hypothesis, H_0, is that all the medians of all the samples are equal, while the alternative hypothesis, H_1, is that there is at least a median of one group that is different. A significant test will indicate that there is a sample that stochastically dominates at least one other sample (Kruskal & Wallis, 1952). Similarly to the previous test, the first step is to rank the data, ignoring group membership, from 1 to N. In case of a tie between two values, the value for the rank is the average of the rank they would be given had they not been tied.

In conclusion, in each of the indicators, for which data is available: the Mann-Whitney U test was applied with the control (HS) with each of the treatment groups for the period of time of post-merger (CHMT, CHBM, CHO and CHON). Significance is initially considered at 5%, but since we are working with a small sample, a 10% significance is acceptable. For the Kruskal-Wallis test we compared the four entities (HS, CHMT, CHBM and CHO), in the last two years of the period considered. For the D_iD, in both methods, the control was compared to the CHBM, CHO and CHON. Since CHMT was created in 2005, for the time period considered there was no information on the pre-merger situation.

3. Results

Table 1 shows the results of the Mann-Whitney U test for CHMT when compared to HS. This test only indicates which of the two has overall higher or lower values, it does not conclude on which had the best improvement.

Table 1 - Results of the Mann Whitney test for CHMT.

	Mean rank				Mean rank		
	Control	**CHMT**	**Sig.**		**Control**	**CHMT**	**Sig.**
Average length of stay	12,20	8,80	0,22	**%Exp.ESP**	5,60	15,40	0,00
Occupancy rate	12,75	8,25	0,09	**%Exp.CGSMC**	15,50	5,50	0,00
%Outpatient surgery	13,00	8,00	0,06	**Op. C./Op.I.**	7,85	13,15	0,04
%Exp.Staff	8,00	13,00	0,06				

Table 2 - Results of the DiD estimation for CHBM, CHO and CHON.

	Average length of stay			Occupancy Rate			%Outpatient surgery		
Group	**Δ^1**	**Δ^2**	**Sig.**	**Δ^1**	**Δ^2**	**Sig.**	**Δ^1**	**Δ^2**	**Sig.**
Control	0,51	-0,21	0,48	7,43	2,26	0,55	13,87	8,31	0,095
CHBM	0,31			9,68			22,2		
Control	0,51	-0,28	0,36	6,05	3,61	0,54	-2,65	9,21	0,19
CHO	0,18			9,66			6,56		
Control	0,25	-0,27	0,28	4,03	17,1	0,002	15,93	2,08	0,8
CHON	-0,02			21,12			18		

	%Exp.Staff			%Exp.ESP			%Exp.CGSMC		
Group	**Δ^1**	**Δ^2**	**Sig.**	**Δ^1**	**Δ^2**	**Sig.**	**Δ^1**	**Δ^2**	**Sig.**
Control	-3,20	7,37	0,252	4,84	-3,49	0,15	0,72	2,20	0,50
CHBM	4,17			1,35			2,91		
Control	-8,32	10,5	0,13	0,03	-8,08	0,24	-6,73	4,06	0,26
CHO	2,15			-8,05			-2,63		
Control	1,79	-9,74	0,10	4,91	4,93	0,40	4,32	-2,04	0,60
CHON	-7,96			9,84			3,29		

	Oper.cost/oper.income			%1st appointments		
Group	**Δ^1**	**Δ^2**	**Sig.**	**Δ^1**	**Δ^2**	**Sig.**
Control	0,04	0,05	0,63	0,085	2,28	0,03
Treatment-2	0,08			2,37		
Control	-0,094	-0,002	0,97	-1,33	2,40	0,10
Treatment-3	-0,095			1,07		
Control	0,095	-0,029	0,85	0,82	-0,08	0,94
Treatment -3(CHON)	0,069			0,74		

Note: Δ^1 is the difference of the average of values pre- and post-merger; Δ^2 is the differences of the two averages calculated. Corresponds to the DiD estimator. %Exp.Staff – percentage of expenses with staff in total operating income; %Exp.ESP – percentage of expenses with ESP in total operating income; %Exp.CGSMC – percentage of expenses with CGSMC in total operating income; Oper.cost/oper.income – Ratio of operating costs in total operating income.

Table 3 - Results of the Kruskal-Wallis test.

	(%) Returns 30 days		(%) Hospital stay > 30 days		(%) Births by c-section	
	Mean rank	**Sig.**	**Mean rank**	**Sig.**	**Mean rank**	**Sig.**
Control (HS)	5,50	0,103	5,00	0,123	3,50	0,103
CHMT	7,50		2,00		4,50	
CHBM	2,75		7,50		7,50	
CHO	2,25		3,50		2,50	

In terms of average length of stay, CHMT has the lowest mean rank, meaning, overall it has lower average values. However, through the descriptive analysis, between 2009 and 2011, CHMT actually had an average length of stay higher than the control. In fact, in the first years of existence (2006 to 2007) it had better values for the average, but suffered a sharp increase from 2008 to 2010. This increase consisted of rise in the average of 1.5 days, increasing from around 6.5 days to almost 8 days. Fortunately, the entity appears to have been able to recover, and their average dropped to around 7 days. In fact, the sharp decrease in this indicator from 2012 to 2013 is most likely due to the reorganization that the hospital center underwent in order to address the existence of unnecessarily duplicated services. In the case of the control, they maintained an average of around 7.2 to 7.5 until 2011. From then on, their average increased by almost a day, reaching close to 8.5 days in 2014.

In the case of the occupancy rate, during the time period considered, CHMT always has a lower rate than HS. This is reinstated by the Mann-Whitney U test. When analysing the occupancy rate values, we have to consider two points: the rate has to be high enough to assume that the resources are not being underutilized, but, at the same time, it has to be low enough in order to avoid cases of overcrowding. Usually, for public hospitals, the bottom limit is defined around 75% and the upper limit at 85% (Morton, 2011). Taking this into consideration, we have that HS has been in a situation of danger of overcrowding since 2008 and it has been worsening since 2011. Even if we consider not the optimal upper limit but an acceptable upper limit, 90%, HS has crossed that limit already in 2012. The CHMT, on the other hand, remained below 85% until 2011. From 2012 to 2014, the occupancy rate increase to almost 90%. For the percentage of outpatient surgery, in the case of CHMT, its results were always lower than the control except for the last two years, where both entities have similar results. In terms of evolution, CHMT has shown a continuous increase, starting in 2006, until 2014. HS had an increase from 2008 to 2010, after which there was a decrease that lasted for two years. In 2012, this indicator began increasing again until 2014. Although HS has the highest result in the Mann Whitney test, we can conclude that CHMT was the one with the best improvement in the time period. In the case of the percentage of expenses with staff in relation to the total operating income, since 2007, CHMT spends a higher amount in staff than HS, but this expense has been decreasing since 2010 and in 2014 is almost the same as the control group. With the MWU there is a confirmation that HS has the lowest overall percentages for this indicator. In terms of improvement in this indicator, we could state that CHMT was the entity that improved the most, considering that their expenses have been decreasing continuously since 2011. For the percentage of expenses with ESP, in terms of the MWU test, control scored a lower mean rank, which means that, overall, it has lower percentage of expenses in this category than CHMT, with a value of sig. of 0.00. Through the descriptive analysis we note that, since 2012, CHMT has manage to reduce this percentage while the control has maintained the value.

In terms of percentage of expenses with CGSMC, through the Mann-Whitney U test we have that CHMT has the lowest rank, and in fact, in a more descriptive way, CHMT as a lower percentage in this type of expenses in all the period, but it increased the percentage of expenses with CGSMC from 20% in 2006 to around 28% in 2011. From this year to 2014, CHMT was able to decrease the indicator to back to 20%. HS also has a decrease in the indicator since 2011 until 2014 although less pronounced. Finally, in terms of the ratio of operating cost and operating income, in the Mann-Whitney U test, CHMT has the highest mean rank. CHMT presents a higher ratio for most of the period, but in the last three years they registered a decrease while the control, in the same period, registered an increase. This means that CHMT has been able to improve their relation of costs and income.

Table 2 shows the results of the DiD estimation. For the average length of stay, we can conclude that the merger was successful in preventing a higher increase in the indicator for CHBM and CHO, since we can observe that both the control and the entities suffered an increase in the period of before to after the merger but the control increase in a higher rate. For CHON, the “treatment” resulted in a decrease of the indicator as opposed to the increase observed in the control group, which means the merger was successful in improving the indicator. For the

occupancy rate, there was an increase in the indicator from before to after the merger in all three (CHBM, CHO and CHON). In this case, however, since there is an upper limit that should not be exceeded, this increase was not as productive in the case of CHO, since this increase resulted in crossing the upper limit and registering unwanted results, so in this case we could assume that the merger was not successful. For the percentage of outpatient surgery, both CHBM and CHON registered an increase higher that the control group, while CHO also registered an increase with HS reporting a decrease.

In terms of the percentage of expenses with staff in total operating income, there was no improvement in CHBM or CHO but CHON reported a decrease in the percentage while the one for the control increased. In percentage of expenses with ESP, CHBM reported an increase from before to after the merger, but at a lower rate than the control, while CHO observed a decrease in the indicator at the same time the control went through an increase. In the case of CHON it was unsuccessful. As for the percentage of expenses with CGSMC, there was increase higher than the control (CHBM), decrease at a lower rate than the control (CHO), and only a small increase higher than the control (CHON). Finally, the ratio of operating costs over operating income again had mixed results, with the CHBM reporting a higher increase, CHO decreasing but with a decrease very close to the one observed in the control and CHON increasing at a lower rate than the control.

In the case of the percentage of 1st appointments in the total of appointments, the indicator reported improvements in the case of CHBM and CHO, with a higher increase in the first case, and an increase while the control decrease for the second case. CHON reported an increase also, but it was lower than the one registered for the control.

There was an inability to analyse some indicators under the same methodology due to lack of data. The two indicators of the health care performance that were not analysed, the percentage of return to the hospital in 30 days and the percentage of hospital stay longer than 30 days, only data on the last two years was available. In order to conclude something from this data, a Kruskal-Wallis test was performed (Table 3). The results revealed that, in the first case, CHBM had the lowest mean rank, followed by CHO, HS and CHMT. In the second case, CHMT had the lowest mean rank, followed by CHO, HS and CHBM. The test reported that the control was in third with two hospital centers with better results in each one. However, since this test was performed with a very small sample and only with post-merger data, we cannot conclude whether the merger was the reason for the better results of the hospital centers.

In the quality performance, there was no data available on the indicators. Through contact with the entities in question, some data was obtained, but not enough to perform any analytical or in-depth descriptive analyses. CHBM reported no occurrences of post-surgical hip-bone fracture, low percentage of nosocomial infections from 2012 to 2014, and a decreasing rate of pressure ulcers, from 15% in 2011 to 5.9% in 2014. CHO reported on nosocomial infections where they registered increases in the percentage from 2011 to 2014. If we consider the SINAS classification for each hospital that composes each entity, for the rate of pressure ulcers, all the entities scored high in quality and safety levels (level 3). The same happened for the rate of nosocomial infections, and only in the rate of fractures of the hip bone did the score dropped to a level 2 in quality in all cases. So, overall, every entity considered has good results in terms of quality and safety for the patient. In the case of the percentage of births by caesarean section, again only the values for the last two years were available, so a Kruskal-Wallis test was performed where it could be observed that CHO, for the last two years, reported better results than the others and CHBM had the worst results. This test had a sig. value of 0.10, which is acceptable for 10% significance.

4. Conclusion

In general, the results are mixed, in which we have cases where there is a clear improvement of indicators directly related to the merger, while in other cases there is no improvement. Since this paper only analyses the results on a select number of entities, the conclusions reached cannot be transposed to the general case of any merger in Portugal. We can, however, draw some conclusions for the region of Lisbon, since the entities studied are similar in terms of production, capacity and affected area.

Overall, in terms of heath care performance and access performance, the merger has resulted in some improvements. For the average length of stay, the merger contributed to an improvement in efficiency in all three hospital centers considered, with stronger impact on CHON, when considering the result of method 1. In terms of the regression no result was statistically significant. For the occupancy rate, the merger resulted in an increase of the indicator for the three cases. This is considered an improvement for CHBM and CHON, but not CHO since the upper limit was crossed. In terms of the regression, there was a significant result for CHON. In the case of the percentage of outpatient surgery, the merger contributed to an improvement in efficiency in all three hospital centers considered, with stronger impact on CHO, although the only significant result was from CHBM. Finally, for the percentage of 1st appointments, the merger contributed to an improvement in two hospital centers with CHON reporting no improvement. Considering the regression, this method resulted in two statistically significant results: CHO and CHBM. No definite conclusion could be drawn from the financial performance and quality performance. CHON reported improvements related to the merger in the percentage of expenses with Staff, which were statistically significant, and in the ratio of operating costs in total operating income, while CHO registered improvements in the percentage of expenses with ESP, along with CHBM, and was the only to report improvements in the percentage of expenses with CGSMC. In terms of quality performance, the lack of data hindered the analysis.

It can be observed that, even with improvements, CHBM seems to be the entity with the worst results for most of the indicators. This can be explained by the fact that they have a considerable number of long-term patients that need to remain in the hospital even after recovery. Mostly older patients with no family or caretakers. This has implications in the indicators, since it contributes to their less than expected results.

Analysing the case of CHMT, for the majority of the indicators in the first two groups, the entity reported less than desirable results over a period of time, until 2012, where, from then on, most of the indicators reported improvements, and in some cases, considerable ones. This can be explained with the fact that 2012 was the year the hospital center underwent a reorganization of its services in order to centralize the services and end duplicated or triplicated ones. This situation was believed to be contributing to inefficiencies and an unnecessary dispersion of resources. The reorganization involved the concentration of each service into one or two hospitals. For example, Internal Medicine was previously available in all of the hospitals but, as of 2012, this service was concentrated and is now only available in the hospital in Abrantes. With the observations made, it can be conclude that this measure was very successful in improving various indicators. Since these duplicated services were most likely a result of the merger in 2005, it begs the question of why this measure was not taken in that same year or the one following. It appears that, if the measure had been readily applied, the hospital center could have improved far more than it did. This situation reinforces a statement already discussed and supported by many different authors that the success or failure of a merger is mostly related to how well it is planned and organized. Considering a comparison of the results obtained in this paper with one similar study published in 2014, which is perhaps the closest approach to this paper, some additional conclusions can be drawn. This paper for comparison focuses only on total costs and average length of stay as indicators (Veigas, 2014). However, treatment and control groups are composed by a considerable number of different entities; the author attempts to evaluate all mergers between 2004 and 2009. In terms of total costs, no effect of the mergers on this indicator is identified, which the author considers as evidence that, due to management changes, neither did the hospitals' cost increase, nor did they decrease. In the case of the current paper no clear effect of the merger is detected in any of the economic indicators, which confirms that costs have remained fairly constant overall. Diverse results concern the average length of stay: Veigas (2014) identifies an efficiency decrease for this indicator, which the author concludes to be due to previously inefficient hospitals (before the merger) that suffered increases in the average length of stay in the post-merger period, so they remained inefficient. Contrarily, the evidence in the current paper points to an increase in efficiency in terms of average length of stay.

In conclusion, the analysis in this paper presents a number of mixed results, especially in what concerns economic and financial performance. Overall, we can conclude that, in terms of health care performance and access performance, recent hospital mergers in the Lisbon and Tagus Valley area have resulted in improvements in various indicators. No definite conclusion can be extracted from the financial performance and quality performance indicators, in the first case due to contradicting results and in the second one due to lack of data.

Since this paper was based on a small size sample, conclusions cannot be generalized to other hospital mergers. In fact, when comparing the results obtained with other studies, some conclusions differ. For example, in a similar study that considered a greater number of mergers throughout the country, there was evidence of decreasing efficiency in the average length of stay. It can be concluded that, in a general perspective for Portugal, mergers have yet to produce significant gains. At a regional level, efficiency gains could already be detected in the current paper.

In any case, hospital mergers are a valuable measure in improving the Portuguese NHS. Each merger should be considered carefully, and several consolidation policies should be taken into account, from back office consolidation to business plans that consider the complementarity of the various institutions and aim to reduce redundancies, both administrative and of medical services.

References

Barros, P. P., Machado, S. R., & Simoes Jde, a. (2011). Portugal. Health system review. *Health Syst Transit*, *13*(4), 1–156.

Barros, P. P., & Sena, C. (1999). Quanto maior melhor? Redimensionamento e economias de escala em três hospitais portugueses. *Revista Portuguesa de Saúde Pública*, *32*(01), 1–21.

Carreira, C. M. G. (1999). Economias De Escala E De Gama Nos Hospitais Públicos Portugueses: Uma Aplicação Da Função De Custo Variável Translog. *Estudos Do GEMF*, *1*(1), 1–37.

Dafny, L. S., & Lee, T. H. (2010). The Good Merger. *Perspective*, *363*(1), 1–3. Retrieved from http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:New+engla+nd+journal#0

Fay, M. P., & Proschan, M. a. (2010). Wilcoxon-Mann-Whitney or t-test? On assumptions for hypothesis tests and multiple interpretations of decision rules*. *NIH Public Access*, *4*, 1–37.

Gonçalves, R., & Barros, P. P. (2013). Economies of scale and scope in the provision of diagnostic techniques and therapeutic services in Portuguese hospitals. *Working Papers de Economia (Economics Working Papers)*, *4*, 28.

Kruskal, W. H., & Wallis, W. A. (1952). Use of Ranks in One-Criterion Variance Analysis. *Journal of the American Statistical Association*, *47*(260), 583–621.

Lee, S. Y., & Alexander, J. A. (1999). Consequences of organizational change in U.S. hospitals. *Medical Care Research and Review : MCRR*, *56*(3), 227–76.

Markham, B., & Lomas, J. (1995). Review of the multi-hospital arrangements literature: benefits, disadvantages and lessons for implementation. *Healthcare Management Forum / Canadian College of Health Service Executives = Forum Gestion Des Soins de Santé / Collège Canadien Des Directeurs de Services de Santé*, *8*(3), 24–35.

Menezes, A., Rendeiro, M. F., & Vieira, J. C. (2006). Eficiência Técnica dos Hospitais Portugueses 1997-2004 : Uma Análise (Regional) com base num Modelo de Fronteira Estocástica. *Seminar Series*, (08), 0–28.

Morton, A. P. (2011). Is quality of care improving? Hospital safety and complexity. *BMJ (Clinical Research Ed.)*, *342*(3), d1320.

Pischke, J.-S. (2015). Labour Economics for Research Students. Retrieved October 28, 2015, from http://econ.lse.ac.uk/staff/spischke/ec533/did.pdf

Veigas, J. (2014). *Hospital mergers : just what the doctor ordered ?* Universidade Católica Portuguesa.

WHO. (2015). WHO Statement on Caesarean Section Rates. *Human Reproduction Programme*, 1–8.

Wooldridge, J. (2007). *Lecture 10: Difference-in-Differences Estimation*. Cambridge.