

ANALYSIS OF THE PORTUGUESE PUBLIC HOSPITAL'S PERFORMANCE THROUGH QUALITY AND MANAGEMENT INDICATORS

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ABSTRACT

BACKGROUND: The analyses of healthcare measures allow us to assess healthcare quality, being essential to understand the development of the public Portuguese hospitals. We adopt some quality indicators (QI's) to determine the activity and the quality of healthcare in a simple, understandable and comparable way. The previous studies in this field reflect the need to provide an overview of the

performance of hospitals using new information and to innovate in terms of using this methodology in Portugal. AIM: The main goal of our research is to analyse the activity/productivity and the quality of healthcare in the Portuguese public hospitals between 2000 and 2007 in different regions. METHODS: This study is observational, longitudinal and retrospective because we are analysing all inpatient admissions data collected from 2000 to 2007 and provided by ACSS (Administração Central do Sistema de Saúde). The database contains 7768467 admissions in 87 Portuguese public hospitals. The indicators were compared over time and among regions. RESULTS: Statistically significant differences ($p < 0,05$) were found during the mentioned 7 years: in most of the indicators there was an increase of the percentages, except newborn problems, inappropriate short-term admissions in medical DRG's and unspecified surgical procedures, in which there was a decrease. There are also statistically significant differences ($p < 0,05$) among the different regions, which are very heterogeneous according to the QI in analysis. CONCLUSIONS: Globally, during the studied period, the majority of the indicators present a positive evolution. The exceptions are readmissions, vaginal deliveries with complications, short inappropriate admissions in surgical DRG's and medical DRG's complications. As to the regions, Norte is the one whose percentages are the most positive, when considering all the indicators. This study showed how useful such an approach may be, reinforcing the need to do much more work in this area.

KEY-WORDS: *Quality of Health Care, Quality Indicators, Length of stay, readmission, vaginal deliveries.*

INTRODUCTION

Nowadays, the need for a bigger efficiency and cost-cutting in public institutions leads to the development of indicators – tools that allow us to assess and often evaluate the key variables of an organization through comparisons in internal and external matching references. So that they may have the appropriate quality, indicators must enclose certain essential features such as relevance, objectivity, clarity, accuracy, liability, facility of access and interpretation^[1].

In hospitals, the use of indicators allows the evaluation of economical performance and hospital productivity, as well as to investigate in which way the pay-for-performance method may lead to a greater system's efficiency^[2]. The financing of these institutions is based on *Diagnosis Related Groups* (DRGs) which are sorting systems for interned patients with severe problems, in clinically coherent and homogeneous groups – in a resource consumption point of view – built from the

diagnostic features and patients' therapeutic profiles that explain the resource consumption in hospitals^[3].

However, these measures based on *Quality Indicators* (QI's) are limited by probabilistic natured problems, inadequacies of information systems, variety of measurers and measures, complexity of health plans, availability of funding^[4], confusion factors and problems with robustness, sensitivity and specificity^[5].

Another important detail is that these QI's, taken in account by entities such as *Alto Comissariado da Saúde* (ACS, Portugal), *Administração Central do Sistema de Saúde* (ACSS) and the *Agency for Healthcare Research and Quality* (AHRQ, USA) were not developed for the purpose of hospital-specific comparative quality reporting in the first place, but they have been and are being used for public reporting and *pay-for-performance* (emerging movement in health insurance in which providers are rewarded for quality of healthcare services)^[6].

As an example: hospital mortality is a QI that is now being used in the United Kingdom, United States, Netherlands and Sweden^[7], but a focus on single conditions or procedures will be required in order for that to be a relevant quality measure. Such a focus would simplify the recognition of explanations for poor performance and allow more accurate risk adjustment than would otherwise be possible with overall hospital mortality. Although, in some cases, administrative data alone may be enough for risk adjustment, in others, combined administrative data with clinical information is needed^[8].

In Portugal, *Plano Nacional de Saúde* (PNS), developed by ACS and *Ministério da Saúde*, incorporates its indicators based on family and general life cycles – being born healthy, growing safely, searching for a healthy future... –, indirectly evaluating health services, particularly their competency, efficiency, security and sustainability^[9].

A study made to determine patient and physician opinion of the relevance of the reported quality indicators for choosing or referring to a particular hospital in Germany, in 2005, showed that, out of the 29 QI, 19 were classified as highly or very relevant by the patients, whereas the physicians chose 15 indicators. As such, hospital quality reports seem to be useful for patients and physicians and influence their choice of hospitals^[10].

On the other hand, at times, QI's don't have much relevance for patients, since the accuracy of measures is answering questions that the true movers of the market are not asking. So, it is necessary to understand what patients are really interested in and develop a measurement system that informs them^[11]. In other words, it is not important to measure certain aspects, but instead that those measures should be focused in order to be seen as a whole that can be linked to the patient, that has a clear and compelling use, helps providers improve care delivery, helps stakeholders make

more informed decisions and balances the need for continuous improvement with the stability needed to track progress over time^[12].

The *International Quality Project* is the largest international data set of quality indicators. It provides participants with quarterly feedback of comparative indicator data and support for effective use of these data within the participants' own quality improvement programs^[13].

In this way, there is a series of indicators for us to measure the activity/production that allow an assessment of the physical capacity of the hospital and the quality of its healthcare.

This paper attempts to analyze the quality of admissions in Portuguese hospitals, by comparing QI's during 7 years and among regions. This provides an overview of their performance. Besides, we tried to compare our results concerning different indicators with those from other countries, finding reasons for the similarities and differences found. Nevertheless, it would not be objective to present measures in order to improve healthcare problems, as studies analysing each indicator in more detail would be needed to attain such a goal.

PARTICIPANTS AND METHODS

In order to do a statistical analysis, we used a database containing 9098628 episodes from 87 Portuguese public hospitals^[14], from 2000 to 2007. This was provided by ACSS^[15]. Our target population is composed by the patients admitted into these hospitals.

Our study is: observational, since there is no manipulation of direct interventions; longitudinal and retrospective, as we are collecting data from occurrences between 2000 and 2007; analytic, because we want to describe the variables of the study (in this case the indicators) and compare them.

The exclusion criteria were the ambulatory medical DRG's (radiotherapy, chemotherapy, pacemakers, etc.), as defined in *Anexo II* from *Portaria nº110-A/2007, January the 23rd*^[16]. Then, episodes with programmed admission, whose release date equals the entry date, whose patient is not being transferred from a hospital to another, where there is not release against the doctor's opinion, nor the patient dies, were excluded^[16]. This is why we were left with only 7768467 episodes to deal with.

The raw data in this database corresponds to the identification of the hospital, identification of the episode, sex, birth weight, type of admission, destination after discharge, date of release, residence, main diagnosis, secondary diagnosis, medical or surgical diagnostic procedure, date of admission. The processed data is the total of days, DRG and Major Diagnostic Category (MDC). A description of each one may be found on table 1.

Variable	Description
Birth weight	The amount that a baby weighs at the time of birth , in grams; it is relevant whenever a patient is admitted being under 29 days of age.
Type of admission	Key: 1- programmed, 2- not programmed, 3- access program, 4- pectec, 5- private medicine, 6- sigic additional production, 7- paco (ophthalmology).
Destination after discharge	Key: 1- exterior and not referenced, 2- left for another hospital, 6- left in domiciliary service, 7- left against medical advice; 20- deceased.
Main diagnosis	Code of the main diagnosis
Secondary diagnosis	Codes of the diagnoses codified in ICD-9-MC.
Medical or surgical diagnostic procedure	Codes of the procedures codified in ICD-9-MC.
DRG	It contains the DRG in which the episode was included in the version AP-DRG 21.0.
MDC	Formed by dividing all possible principal diagnoses (from ICD-9-CM) into 24 mutually exclusive diagnosis areas.

Table 1 Description of the different variables in the database

In order to achieve results in the context of this study, we decided to analyse the evolution of each indicator during the referred years and also do that by regions. We used NUTS (Nomenclature of Territorial Units for Statistics), as this division of the Portuguese territory exists in many other countries of the European Union (EU)^[17] allowing the data to be comparable within the EU. This nomenclature is hierarchical - this means each member state is divided into territorial units of the level NUTS I, which are divided into units of the level NUTS II and these, finally, are divided according to the level NUTS III^[18]. In the specific case of Portugal, level I consists of three units: the continental territory and the two autonomous regions (the Azores and the Madeira islands); level II comprises seven units, of which five correspond to the continent (North, Centre, Lisbon, Alentejo and Algarve) and the remaining two to the referred archipelagos; level III includes 30 units (again Azores and Madeira as well as 28 other units in the continent)^[19]. The criteria in the basis of the choice of NUTS II were related to the fact that this was the most accurate division: NUTS I would not give us a more homogeneous territorial comparison and NUTS III, given the big division made, could not allow us to compare regions with interest.

The QI's that allow to evaluate the activity/productivity of a hospital are discharge patients and newborns; the ones that assess the quality of healthcare per se are exceptional admission episodes, surgical admission time, complication-free long-term admissions, readmissions, short-term inappropriate admissions, newborns, vaginal deliveries, unspecified surgical procedures and medical DRG's complications.

To calculate each indicator using the SPSS 16.0 program of Windows^[20], we created the algorithms presented in the attachments. We have also used Microsoft Excel to build charts.

RESULTS

The main characteristics of the database that was used in this study are presented in Table 2. The analyses of the indicators were done by year of discharge and NUTSII.

YEAR

To measure the hospital's activity in each year, keeping in mind the type of admission, it is visible that the percentages of programmed and non-programmed admissions have opposite evolutions: in 2007 there is a higher percentage of programmed admissions, unlike previous years (Figure 1).

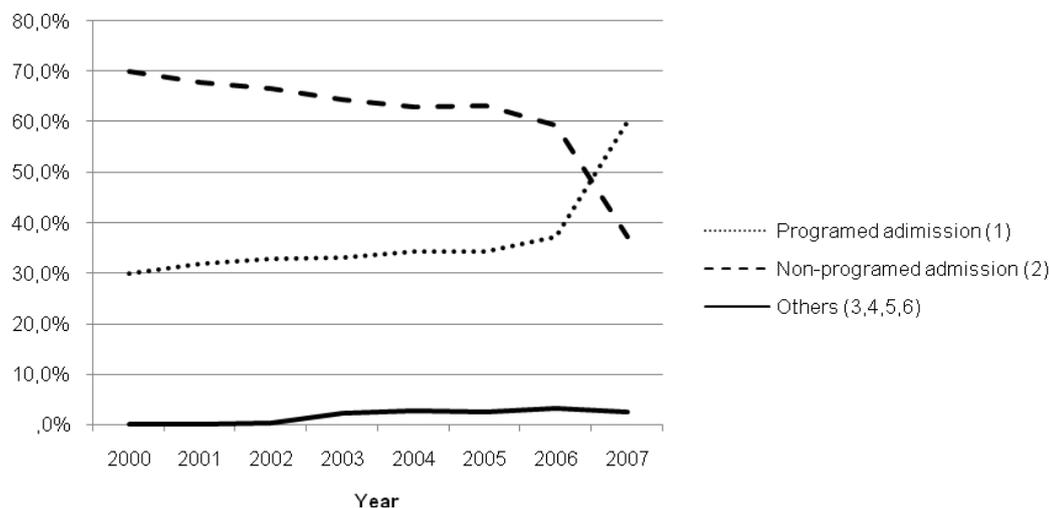


Figure 1 Variation of the type of admission from 2000 to 2007.

The most frequent destination after discharge is "exterior and not referenced" (Table 3). It should also be noticed the decrease in the percentage of deaths from 2004 on, which is more noticeable in 2007. The percentage of destination being a hospital out of the National Healthcare System (SNS – Serviço Nacional de Saúde) is 0% in every year from 2000 to 2007.

	Exterior and not referenced (1)	Hospital (SNS) (2)	Left in domiciliary service (6)	Left against medical advice (7)	Deceased (20)
2000	89,8	4,3	1,2	0,8	3,9
2001	90,1	4,1	1,1	0,7	4,0
2002	90,4	3,8	1,0	0,7	4,1
2003	90,6	3,4	1,3	0,7	4,0
2004	90,9	3,1	1,4	0,6	3,9
2005	90,7	3,2	1,3	0,6	4,2
2006	92,0	2,6	0,9	0,6	3,9
2007	94,7	1,8	0,4	0,4	2,6

Table 3 Variation of the destination after discharge from 2000 to 2007 (percentages)

In relation to the total number of births without singular stillborns (i.e., in the case of one twin surviving and the other dying, this is still considered a delivery) it achieved 761038. It is verifiable that the number of newborns has decreased during the period of 7 years in approximately 3%.

The differences found during these years are statistically significant in each indicator ($p < 0,05$).

Characteristic	%
Gender	
Male	44,4
Female	55,6
Age	
≤ 17	19,8
18-24	5,4
25-34	12,6
35-44	9,3
45-54	9,3
55-64	10,8
65-74	14,2
≥ 75	18,2
NUTS II	
Norte	33,8
Centro	26,0
Lisboa	26,5
Alentejo	4,9
Algarve	3,7
Discharge Year	
2000	12,1
2001	12,2
2002	12,4
2003	12,7
2004	12,6
2005	13,0
2006	12,5
2007	12,5

Table 2 Characteristics of the analysed population (% of total hospitalizations)

		2000	2001	2002	2003	2004	2005	2006	2007	Pearson Chi-Square
Exceptional admission episodes	Short-term episode	19,2	19,4	19,7	19,8	19,8	20,3	19,7	19,8	<0,001
	Long-term exceptional episode	2,39	2,11	1,92	1,68	1,61	1,54	1,52	1,49	
Complication-free long-term admissions¹⁾		1,36	1,34	0,96	0,80	0,78	0,66	0,57	0,62	<0,001
Readmissions		4,98	5,31	5,48	5,47	5,63	5,65	5,70	5,59	<0,001
Newborns problems		1,04	1,08	1,15	1,15	1,08	1,06	1,04	1,02	<0,001
Short-term inappropriate admissions	Surgical DRG	4,41	4,68	5,09	5,73	6,15	6,05	6,40	6,32	<0,001
	Medical DRG	1,70	1,36	1,33	1,17	0,97	0,95	0,90	1,55	<0,001
Vaginal Delivery	With complications	23,6	24,1	26,0	25,4	24,4	25,6	26,3	27,6	<0,001
Unspecified surgical procedures		0,83	0,77	0,74	0,76	0,75	0,71	0,69	0,74	<0,001
Medical DRG's complications¹⁾		15,8	17,3	18,4	18,3	17,7	19,6	19,4	20,2	<0,001
Surgical admission time (mean in days)		6,03	5,78	5,55	5,30	5,05	4,98	4,89	4,74	<0,001

Table 4 Variation of overall indicators from 2000 to 2007 (percentages)

¹⁾ Data obtained from the 1% sample

In the indicator exceptional admission episodes it was verified a decrease of 1% in the long-term episodes and na increase of 0,6% in the short-term episodes (Table 4).

When analysing the indicator complication-free long-term admissions, we detect a continuous decrease in the percentage of complication-free admissions within the total of admissions, from 2000 to 2006, and a 0,05% rise from 2006 to 2007.

The general percentage of readmissions was 5,5%, coinciding with the interval referred in other articles (5-29%)^[21-23]. There is also a general tendency of raise (0,6% between 2000 and 2007), which is again verified^[24](Table 4).

By comparing the DRG considered in the first admission and the one that corresponds to the readmission, it is shown to us that the percentage of cases with a different DRG in both episodes was approximately three times higher than this of the cases in which there was the same DRG in both occasions. It

is also verifiable that, considering this period of time, the percentage of readmissions with a different DRG increases in 2,2% and the percentage with coinciding DRG's decreases by the same value (Table 5).

As to the indicator newborn problems, there was an oscillation during the 7 years, although with a total variation of solely 0,02%. The years of 2002 and 2003 showed the highest percentages, and from the period on they have decreased continuously (Table 4).

	Different DRG	Same DRG
2000	76,2	23,8
2001	76,7	23,3
2002	76,2	23,8
2003	76,7	23,3
2004	77,0	23,0
2005	77,6	22,4
2006	78,1	21,9
2007	78,4	21,6

Table 5 Comparison of the first admission and readmission DRG's (percentages)

In the analysis in the period 2000-2007, an oscillation was verified on the percentage of complicated vaginal deliveries, although always around the values of 20-25%. There was even an increase from 2000 to 2006, contrary to what was expected in face of the improvement in healthcare [25](Table 4). As it was predictable, there is also a decrease in the total number of vaginal deliveries [26], but it would be necessary another kind of statistical analysis in order to know up to what point such a decrease may be due to an increase in the rate of caesarean sections, as it happens all around the world [27].

We verified that, within the unspecified surgical procedures made during 2000-2007, there was a decrease of 12,6%. At the same time, the number of specified surgical procedures rose by 3,2%. It must be noticed that the rate of decrease in the unspecified surgical procedures is lower than that of the decrease in the specified surgical procedures.

The general percentage of medical DRG's was 18,4%, but it was observed that it tended to rise, with an effective increase of 4,4% between 2000 and 2007 (Table 4).

The surgical admission time has been decreasing. The tendency is the same when analysing the pre- and post-operative admission times (Table 6).

	2000	2001	2002	2003	2004	2005	2006	2007
Pre-operative admission time	1,50	1,31	1,04	1,03	1,26	1,23	1,21	1,11
Post-operative admission time	4,53	4,47	4,51	4,27	3,79	3,76	3,69	3,63

Table 6 Variation of the mean of pre- and post-operative time (in days) from 2000 to 2007

REGIONS

We'll start with the Discharged Patients indicator. This indicator comprises information relative to types of admission and destination after discharge. We found no relevant differences between regions (Figure 2, Table 7).

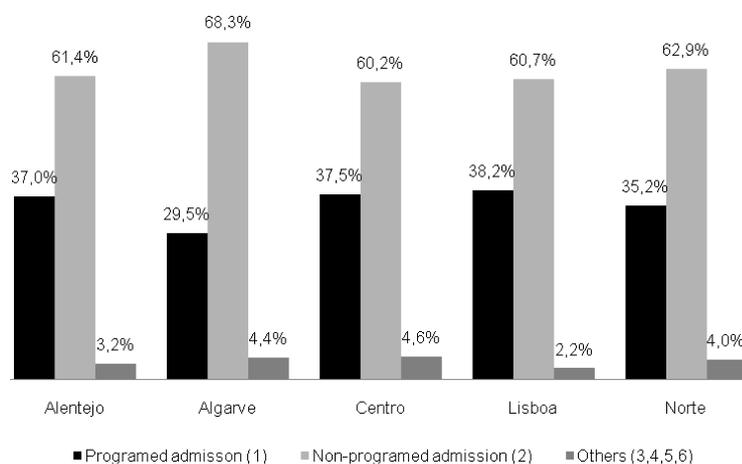


Figure 2 Variation of the type of admission according to Portuguese regions

	Exterior and not referenced (1)	Hospital (SNS) (2)	Left in domiciliary service (6)	Left against medical advice (7)	Deceased (20)
Alentejo	90,6%	3,9%	0,2%	0,6%	4,8%
Algarve	91,1%	3,4%	0,1%	1,0%	4,4%
Centro	92,1%	3,1%	0,5%	0,5%	3,8%
Lisboa	89,2%	4,0%	2,0%	0,6%	4,2%
Norte	92,4%	2,7%	1,0%	0,8%	3,2%

Table 7 Variation of the destination after discharge according to Portuguese regions

In Table 8 we can see the results obtained for every indicator, per region. These results are shown in relative percentages (percentages that take into account the total number of cases for each region). We also show the results of the Pearson Chi-square test we did for every indicator, to signal the fact that the results found were statistically significant.

The colour code works in the following manner: for each indicator, the percentage highlighted with the lighter colour is the one that represents the best situation across country (for example, when it comes to Readmissions, a lower percentage of readmissions indicates a better situation: so, the percentage for the Norte region has the lighter colour).

		Alentejo	Algarve	Centro	Lisboa	Norte	Pearson Chi-Square
Exceptional admission episodes	Short-term episode	16,6	18,3	18,6	21,3	19,8	<0,001
	Long-term exceptional episode	2,06	2,36	1,73	1,94	1,55	
Complication-free long-term admissions¹⁾		0,96	1,44	0,88	0,85	0,81	0,024
Readmissions		5,55	5,70	5,94	5,25	5,17	<0,001
Newborns problems		1,08	1,12	1,45	1,21	1,32	<0,001
Short-term inappropriate admissions	Surgical DRG	3,76	3,94	4,32	5,57	7,17	<0,001
	Medical DRG	1,33	1,63	1,04	1,63	1,06	<0,001
Vaginal Delivery	With complications	13,9	13,4	27,2	27,3	25,9	<0,001
Unspecified surgical procedures		0,96	0,74	0,76	0,84	0,61	<0,001
Medical DRG's complications¹⁾		22,5	15,9	19,0	20,6	16,2	<0,001
Surgical admission time (mean in days)		5,92	6,11	5,67	5,56	4,55	<0,001

Table 8 Variation of overall indicators according to Portuguese regions (percentages)

¹⁾ Data obtained from the 1% sample

When it comes to the Indicator Exceptional Admission Episodes, we consider that having more Short Term Episodes is a better situation than having more Long Term Episodes. We can see that Lisbon has the higher percentage of Short Term Episodes, although it is the third region with the higher percentage of Long Term Episodes. Norte has positive results in both types of episodes.

Algarve and Alentejo have the worst results on this indicator: a high percentage of Long Term Episodes and a low percentage of Short Term Episodes (Table 8).

Moving on to Complication-Free Long-Term Admissions, the region with the highest percentage is Algarve, and the region with better results (the lowest percentage) is Norte.

Analysing the Readmissions percentages, we can see that Centro has the higher value and Norte and Lisbon the lowest values. While talking about this indicator we can also analyse if the reason that lead to the first admission is or not the same that lead to the subsequent readmission, by comparing the DRG's of each admission. Centro is the region in which there is a higher percentage of cases in which patients are readmitted for the same reason of the first admission (Table 9).

	Different DRG	Same DRG
Alentejo	78,8	21,2
Algarve	78,4	21,6
Centro	76,5	23,5
Lisboa	77,2	22,8
Norte	77,1	22,9

Table 9 Comparison of the first admission and readmission DRG's among regions (percentages)

Alentejo is the region with the lowest percentage of Newborn Problems, while Centro has the highest percentage (0,37% higher than Alentejo's) (Table 8). By examining the variation of this indicator throughout the years for each region, we can see that it wasn't very large (less than 0,3% for Algarve, Centro, Lisbon and Norte) and that the percentages are all within the same range [0,8%;1,4%] for the mentioned regions. Alentejo has a different situation: there is a decrease of >0,7% from 2002 to 2007. (Figure 3)

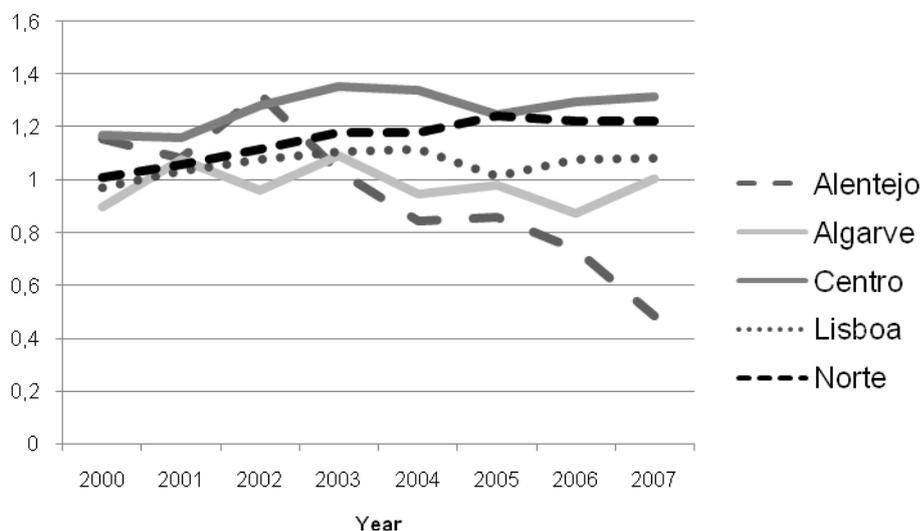


Figure 3 Variation of the newborn problems among regions from 2000 to 2007 (percentages)

Let us consider now the Unspecified Surgical Procedures. Considering the relative percentages of Table 8, Norte is the region with the best situation - the lowest percentage, being that Alentejo has the highest percentage for this indicator (Table 8).

We can observe a higher percentage of Medical DRG's Complications in Alentejo than in any other region; the lowest percentage is observed is Lisbon.

When it comes to the last indicator of our list, Surgical Admission Time (mean in days), we can see that Algarve has the highest values, while Norte is on the other side of the scale (Table 8). The same results were obtained while calculating the mean, in days, of Post-operative Admission Times for each region. The results are different for Pre-operative Admission Times: the highest percentage value is found in Centro (Table 10).

	Alentejo	Algarve	Centro	Lisboa	Norte
Preoperative admission time	1,26	1,27	1,32	1,26	1,07
Postoperative admission time	4,66	4,84	4,36	4,31	3,48

Table 10 Variation of the mean of pre- and post-operative time (in days) among the regions

HYPHOTESSES: Newborns Problems

Analysing the problems that are considered within the indicator “Newborns Problems”, the three most frequent ones are: respiratory distress syndrome, preterm delivery and withdrawal in newborn condition (related to the drugs they may have been exposed to during their in-uterus life).

In “Others” we include complications such as exceptionally large baby, breast engorgement, skin/temperature or feeding problems (Figure 4).

In European countries (and other developed countries), the pre-term birth rate is usually around 5-9%, having risen to 12-13% in the USA in the last decade [28]. Other studies estimate that the preterm birth rates go from 5% (developed countries) to 25% (developing countries). We can see that such rate is, in Portugal, for the years considered, between 4-6%.

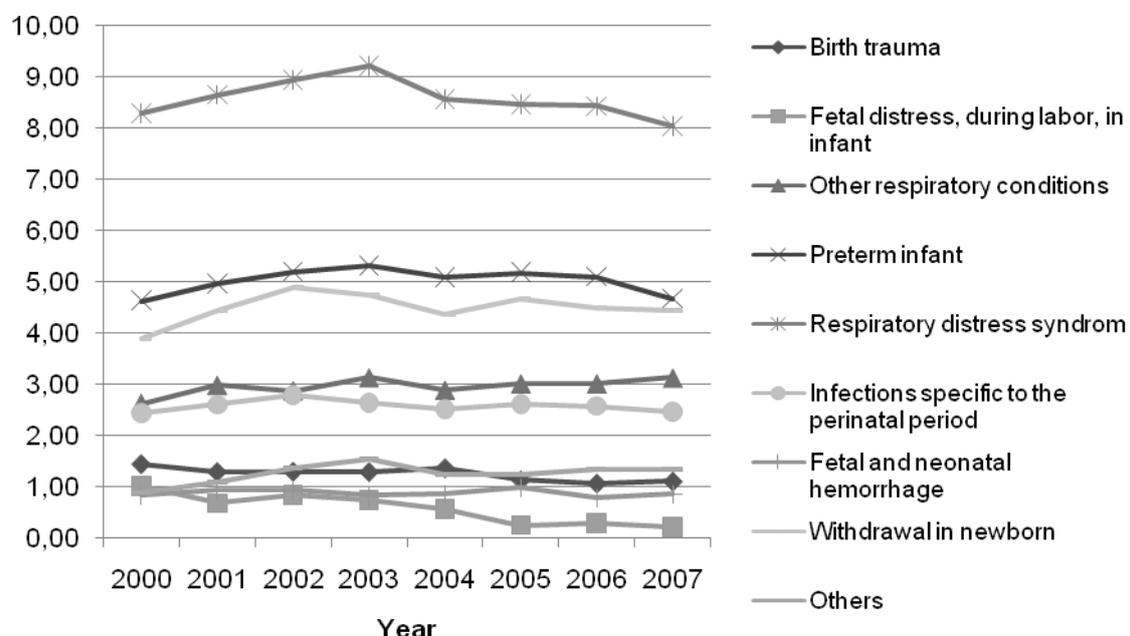


Figure 4 Variation of the newborn problems from 2000 to 2007 (percentages)

HYPOTHESES: Vaginal deliveries may be compromised on weekends

During our research we found evidence of an increase in the number of complications in vaginal deliveries during weekends in the USA [30].

We wanted to see if the relation between the complications and weekends was also found in Portugal. We came to the conclusion that yes, it is also found in Portugal, by performing a Pearson Qui-square test, the Null Hypothesis (Ho) being that there is no association between complications in vaginal deliveries and the fact that such deliveries happen on weekends. The p value we obtained was under 0,05: we can reject Ho, coming to the conclusion that vaginal deliveries are in fact compromised on weekends. (Table 11, Table 12)

		Normal deliveries	Complicated deliveries
Weekdays	Count	297532	99815
	% within day of week	74,9	25,1
Weekend	Count	97257	33864
	% within day of week	74,2	25,8

Table 11 Comparison between the percentages of normal and complicated deliveries on weekdays and weekends

	Value	P-value
Pearson Chi-Square	26,016	<0.001

Table 12 Pearson Chi-square test

HYPOTHESES: The LOS (hospital inpatient's length of stay) may be inversely related to readmission rates

We decided to investigate if there is a relation between short term admissions and readmissions, given evidence that such relation would be a negative cause-effect relation^[31]. We concluded that 1,9% of the readmissions followed a short term admission. The percentage of readmissions in the total of cases is of 5,5%: we can assume that 34% of the readmissions have occurred after a short term admission (Figure 5). Given that the p value obtained in the Pearson Qui-square test is under 0,05, we can conclude that there is, in fact, a relation between short admission episodes and posterior readmissions (Table 13).

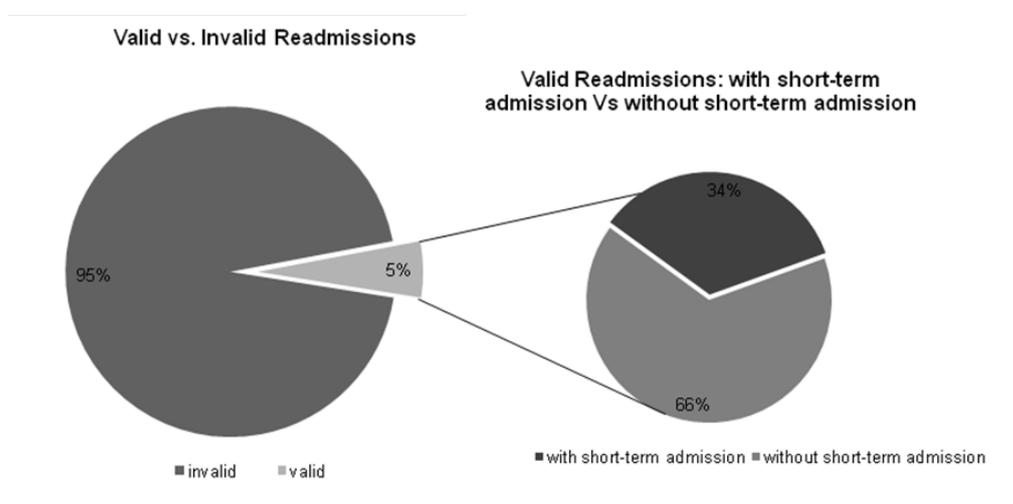


Figure 5 Comparison between the number of readmissions coinciding with short-term admissions and the total number of readmissions

	Value	P-value
Pearson Chi-Square	926,942	<0.001

Table 13 Pearson Chi-square test

HYPOTHESIS: LOS (length of stay) might be increased by Complications during stay.

After finding evidence that complication in medical DRG's are related to long-term admissions^[32-39] we analysed our data to see if we could reach similar conclusions.

The statistical analysis demonstrates that, in 36,5% of the long term admissions, complications occurred (Table 14). If we consider only the long term admissions in the medical DRG's category, that percentage rises to 41,3% (Table 15). Once again, the p value obtained in the Pearson chi-square test is under 0,05, indicating that the results found are statistically significant.

	Long-term exceptional episode
With CC	36,5
Without CC	63,5

Table 14 Percentages of long-term exceptional episodes with and without CC

	Long-term exceptional episode	
Medical DRG	With CC	41,3
	Without CC	58,7

Table 15 Percentages of long-term exceptional episodes in medical DRG's with and without CC

HYPOTHESES: What MDC's (Main Diagnose Categories) present the higher percentages of complications?

The MDC's that show a higher percentage of complications are Diseases and Disorders of the Respiratory System, Myeloproliferative Diseases and Disorders (Poorly Differentiated Neoplasms) and Multiple Significant Trauma. We can see these MDC's as being related to diseases more prone to complications (Table 16).

MDC			MDC		
		%			%
1	Diseases and Disorders of the Nervous System	23,2	14	Diseases and Disorders of Pregnancy, Childbirth and Puerperium	3,07
2	Diseases and Disorders of the Eye	1,21	15	Diseases and Disorders of Newborn and other Neonates (Perinatal Period)	5,54
3	Diseases and Disorders of the Ear, Nose, Mouth and Throat	7,66	16	Diseases and Disorders of Blood and Blood Forming Organs and Immunological Disorders	34,8
4	Diseases and Disorders of the Respiratory System	50,1	17	Myeloproliferative Diseases and Disorders (Poorly Differentiated Neoplasms)	62,9
5	Diseases and Disorders of the Circulatory System	22,3	18	Infectious and Parasitic Diseases and Disorders	37,5
6	Diseases and Disorders of the Digestive System	17,9	19	Mental Diseases and Disorders	7,56
7	Diseases and Disorders of the Hepatobiliary System and Pancreas	27,4	20	Alcohol/Drug Use or Induced Mental Disorders	16,0
8	Diseases and Disorders of the Musculoskeletal System and Connective Tissue	3,71	21	Injuries, Poison and Toxic Effect of Drugs	19,5
9	Diseases and Disorders of the Skin, Subcutaneous Tissue and Breast	9,63	22	Burns	9,27
10	Diseases and Disorders of the Endocrine, Nutritional and Metabolic System	26,6	23	Factors Influencing Health Status	39,9
11	Diseases and Disorders of the Kidney and Urinary Tract	32,8	24	Multiple Significant Trauma	77,0
12	Diseases and Disorders of the Male Reproductive System	8,99	25	Human Immunodeficiency Virus Infection	33,1
13	Diseases and Disorders of the Female Reproductive System	3,66			

Table 16 Percentages of CC in medical DRG's in each MDC

DISCUSSION

On a global overview, we were able to achieve a depiction of the inpatient's healthcare quality, using QI's.

In general, the evolution of the QI's exceptional admission episodes, complication-free long-term admissions, newborns, short-term inappropriate admissions in medical DRG and unspecified surgical procedures was positive over the 7 year period we analysed, in opposite to the QIs short-term inappropriate admissions in surgical DRG, vaginal deliveries with complications and medical DRG's complications.

Concerning the division of the data by NUTSII, the region that shows the best results on the total range of indicators is Norte. A possible explanation for this result would be the greater specialization and technical quality of the hospitals serving the most populated regions of Porto and Lisboa. However, such positive results are not found in the later. In fact, one of the least populated regions – Alentejo – as far better results.

Bearing in mind the indicator exceptional admission episodes, it is in fact possible to observe that the length of stay (LOS) of patients in hospitals has come to a decrease in our country, as well as in all the countries of OECD. These finding may be explainable by the financing systems that encourage length of stay reduction, reduction of the number of beds, shortening of personnel and reductions in admissions caused by bed shortages^[4]. Despite all this, complications such as the development of thromboembolic disease or the development of hospital acquired infections are said to increase with longer stay. Also, both relatives and patients may gain a great deal of pleasure from early discharge^[40].

Concerning the indicator complication-free long-term admissions, the existence of CC's may justify a length of stay longer than expected, but when these complications do not exist it is considered an abnormal situation due to medical or economical reasons such as prolonging the admission time in a few more days to enlarge the financing provided to the hospital for that same admission, errors in data encoding^[41] or admission, on Fridays, of patients that will undergo medical/surgical procedures only on the following Monday. On the other hand it can also mean family/social support issues of the patients, whose length of stay is extended by the delay of their families, which is not related to the quality of the healthcare provided.

Readmissions are one of the areas in which is possible to reduce costs^[42]. As a quality indicator they are quite significant, for they allow us to reflect on the impact caused by hospital care on the patients' health after being released. However, the analysis of readmissions as a solid and reliable health indicator is questioned by a few authors that speak of the complexity of the factors that can influence the treatment procedures and readmissions that take place on a short period of time, concluding the impossibility of assuring, with full confidence, that these readmissions can be valid as a quality indicator^[43]. Therefore, there are several authors that defend the study of potentially avoidable readmissions, which seem to offer better statistical relations^[44].

Taking in account the fact that readmissions lead to an increase of Health costs – Medicare described that, in the year of 2004, \$17.4 billion were spent^[42] – it is necessary the reduction of these same rates of non-programmed readmissions (and potentially avoidable ones). There are many suggestions of strategies to do so, such as a better collaboration between different hospital services^[45] or a previous planning of the patients' release date^[46].

In our study, the possible cause-effect relation between short-term episodes and readmissions is statistically significant ($p < 0,05$) and there are even a few investigators that mention the increase of readmission rates with the decrease in the length of stay^[31, 47, 48]. Nevertheless, other studies show that readmission rates remain unaffected, despite shorter lengths of stay^[49].

There is a wide variety of records concerning problems that appear in newborns and that they can experience during the perinatal period. Each has a meaning and can be molded in order to be more reliable to the domains they qualify. For instance, the variable “birth trauma” excludes any trauma that may have occurred before the pregnancy has come to term, since they are not as predictable and preventable as any other trauma that occurs during or after the baby’s delivery. This selection takes place, so that the documentation of these problems can, with greater reliability, portray the quality of the delivered healthcare^[50]. On the other hand, the variable “low birth weight” (birth weight <2500gr) cannot be used exclusively to qualify the establishment where the delivery takes place and where the post-delivery care is performed, but also to qualify the measures followed by the outpatient and other healthcare services in that region – ultimately, it qualifies the region^[51].

Respiratory distress syndrome (RDS) is the most common cause of respiratory failure and RDS mortality rate and percentage of complications still remain high in developing countries – as we verified in our study –, when in comparison to already developed countries^[52]. The following parameters were found to increase the risk for RDS: no prenatal steroid treatment, Cesarean section, male gender, metabolic acidosis and rectal temperature < 36 degrees C on admission. As such, although some risk factors for RDS will be difficult to exclude (e.g. maternal disease, gender), the incidence and severity of RDS can be reduced by measures such as maternal antenatal steroid treatment, which depends on the treatment offered by each hospital^[53].

Considering the high percentage of preterm babies, it is noticeable that the rate has failed to improve. In fact, it has increased over the last 20 years^[54]. A number of factors have been linked to a higher risk of premature birth: low socio-economic or educational standing and single motherhood, as well as age at the upper and lower end of the reproductive years be it more than 35^[55] or less than 18 years of age, multiple pregnancies^[56], infections^[57], stress, irritable uterus, lack of prenatal care, drinking, smoking, illegal drug use, etc^[58]. However this increase is also related to the tremendous strides made by neonatologists and the resulting increased willingness of obstetricians to deliver preterm babies from hostile intrauterine environments^[54]. That is why premature deliveries are not always a sign of something going wrong, but often a precaution to avoid a problematic gestation.

Nonetheless, on a more general view, the low and stable rates of the problems analyzed individually and as a whole are probably a result of the success of Programa Nacional de Saúde Materna e Neonatal established more than a decade ago, in 1989, and which allowed, among other measures, the requalification of the perinatal emergency services (facilities, human resources, equipments) – qualitative – and the attempt to grant an even access to healthcare on a national level – equality among regions^[59].

In this indicator, Alentejo presents the lowest rate of problems, which may be due to the discrepancy of the region's particular features, that reflects on a lower activity and, hereby, fewer problems. Some of these features are: the population decrease; the decline of fertility and the high level of aging; the existence of several mono-parental old families^[60].

It is obviously desirable that vaginal deliveries without complications or comorbidities resent a higher percentage in comparison with the complicated ones^[61]. This was a tendency that we were able to verify on the sample we analyzed.

It is important to bear in mind that, whichever way, factors such as the quality of obstetric emergency and the availability to perform deliveries in proper conditions lead to a lower mortality/morbidity rate in deliveries^[62].

In what concerns the analysis about weekends, statistically significant differences were found. It was observed a higher number of complicated deliveries on Saturdays and Sundays which means that hospitals should, in fact, work towards increasing the robustness of safeguards on weekends^[30].

Taking in account that the indicator unspecified surgical procedures is influenced by episodes that were incorrectly encoded, it is expected that, in the future, the rate of encoding errors keeps decreasing, since there is a growing training of health professionals in the area of bioinformatics, concerning data bases and medical records.

Complications in medical DRGs are, among other aspects of hospital management, a quite significant quality indicator, since it allows us to assess the impact of healthcare on the patients health and on the management of hospital resources^[63]. However, the complexity of the factors^[32] that have implications on the patients' treatment and the evolution of their pathologies prevents us from assuring, with certainty, that the presence of complications is a valid parameter to evaluate health care quality. For instance, the complications may be a consequence of the kind of pathology (MDCs) the patient suffers from in the first place^[33, 64-66].

Taking in account the constant evolution of technologies and pharmaceutical industries all over the years, along with the discovery of new therapeutic approaches and the perfecting of the auxiliary methods of diagnoses, we would find it logical to expect a decrease in the number of cases of medical DRGs with complications. That is why the increase in those numbers between 2000 and 2007 stands out in our analysis, opposing itself to the initial hypotheses.

The tendency for Alentejo to present the lowest levels of complications and Lisboa the highest are also slightly surprising, considering the same motives mentioned above. Such results may have their origin in the population growth on the different regions of the country that, as time goes by, are becoming more affected by the multiple diseases of the society of prosperity and environmental

degradation – neuronal problems and avoidable accidents^[63, 64] due to constant stress, cardiovascular diseases caused by nutritional errors^[67], respiratory diseases and cancer due to toxic substances and the polluted environment^[68-70], among others –, outrunning the capacity of the restricted numbers of hospitals and healthcare centers that lack conditions, human resources and funds^[35].

The cause-effect relation between long-term episodes and complications in medical DRG^[32-39] is of Great relevance, because, in case the long term admissions were caused by the occurrence of complications^[35], they become somewhat justified, showing a greater efficiency in the management of patients' admission times^[36]. For this relation we also found statistically significant results in our study.

Considering that complications usually lead to a longer length of stay, resulting on a bigger consumption of resources and, therefore, an increase in Health costs^[34,35, 38], it is clearly necessary to reduce these episodes with complications, through a variety of strategies. Some of those strategies include a more cautious monitoring of the patients^[36] and a more efficient use of the auxiliary methods of diagnoses by health professionals or, on a wider level, the creation of more healthcare facilities with adequate conditions and an increased training of competent healthcare professionals along with a enhanced collaboration between different hospital services^[71].

Postoperative admission time is very dependent on the type of surgery, and it can only be reduced till a limit from which there might be negative consequences to the patient. Preoperative admission time can be reduced as much as possible since every necessary exam for the surgery is already done, so that the patient only stays the minimum necessary time hospitalized before the surgery. Preoperative admission time has a great impact on evaluation of health facilities because it's inappropriate use affects hospitals' efficiency^[73].

However it's hard to establish a relation between effectiveness/quality of care and a longer or shorter surgical admission time^[74]. The registered decrease of surgical admission time mean seems to be a good indicator of quality and effectiveness of Portuguese hospitals, since this is a way to reduce costs^[75]. The money saved can then be used to invest in other patients or to improve hospital quality.

CONCLUSIONS

In a global perspective, one can say that most of the indicators studied in Portuguese public hospitals from 2000 to 2007 have had a positive evolution. As exceptions, we should refer readmissions, vaginal deliveries with complications, short inappropriate admissions in surgical DRG's and medical DRG's complications.

When analysing the various regions (namely Alentejo, Algarve, Centro, Lisboa e Norte), it should be noticed that Norte is the region in which percentages are the most positive, when considering the whole of the indicators.

Even though it may be difficult to make studies like this one, not only in terms of the analysis needed but also because of the various interpretations the very same result may have, the results given prove that it is imperative to have more work done on this field. Consequently, the main conclusion one should get from the effort done throughout this study is that it is worthy, by contributing to a wider view of the healthcare system in a country and to know how it can be improved.

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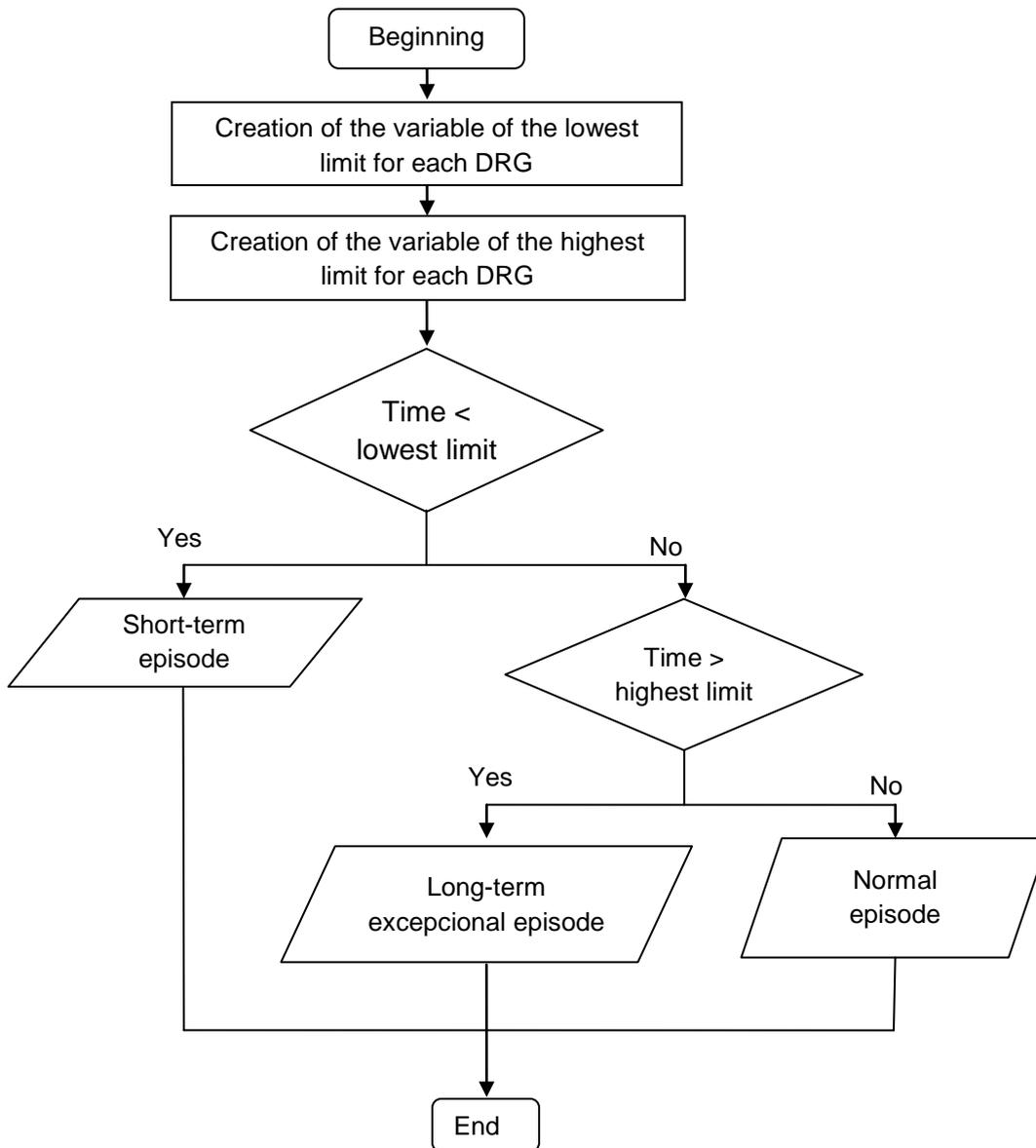
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ATTACHMENT 1

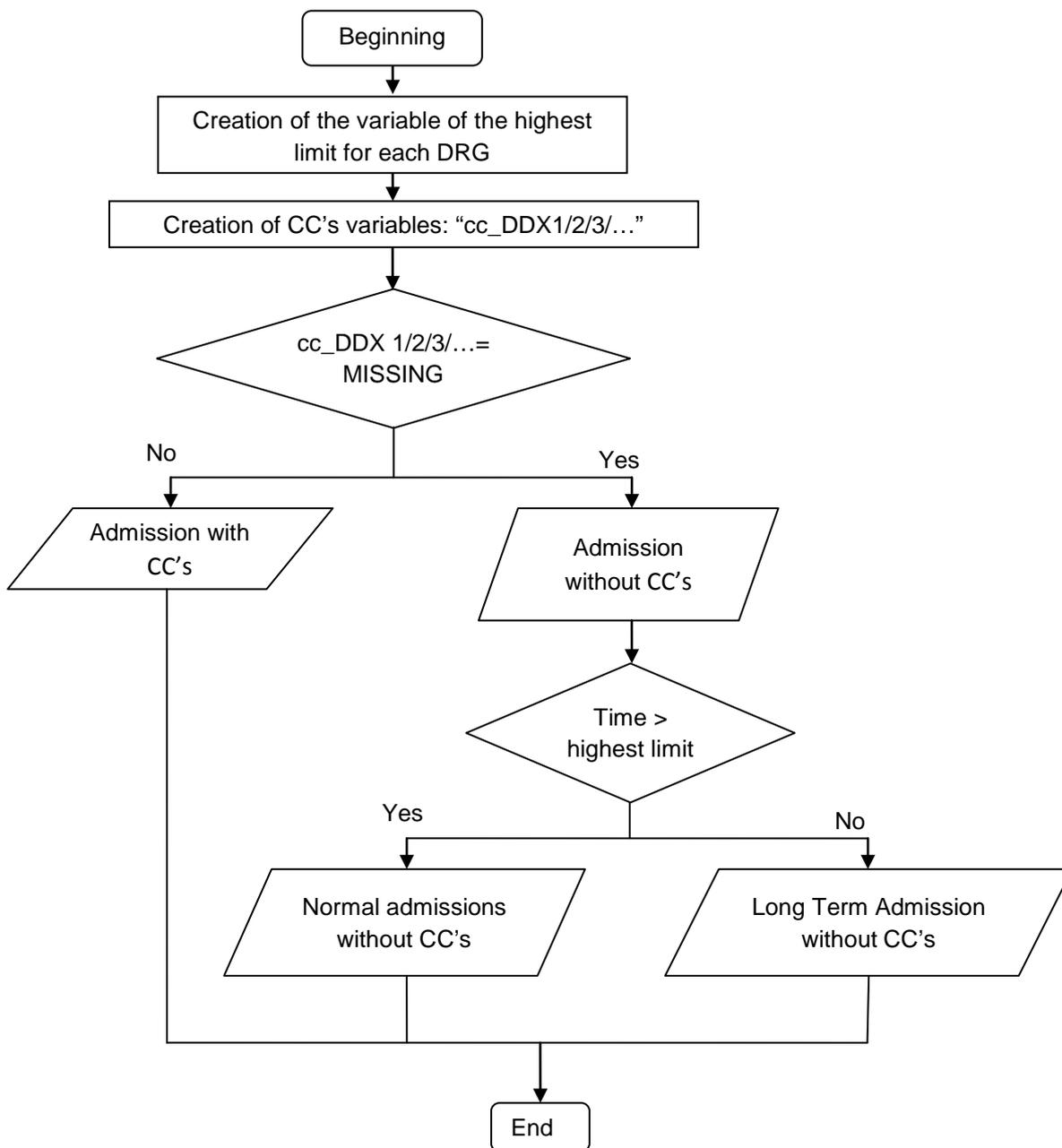
Exceptional Admission Episodes

In this indicator the limits taken into account were those defined in *Tabela Nacional de GDHs*, in which column J includes the lowest limit and column L includes the highest limit for each indicator, as presented in *Portaria nº 110-A/2007* from 23rd of January^[24].



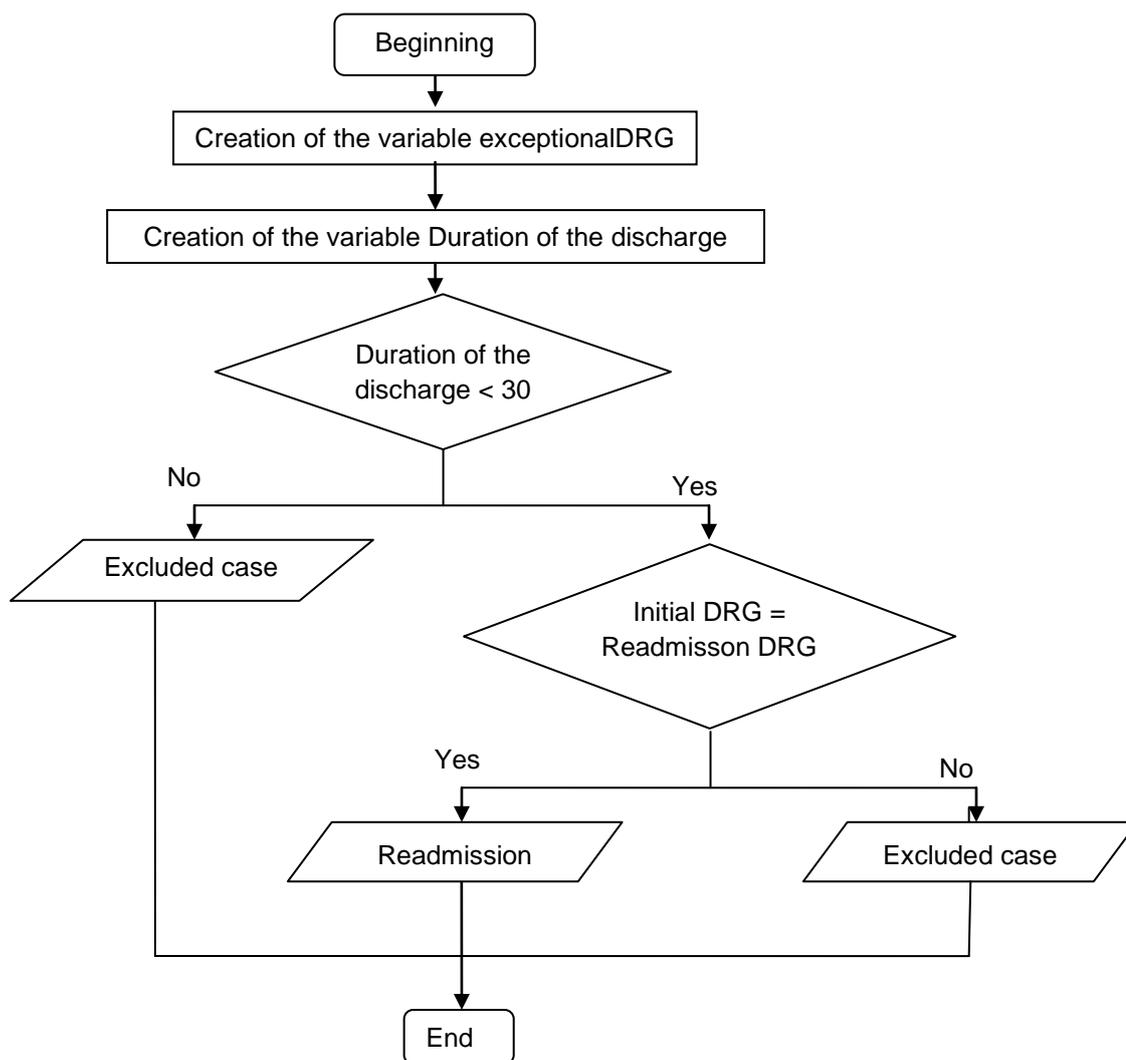
Complication-free long-term admissions

For Complication-free long-term admissions, the limit defined in *Tabela Nacional de GDHs* was taken into account, namely column L, which includes the highest limit for each indicator, as presented in *Portaria nº 110-A/2007* from 23rd of January^[24].



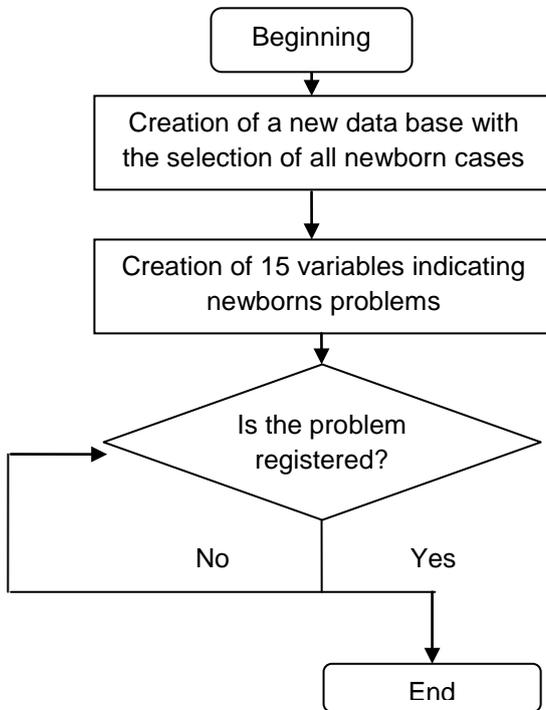
Readmissions

This indicator was analysed according to the definition present in *ofício 15299 de 7/12/1999* from IGIF (Instituto de Gestão Informática e Financeira da Saúde) and the objectives to count the number of readmissions. This can be done with different criteria: period of time of 5 days or less or of 30 days or less after the release date, except when the second episode refers to some DRG's (249, 317, 409, 410, 465, 466 and 492).

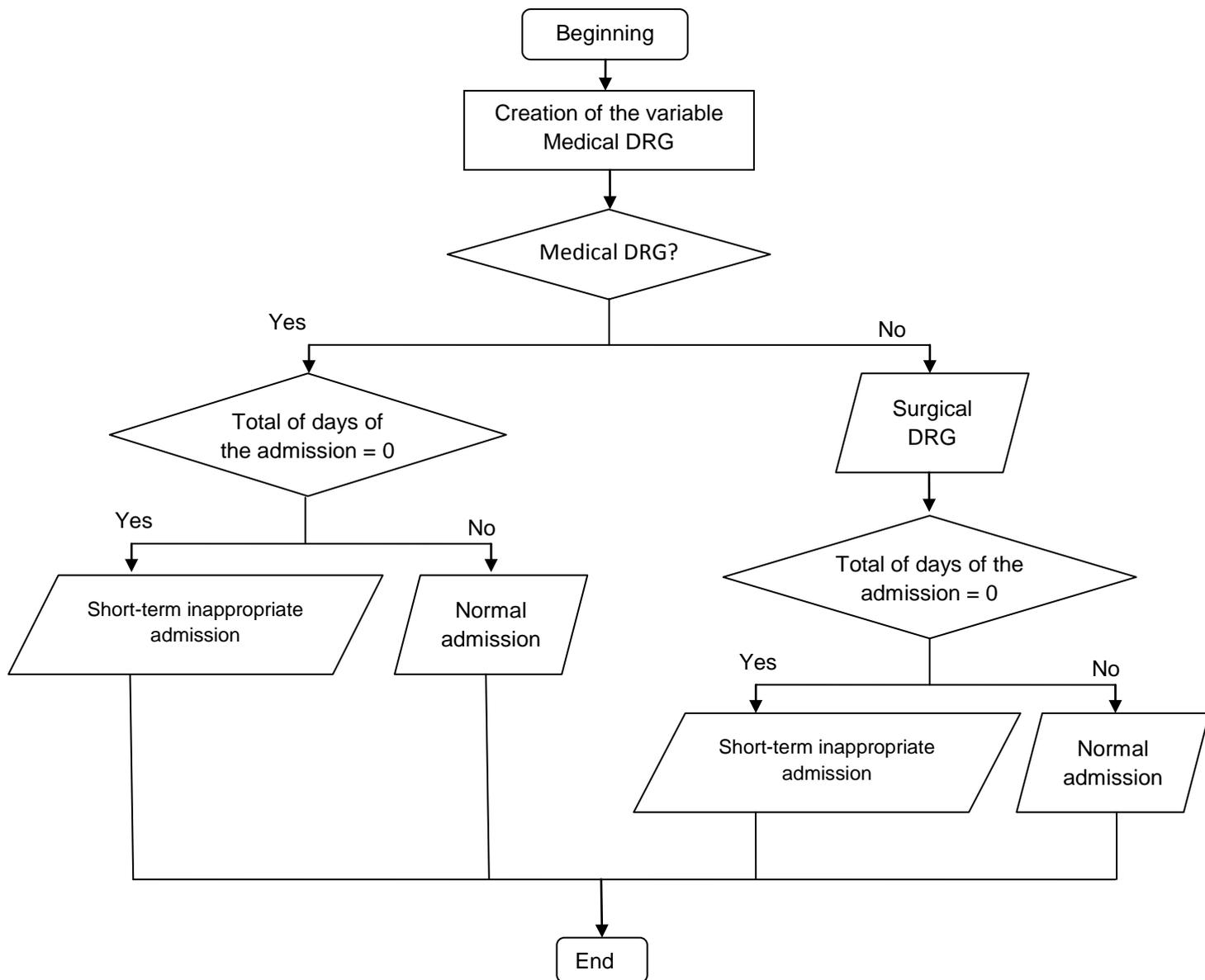


Newborns

We have used the DRG's linked to newborns with multiple severe problems, non-severe problems or others, or deaths after 1 day, as well as the *ICD-9-MC*, allowing us to work with newborns that had had problems during their birth itself^[27].

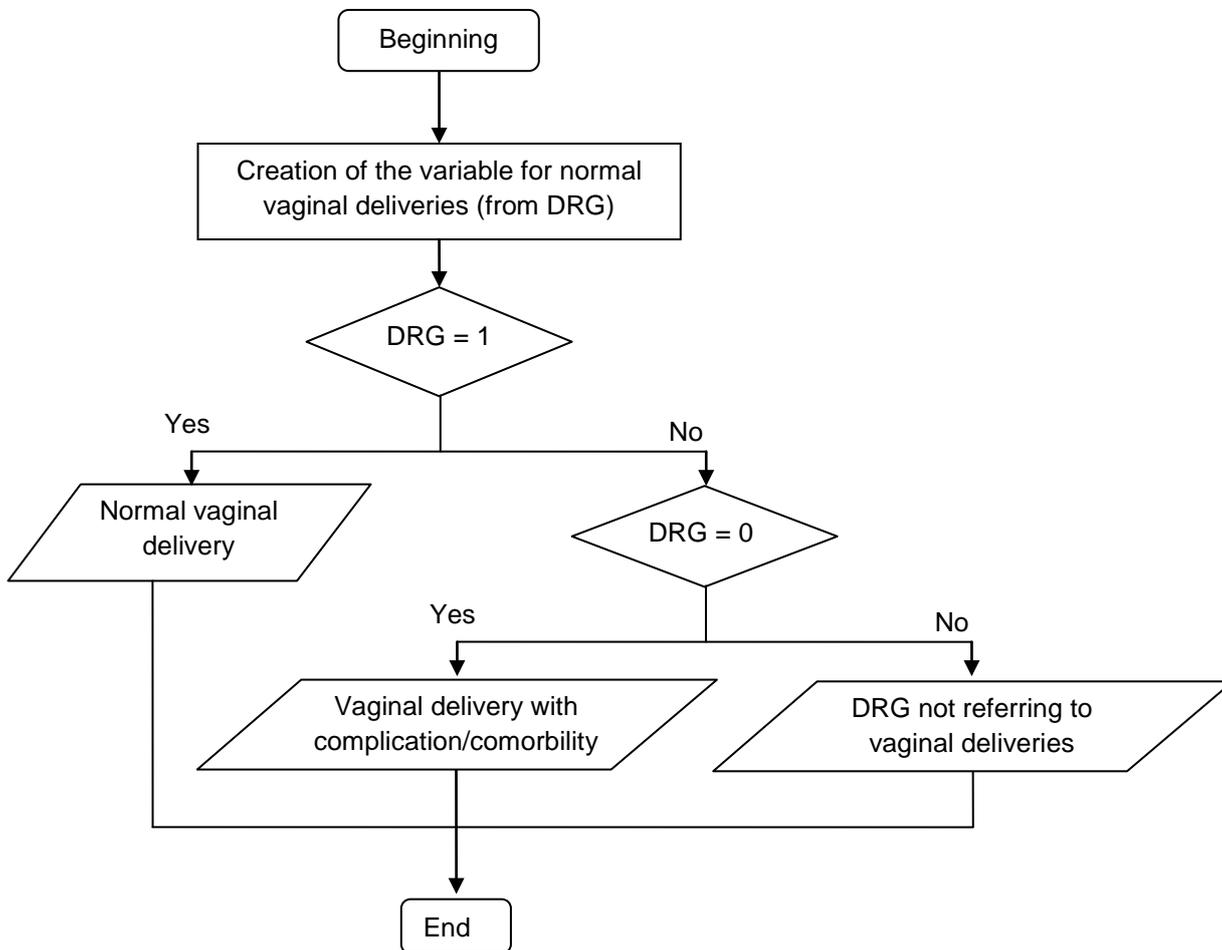


Short-term inappropriate admissions



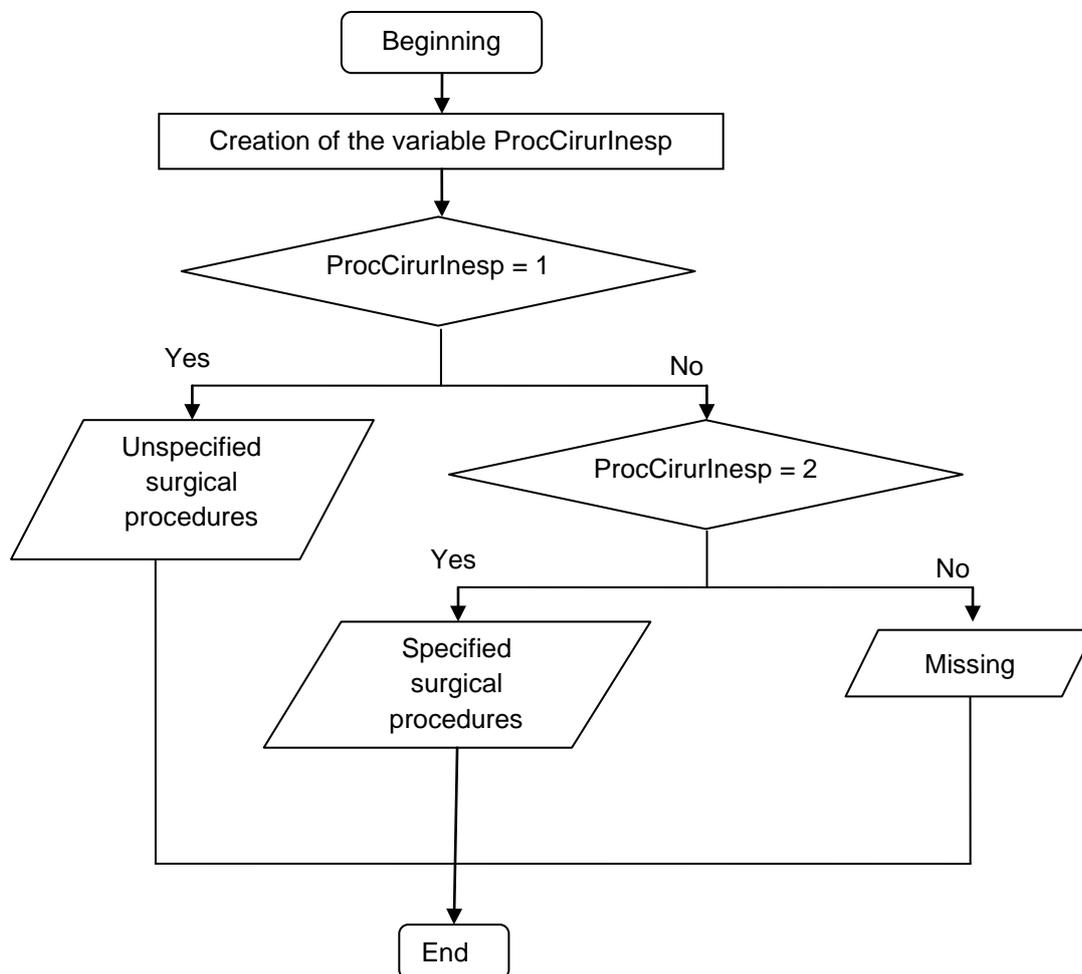
Vaginal Deliveries

When analysing the indicator Vaginal Deliveries, those were divided into normal and complicated deliveries, according to the GDH's with the codes 372 to 375 and also 652^[24]. It was distinguished, too, if there had been the use of epidural, in relation to the SRG's 0390 and 0391.



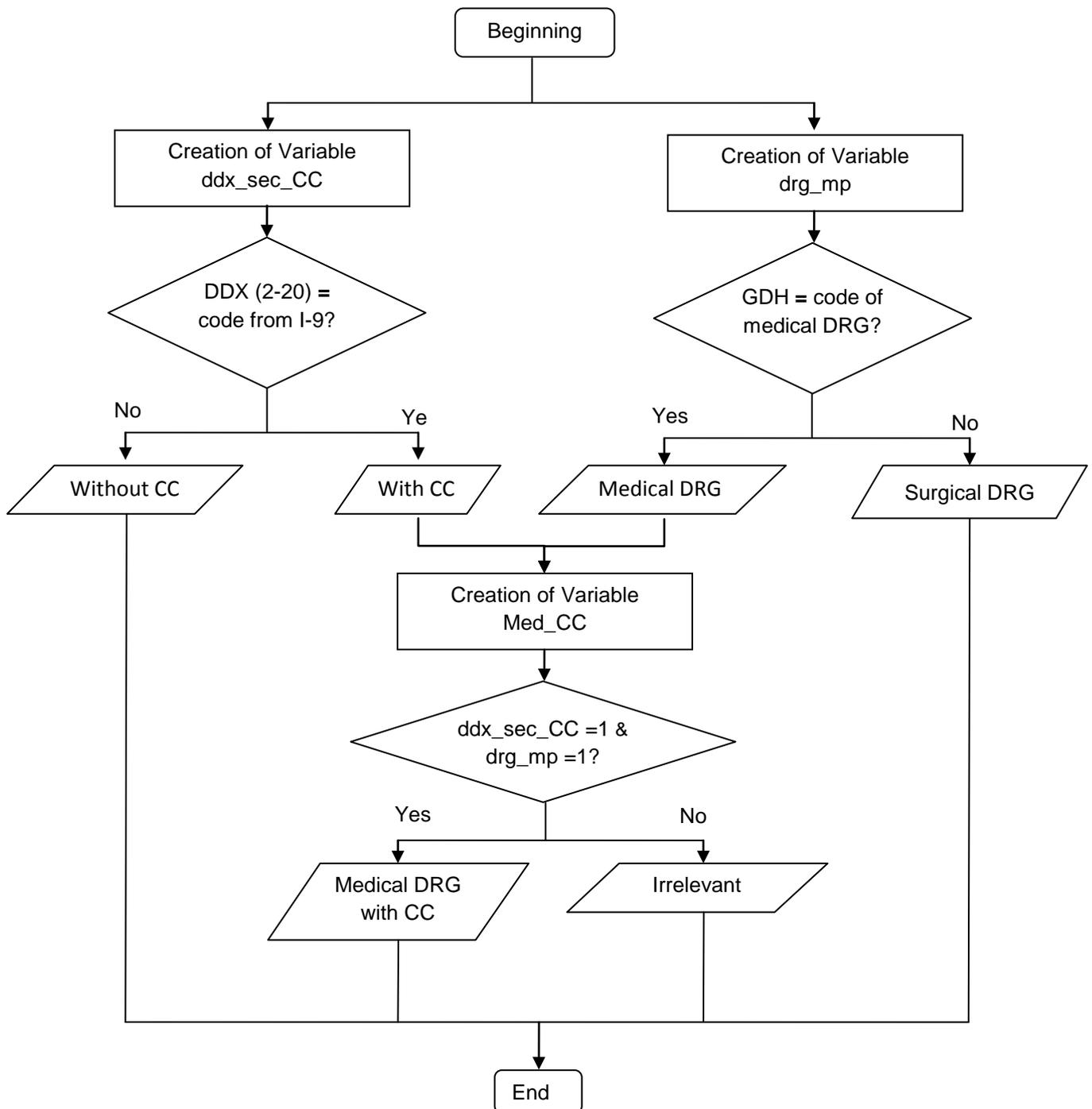
Unspecified Surgical Procedures

We have used the codes mentioned in the book All Patient Diagnosis Related Groups (AP-DRGs) Version 21.0 Definitions Manual^[28].



Medical DRG's complications

We crossed the codes corresponding to complications or comorbidities, present in the 2008 list from ICD-9, with the codes from the variables referring to secondary diagnoses.



Surgical admission time

