

The impact of the economic recession on hospital quality indicators in Tocantins

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Abstract—Introduction: Indicators refer to measures used to portray an existing situation, analyze changes or trends over a period of time and evaluate, in terms of quality and quantity, the health behaviors performed. Objective: To verify whether the recession in the Brazilian economy experienced from 2012 to 2018 generated changes in the in-hospital quality indicators of the state of Tocantins. Materials and Methods: This is a retrospective documentary study with data with patients admitted to the main public hospitals of Tocantins, located in the municipalities of Palmas, Araguaína and Gurupi from 2012 to 2018, available from the SUS Department of Informatics (DATASUS), correlating health indicators with financial indicators taken from the Brazilian Institute of Geography and Statistics (IBGE) and the National Confederation of Industry (CNI) in relation to the variation in Gross Domestic Product (GDP) and the unemployment rate at national level. Results: About the correlation, it was evidenced in the GDP with the unemployment rate, mortality rate and average cost per hospitalization. The unemployment rate correlated significantly with the mortality rate and length of stay. Conclusion: The scenarios presented during the years analyzed, regarding health-economic development, show the impact generated by the negative performance of Brazil's gross domestic product in the state of Tocantins.

Keywords—Economic recession, Public health, Intensive care unit, Tertiary healthcare.

I. INTRODUCTION

Indicators are indispensable assessment instruments when talking about health care quality control [1]. Indicators portray existing situations, analyze changes or trends over a period of time and evaluate, in terms of quality and quantity, the health behaviors performed [2]. When well specific they help to monitor the quality of health care, opportunities for improvement, implement measures, monitor their evolution over the years and are applied to assist in quality management [3] [4].

Regarding, the effectiveness, effectiveness, efficiency, optimization, acceptability, legitimacy and equity became known as the "seven pillars" encompassed by Donabedian. These concepts helped to better

understand about quality in health [5].

According to the National Health Surveillance Agency (ANVISA), in Brazil, Normative Instruction (IN) number 4, of February 24, 2010, which regulates the evaluation of the performance of the overall operating pattern of the Intensive Care Unit (ICU) and identifies the events that may point to the need to improve the quality of care, highlighting specific indicators that should be monitored monthly as absolute and estimated mortality rate; length of stay in the ICU and rehospitalization index in 24 hours [6].

When it is tertiary care, the ICU is actually a system of high complexity to the user, due to the need for care with more advanced technology, and because it presents one of

the scenarios of greater complexity in care. In this context, this level of attention generated an expenditure of 24 billion between May 2011 and April 2016 in Brazil. In the same period, spending reached 325 million in Tocantins [7].

The recent financial recession of the Brazilian economy has led the country to the largest and longest fall in GDP in history and high unemployment rates [8]. Some of the causes of decline in the Brazilian economy are Inflation, Unemployment, Corruption and the lack of effective fiscal adjustment measures [9]. In these moments of economic crisis, there is a limitation in the availability of resources and an increase in demand for public services when it comes to public health [10].

The economy was negative with 3,8% in 2015 and 3,6% in 2016, leaving recession only in subsequent years. According to the National Confederation of Industry (CNI), the deepening of the economic crisis led to the loss of the standard of living of a significant part of the Brazilian population, resulting in the exchange of private services by audiences and 34% no longer had health insurance [11].

According to the Department of Informatics of the Unified Health System (DATASUS), when analyzing the indicators of the three largest municipalities (Palmas, Araguaína and Gurupi) it is notorious that the mortality rate from 2012 to 2018 presented variations, however, with high index in 2016, reaching 4,64%. In the following years, the number of deaths decreased to 4,34% in 2017 and 4,25% in 2018, but increased the average stay 6,3 and 6,5 days, respectively, compared to 2013, with 5,1 days [12].

In the last 07 years, the average cost per hospitalization has varied between 2012 and 2018. During the years 2015 and 2016, there was a sudden increase in public spending and the average cost of hospitalization or daily for hospitalization peaked at 1.280,31 reais in 2016, with a reduction in the following years [12]. The same period, according to data from the Brazilian Institute of Geography and Statistics (IBGE) in which the country experienced the economic recession, leading to the decline in Gross Domestic Product (GDP) for two consecutive years [13].

As GDP was moving into recession, the rate of hospitalization in public hospitals increased, reaching 58.413 cases of hospitalizations in 2012 and 2014 with 57.954 cases the highest recorded between the period analyzed [12].

Therefore, this study aimed to analyze whether the recession in the Brazilian economy impacted the indicators

of in-hospital quality in the State of Tocantins.

II. MATERIALS AND METHODS

This is a retrospective documentary study using the official data of the Government of the State of Tocantins DATASUS, with information on mortality rate, average length of stay of hospitalization, average cost per hospitalization, total public expenditure and index patients hospitalized in the main public hospitals of the State of Tocantins, located in the municipality of Palmas, Araguaína and Gurupi.

The period analyzed comprises the years between 2012 and 2018. Correlated in a qualitative and quantitative manner with data from the Brazilian Institute of Geography and Statistics (IBGE) and the National Confederation of Industry (CNI) regarding the variation in GDP and the unemployment rate at the national level, in the same time-space.

The inclusion criteria adopted were data from patients admitted to public hospitals in the state of Tocantins from 2012 to 2018. And patients with incomplete or undefined data are excluded.

The present study dispenses with the approval of the Research Ethics Committee, due to being public government data, made available by the Department of Informatics of SUS (DATASUS) and ministry of health.

After data collection and selection of quality and financial indicators to compose the sample, univariate statistics were used to perform descriptive analysis of indicators and variations of them during the analyzed period, with presentation of the minimum, maximum, mean, and standard deviation values. Pearson's correlation was used to verify the relationship between financial indicators and quality indicators. To identify the significance level of each variable, the Student T-test was used, and the percentage was established in all cases of 5% ($P \leq 0,05$).

Data tabulation, correlation, significance test, and graphs were performed from the tabulation in Microsoft Excel[®] 2010 and with the IBM SPSS Statistics 22[®] 2013 Program.

III. RESULTS AND DISCUSSION

In this stage, the data collected from the seven indicators are exposed, five of these, are qualitative and two financial, as can be observed in Table 1 that presents descriptive analysis of variables with minimum, maximum, mean and standard deviation. Since for financial variables, the national unemployment rate has, between the years analyzed, a higher rate of 12,73% and less than 6,83%. For annual GDP, the maximum was 3,00%, and a minimum of

-3,80%.

For the quality variables related to the State of Tocantins, the mortality rate presented a maximum value of 4,64% and a minimum of 3,87%. In the hospitalization index, the maximum number of patients admitted to the units was 58.413 and a minimum of 42.715 cases, with the

mean stay of maximum hospitalization verified of 6.50 days and a minimum of 5,10, presenting in public expenses an average cost per hospitalization between R\$ 1.097,46 to R\$ 1.280,31. Regarding total public expenditure, the highest amount was R\$ 65.940.003,84 and the lowest value found was R\$ 51.190.309,98. According to table 1.

Table 1. Valores absolutos dos indicadores financeiros e indicadores de qualidade no período de 2012 a 2018.

| Variables | Mínimum | Máximum | Average | Standard Deviation |
|-------------------------------------------|---------------|---------------|---------------|--------------------|
| Unemployment Rate | 6,83 | 12,73 | 9,47 | 2,59 |
| GDP | -3,8 | 3 | 0,02 | 2,66 |
| Mortality Rate | 3,87 | 4,64 | 4,23 | 0,26 |
| Average length of stay of hospitalization | 5,1 | 6,5 | 5,77 | 0,57 |
| Average cost per hospitalization | 1.097,46 | 1280,31 | 1.188,34 | 64,77 |
| Total public spending | 51.190.309,98 | 65.940.003,84 | 62.195.264,93 | 5.217.185,70 |
| Hospitalization Index | 42.715 | 58.413 | 52.512,14 | 5.737,96 |

Figure 1 shows a variation in the country's GDP and Unemployment Rate between 2012 and 2018. In 2012, GDP showed 1.9% in 2013 its highest value, with 3% variation, with a reduced unemployment rate in the same time period analyzed in the period of 2014, GDP fell, with 0,5% without having repercussions on the unemployment due to the indicator presenting the lowest variation found in this study, of 6,83% respectively.

In the following two years, 2015 and 2016, GDP was negative with -3,8% and -3,6%, respectively. And in 2017 and 2018, GDP was stagnant at 1,1%. However, as of 2015, the unemployment rate showed higher values with a maximum of 12.73% in 2017, with a slight reduction in 2018 (Figure 1). The increase in the proportion of unemployed people is a reflection of the economic crisis that began in 2015 and reflected in the following years.

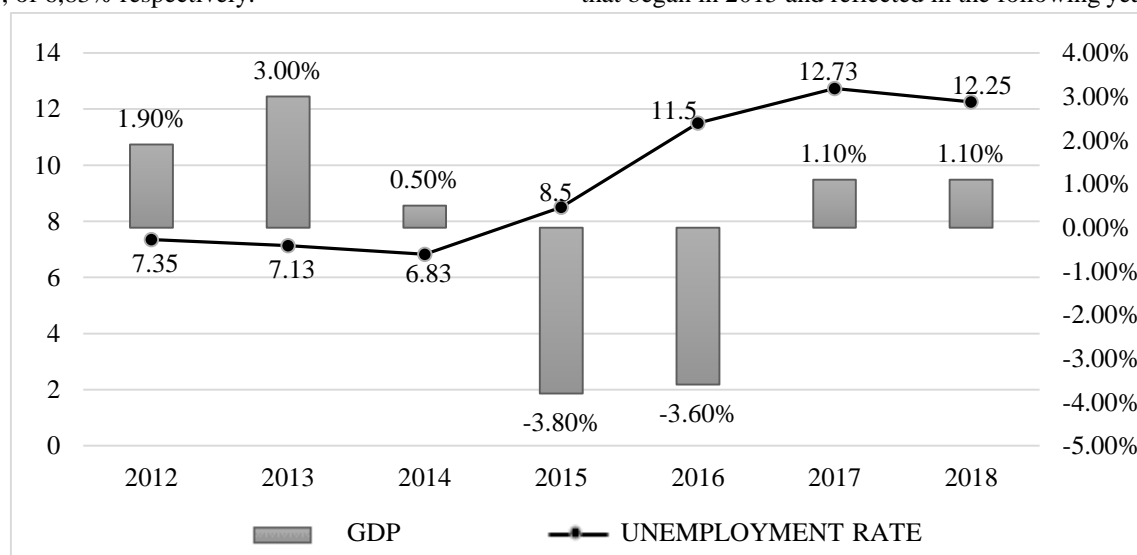


Fig.1. GDP and the Brazilian Unemployment Rate between 2012 and 2018.

Figure 2 shows the evolution of the mortality rate and the average length of stay of hospitalization between 2012 and 2018. Between 2012 and 2014, there was a reduction in the average length of stay in hospital in hospitals in the State of Tocantins, with a slight increase in

the mortality rate. After 2015, the average length of stay of hospitalization increased, and the mortality rate varied in the scale of 4% with the highest rate in 2016, and with a slight reduction in the following years.

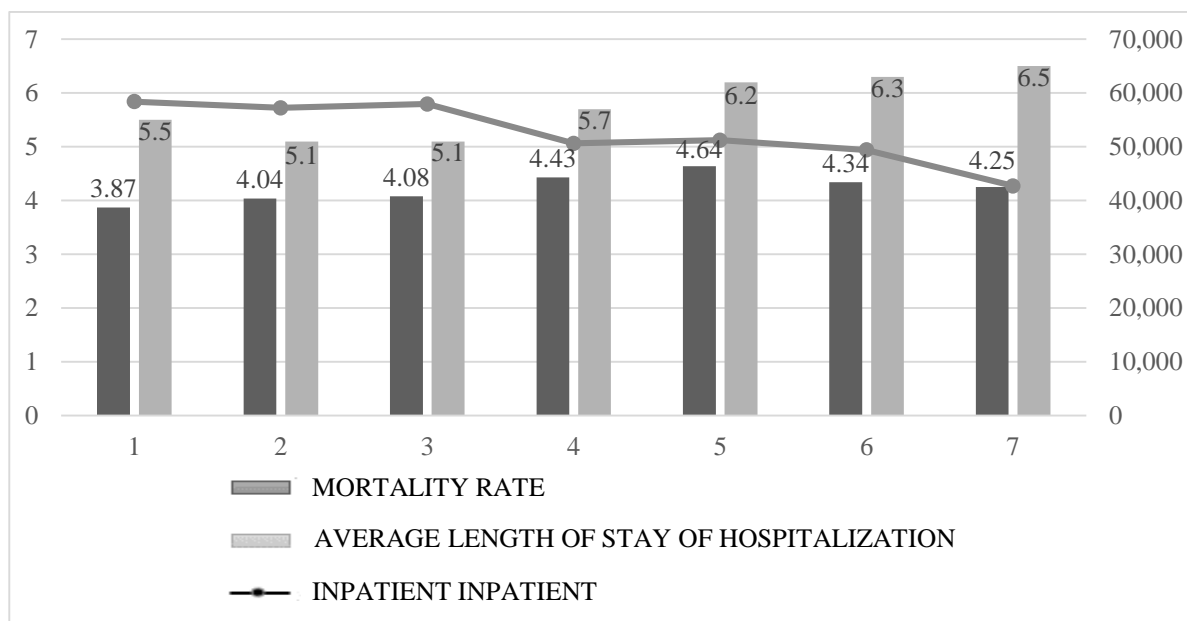


Fig.2. Evolution of mortality rate, Average Length of Stay of Hospitalization and Hospitalization Index between 2012 and 2018.

Between 2012 and 2014, the highest Hospitalization Index was verified in the main public hospitals in the state. After 2015, there was a decrease, followed by a slight increasing variation in 2016, a reduction in 2017, and in 2018 the lowest value of the series was recorded, with 42.715 cases of hospitalization. As shown in figure 2.

As observed in Figure 3, total public health spending in

the State of Tocantins showed increasing values between 2012 and 2014, with 65 million in 2014, followed by a reduction in 2015, an increase in 2016 and a fall in 2017 and 2018, followed by a reduction in 2015, an increase in 2016 and a fall in 2017 and 2018, being recorded the lowest value in the last year of analysis, with 51 million.

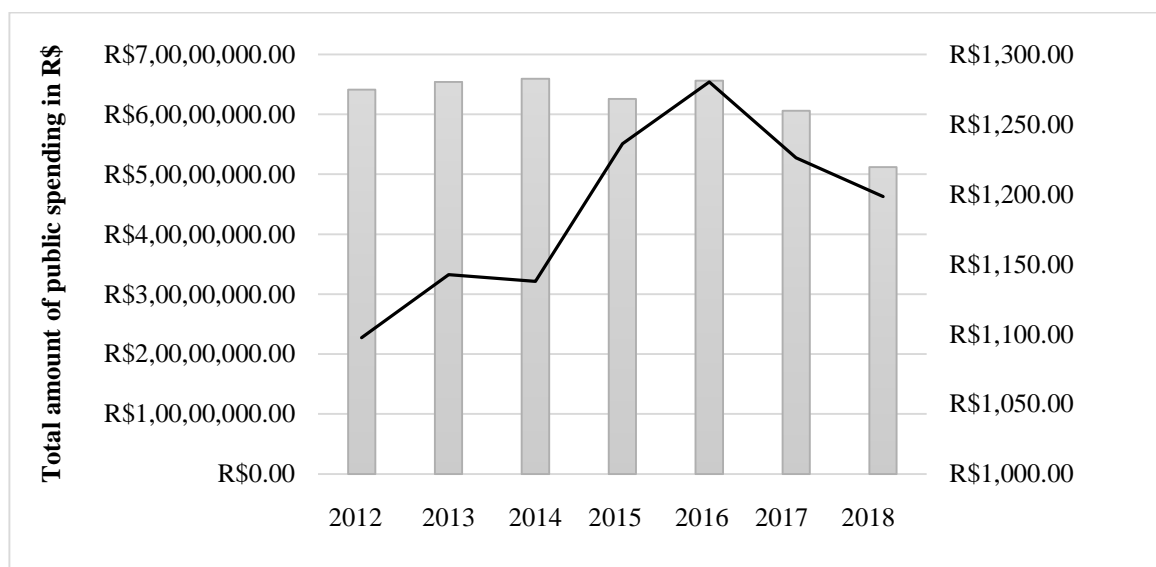


Fig.3. Evolution of average Cost for Hospitalization and Total Public Expenditure between 2012 and 2018.

On the other hand, the average cost per hospitalization, the years 2012 to 2014 were the ones that presented the lowest values for this indicator. After 2015, there was an increase in cost, with its maximum value

verified in 2016, and showing a drop in 2017 and 2018. That is, compared to total public expenditure, the two indicators coincide only in the last three periods analyzed. As figure 3.

Table 2. Correlation between financial indicators (GDP and Unemployment Rate) and quality indicators.

| | Unemployment Rate | Mortality Rate | Average length of stay | Average cost per hospitalization | Total Public Spending | Hospitalization Index | GDP |
|----------------------------------|-------------------|----------------|------------------------|----------------------------------|-----------------------|-----------------------|--------|
| Unemployment Rate | 1 | 0,654 | 0,964** | 0,719 | -0,625 | -0,852* | -0,225 |
| Mortality Rate | 0,654 | 1 | 0,624 | 0,992** | -0,096 | -0,587 | 0,820* |
| Average length of stay | 0,964** | 0,624 | 1 | 0,685 | -0,703 | -0,892** | -0,300 |
| Average cost per hospitalization | -0,719 | 0,992** | 0,685 | 1 | -0,173 | -0,651 | 0,768* |
| Total Public Spending | -0,625 | -0,096 | -0,703 | -0,173 | 1 | 0,860* | -0,150 |
| Hospitalization Index | -0,852* | -0,587 | -0,892** | -0,651 | 0,860* | 1 | 0,280 |
| GDP | -0,225 | -0,820* | -0,300 | -0,768* | -0,150 | 0,280 | 1 |
| | 0,627 | 0,024 | 0,513 | 0,044 | 0,749 | 0,543 | |

GDP: gross domestic product.

(*) (**) $p < 0,05$

Table 2 shows Pearson's correlation between financial and quality indicators.

The results of the present study show that the health indicators, length of stay of hospitalization, cost per hospitalization and mortality rate of Tocantins changed according to the change of financial indicators. Similar results were found in the study by Abel Smith and Catalano [14] [15] that found evidence that the economic recession generates significant liabilities in health indicators.

Regarding GDP, a negative correlation with the unemployment rate, average cost per hospitalization and mortality rate between the years analyzed is notorious. That is, when GDP shows lower variation, there is an increase in the national unemployment rate, an induction in the increase in the cost per hospitalization of patients in the hospital and a tendency to increase the number of mortality rates (Table 2).

Economic crises directly affect the unemployment rate due to reduced investments, generating low admission rates and increased number of employees layoffs [16]. Roy and Cobas et al have shown that demographic, cultural and socioeconomic aspects are influencers that drive for spending when it comes to health [17] [18].

Regarding mortality is cited in the study of Falagas et al [19], that in periods of economic crisis, an increase in the mortality rate, especially in less developed countries, among the main causes are cardiovascular diseases, respiratory infections, and liver diseases.

Regarding the unemployment rate, there was a positive and significant correlation with the mortality rate of 0,654, and average length of stay of 0,964, showing that as a factor in the economic recession, the increase in the unemployment rate generates an increase in the length of stay of the hospitalization of patients and in the in-hospital mortality rate (Table 2). The fact is reported by Brenner; Mooney and Carlisle [20] [21], in their study, they show that the high unemployment rate comes as a reflection of the economic crisis and individuals who are unemployed during this period are more likely to worsen in the state of health compared to those who remain with their vacancy of Job.

Accordingly, the correlation between mortality rate and mean length of stay was 0,624, being considered as a moderate correlation and with a significance level of 1% statistically very significant. Thus, the longer the average length of stay, the more likely the patient will die and raise the mortality rate (Table 2). Therefore, the length of hospitalization is a binding factor for mortality, in this aspect, in a study by Junqueira et al [22], held in the Federal District (DF), the factors that lead to local hospital mortality were analyzed, including the chance for death increases by 1,0% each day that the patient remains hospitalized.

Patients in long periods of hospitalization are more exposed to risks such as depression, fall, decline in physical conditioning, deep venous thrombosis (DVT) and hospital

infections [23]. In the case of hospital infection, Reis [7], in his study, he analyzed two groups of patients, one with cases of ICU-acquired infections and another group, with no cases of ICU-acquired infections, comparing variables such as permanence and mortality, the results confirm that patients without cases of infection in most were discharged, while those who had infection, most of them died, raising the group's mortality rate.

Regarding the financial quality indicator, there is a positive correlation between hospitalization index and total public expenditure of 0,860, relevant at level 0,05%, presenting that the higher the number of patients hospitalized, the higher the expenditure generated in public expenditure health (Table 2). The fact is stated in the study

by Piuvezam et al [24] when the demand for health services rises, and hospitalization among them occurs, there is an increase in public health expenditures.

It is verified for the correlation between average cost of hospitalization and mortality rate, with a correlation of 0,992, statistically significant at the level of 1%, showing that the higher the value of the average cost of hospitalization, the higher the mortality rate (Table 2). As observed by Silva et al [23], when the patient remains hospitalized for more days, generates high costs mainly in the ICU. Abelha et al [25], in his study, he cites that prolonged hospitalization is one of the factors that increases in-hospital mortality.

Table 3. Significance level of financial indicators and quality indicators.

| Variables | T | D f | Sig (2 ends) | Average difference | 95% Difference Confidence Interval | |
|----------------------------------|--------|--------|-----------------|-----------------------|------------------------------------|---------------|
| | | | | | Bottom | Top |
| GDP | 0,28 | 6 | 0,978 | 0,028 | -2,437 | 2,495 |
| Unemployment Rate | 9,661 | 6 | 0 | 9,47 | 7,071 | 11,868 |
| Mortality Rate | 42,945 | 6 | 0 | 4,235 | 3,994 | 4,477 |
| Average length of stay | 26,62 | 6 | 0 | 5,771 | 5,241 | 6,302 |
| Average cost per hospitalization | 48,542 | 6 | 0 | 1.188,34 | 1.128,44 | 1.248,25 |
| Total Public Spending | 31,541 | 6 | 0 | 62195264,93 | 57.370.172,91 | 67.020.356,94 |
| Hospitalization Index | 24,213 | 6 | 0 | 52.512,14 | 47.205,41 | 57.818,87 |

GDP: gross domestic product.

In Table 3, the Student t-test showed significance to measure the quality of the sample, with a level of $P \leq 0,05$. With the exception of GDP, the other variables were significant, showing that the sample is relevant in the description of the results since p-values close to zero show lower probabilities of error.

IV. CONCLUSION

The scenarios presented during the years analyzed, regarding the health-economic development relationship, evidence the impact generated by the negative performance of Brazil's gross domestic product on health indicators in the State of Tocantins. With the results of this study, it is notorious that financial indicators, GDP and unemployment significantly influence the increase in length of stay, cost per hospitalization and patient mortality rate. However, the same was not observed in public spending and hospitalization index.

As a complement to the study, in the correlation between quality indicators, the increase in cases of patients requiring hospitalization reflects in public health expenditures, and the higher the cost of hospitalization, the greater the tendency to raise the rate of mortality.

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