

# Scientific evidence and technocracy as a public policy for the increase in the availability of ICU beds in Brazil: A systematic review

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**Abstract—Objective:** To identify studies and collect data from the studies that resulted from the analysis of variables that generated quality indicators in intensive care, with the increase in length of stay, care costs and mortality rate, aiming to explain scientific and technocracy criteria as a public policy for patient admission, sedation protocols and infection control as a direct or indirect way, to ensure greater supply of ICU beds. **Method:** This is a Systematic Literature Review that sought scientific articles, in Portuguese and English, in the Medline, Cochrane, Capes Journal Portal, Latin American and Caribbean Center for Information in Health Sciences - Bireme, Latin American and Caribbean Literature in Health Sciences - Lilacs and Scientific Electronic Library Online - Scielo. It was set out of the following steps: location of the studies by reading the titles and abstracts, careful reading of the abstracts of the pre-selected articles, selection of articles consistent with the objective of the present study, application of the Jadad scale [1], to evaluate the methodological quality and exclusion of randomized articles with a score of less than three points in it, interpretation and discussion of the results. **Results:** Eliminated duplicity of the search resulted in 269 scientific articles. The inclusion criteria remained 33 references, of these 10 were evaluated for theoretical basis and 23 that met the above recommendations and evaluations. The data from these studies show a close relationship between the adoption of criteria for patient admission, sedation protocols and infection control. **Conclusions:** Evidence found in the studies shows that the application of evidence-based medicine in the management of public health policies, especially in intensive care units, can corroborate better quality indicators, with higher bed supply and, consequently shorter waiting time, lower mortality rate and lower costs.

**Keywords—Intensive Care Unit, Admission of patients, Sedation Protocols, Infection control, Length of stay, Welfare costs, Mortality rate.**

## I. INTRODUCTION

Tertiary health care refers to high complexity care systems for the user whose monitoring is done at the expense of high technological density [2]. At this level of care, according to the computer department of the Unified Health System of Brazil [3], were spent R\$ 24.165.927.467,87 (twenty-four billion, one hundred and sixty-five million, nine hundred and twenty-seven thousand, four hundred and sixty-seven and eighty-seven cents) from May 2011 to April 2016 in Brazil. According to Ribeiro (2009) [4], in tertiary care, the intensive care unit (ICU) is currently one of the most complex scenarios in care.

Evidence-based management began in the health area around the 19th century when it came to the conclusion that doctors should be guided based on coherent research [5].

In recent times it has been constantly reported, in newspapers of great circulation the lack of vacancies available in this sector. This is due to the constant increase in the life expectancy of Brazilians [6] which proportionally concerns an increase in the incidence of chronic diseases, especially cardiovascular and metabolic diseases [7]. According to Rufino (2012) [8], age is directly proportional to the length of hospitalization, which indirectly reduces the availability of beds.

In 2008, the Federal District Government reported an average of up to 30.9 days of staying in the ICUs of its public hospitals. Oliveira (2010) [9] in a study conducted in Campinas (São Paulo) with 401 patients, highlighted that 97.3% have a prolonged stay rate in ICUs, that is, a time longer than or equal to 7 days.

Adding to the current crisis in the availability of vacancies in tertiary care and problems related to prolonged stay in ICUs as a higher incidence of infection rate [10, 11] and high costs [12], public policies based on scientific evidence focused on reducing length of stay and reducing costs in this sector can bring greater supply of beds to the population without investment in the

construction of new units and ensure better allocation of financial resources. According to data from the CNES (National Council of Health Establishments), an agency linked to the Ministry of Health, in 2015 [13] Brazil accounted for a total of 40,960 (forty thousand nine hundred and sixty) ICU beds (Table 1) and had a total population, of according to data from IBGE (Brazilian Institute of Geography and Statistics) [6], 204,450,649 (two hundred and four million, four hundred and fifty thousand and forty-nine) inhabitants, reaching a proportion of 1.86 beds per 10,000 inhabitants, or, 18.6 beds per 100,000 inhabitants.

Table 1– Number of ICU beds in Brazil in 2015

Source: CNES/MS, prepared by the Federal Council of Medicine. [13]

Region / UF	Population <sup>1</sup>	ICUs beds	Total Beds Ratio (%)	Beds / 10,000 Inhabitants
<b>Northern Region</b>	<b>17.472.636</b>	<b>2058</b>	<b>5,0%</b>	<b>1,18</b>
Rondônia	1.768.204	270	0,7%	1,53
Acre	803.513	73	0,2%	0,91
Amazonas	3.938.336	463	1,1%	1,18
Roraima	505.665	48	0,1%	0,95
Pará	8.175.113	964	2,4%	1,18
Amapá	766.679	50	0,1%	0,65
Tocantins	1.515.126	190	0,5%	1,25
<b>Northeast Region</b>	<b>56.560.081</b>	<b>7332</b>	<b>17,9%</b>	<b>1,30</b>
Maranhão	6.904.241	632	1,5%	0,92
Piauí	3.204.208	323	0,8%	1,01
Ceará	8.904.459	1035	2,5%	1,16
Rio Grande do Norte	3.442.175	570	1,4%	1,66
Paraíba	3.972.202	506	1,2%	1,27
Pernambuco	9.345.173	1726	4,2%	1,85
Alagoas	3.340.932	487	1,2%	1,46
Sergipe	2.242.937	363	0,9%	1,62
Bahia	15.203.934	1690	4,1%	1,11
<b>Southeast region</b>	<b>85.745.520</b>	<b>22200</b>	<b>54,2%</b>	<b>2,59</b>
Minas Gerais	20.869.101	3976	9,7%	1,91
Espírito Santos	3.929.911	970	2,4%	2,47
Rio de Janeiro	16.50.024	5985	14,6%	3,62
São Paulo	44.396.484	11269	27,5%	2,54
<b>Southern Region</b>	<b>29.230.180</b>	<b>5995</b>	<b>14,6%</b>	<b>2,05</b>
Paraná	11.163.018	2619	6,4%	2,35
Santa Catarina	6.819.190	1046	2,6%	1,53
Rio Grande do Sul	11.247.972	2330	5,7%	2,07
<b>Central-west Region</b>	<b>15.442.232</b>	<b>3375</b>	<b>8,2%</b>	<b>2,19</b>
Mato Grosso do Sul	2.651.235	363	0,9%	1,37
Mato Grosso	3.265.486	668	1,6%	2,05
Goiás	6.610.681	1273	3,1%	1,93
Distrito Federal*	2.914.830	1071	2,6%	3,67

Total	204.450.649	40.960	100%	1,86
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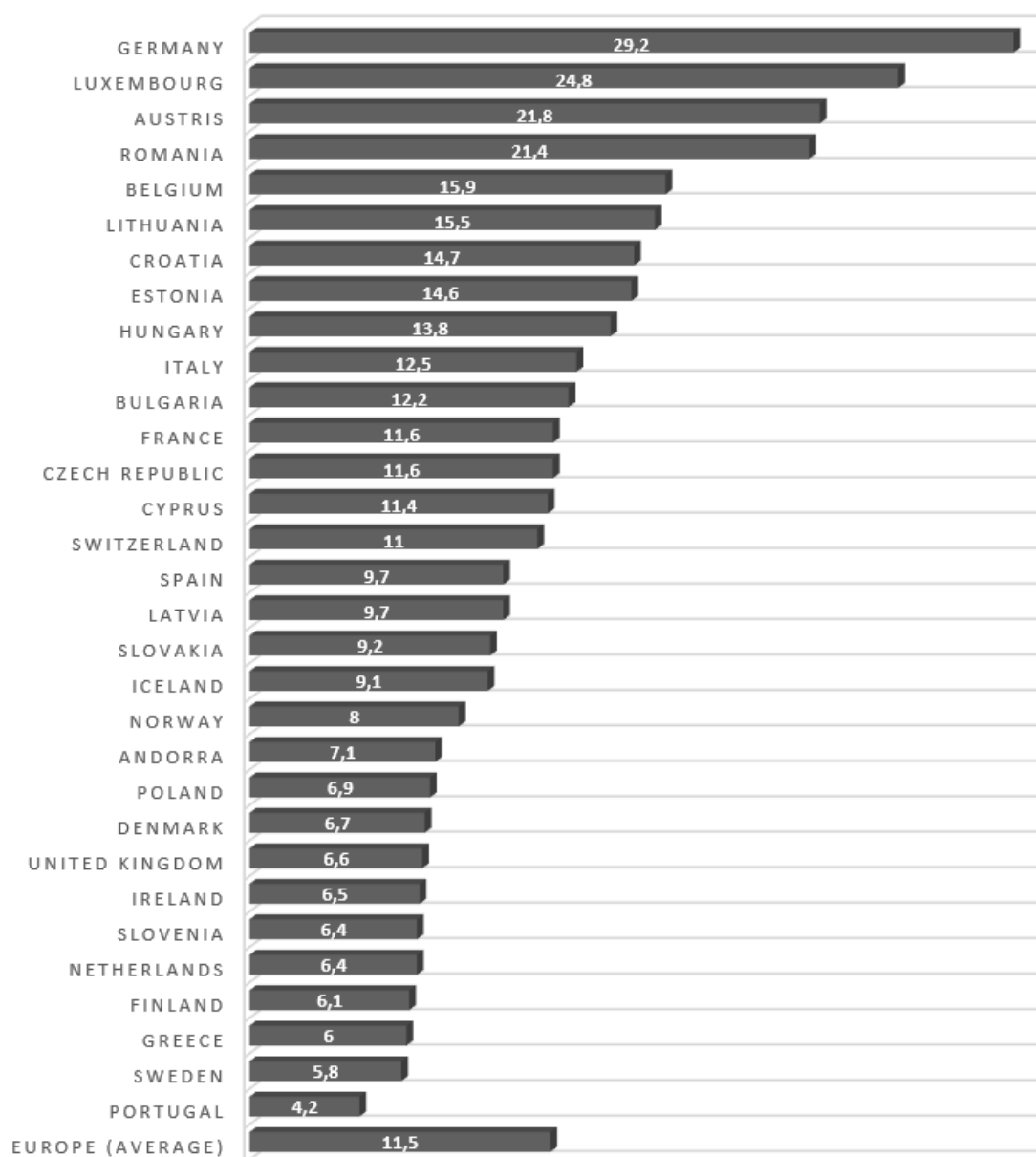


Fig.1 - Proportion of ICU beds in Europe to 100,000 inhabitants in 2012

Source: Rhodes et al., Rev. Intensive Care Medicine [14]

In this plane, comparatively, in 2012, Rhodes et al. [14] published a study entitled The variability of critical care bed numbers in Europe, where results showed that in economically developed countries such as France, Switzerland, Norway, and Sweden, the number of beds per 100,000 inhabitants is lower than Brazil (Figure 1), as well as the average and proportional number of ICU beds throughout Europe, which has accounted for a ratio of 11.5 beds/100,000 inhabitants, against 18.6 in Brazil, which reinforces, in addition to the quality of primary care, the context of primary care, the context of efficiency of the services offered in the current scenario of tertiary

care.

Based on these data, we can infer that evidence-based management and a technocratic model, which was one of the supposed widespread in the 19th century that, "thanks to science, humanity could get rid of politics" [15], where science was considered the mastery of logic and reason, while politics was the orbit of emotion and passion.

It is possible that a change in the profile of current management of public health policies is necessary, especially in tertiary care, since the 1970s, when British teacher Archibald Cochrane published the book "Effectiveness and

efficiency: Random reflections on health services”, medical interventions and diagnostic models have stopped based on personal experiences and began to rely on evidence, or rigorous scientific evidence, with the commitment to explicit and honest search to guide decision making [16]. Perhaps, a change in the current scenario of political health management is necessary, seeking for public administration the concepts of science and technocracy, in order to detail the ills of the Brazilian unified health system. Therefore, this systematic review aims to collect data from studies that resulted in the analysis of variables that generated worse indicators of quality in intensive care, with the increase in length of stay, care costs and mortality rate, the that, directly or indirectly, when prevented, can generate greater efficiency of services and increase the supply of vacancies in Brazilian ICUs.

## II. MATERIALS AND METHODS

This is a systematic review of the literature. The scientific articles for the elaboration of the same were selected in the Medline, Cochrane, portal of capes journals, Latin American and Caribbean Center for Information in Health Sciences - Bireme, Latin American

and Caribbean Literature in Health Sciences - Lilacs and Scientific Electronic Library Online - Scielo, in Portuguese and English, using Portuguese-language descriptors: *Unidades de Terapia intensiva, Tempo de permanência, Infecção Hospitalar, Sedação profunda, mortalidade, Avaliação da Qualidade dos Cuidados de Saúde e Análise Custo-Eficiência*, contained in the DeCS (Descriptors in Health Sciences) and English-language descriptors: Intensive Care Unit, Length of stay, Hospital infection, Deep sedation, mortality, Quality Assessment of Health Care e Cost Efficiency Analysis, all contained in MeSH (Medical Subject Headings).

The inclusion criteria defined were randomized, epidemiological and/or clinical trial that had as inclusion criteria the data approach of patients who remained in ICU, free or paid who address technical data that can increase the number of vacancies and/or that decrease the length of stay of patients and be written in English or Portuguese. Articles that did not obtain statistical significance in the results by theoretical saturation were excluded. Articles were not deleted based on the publication date.

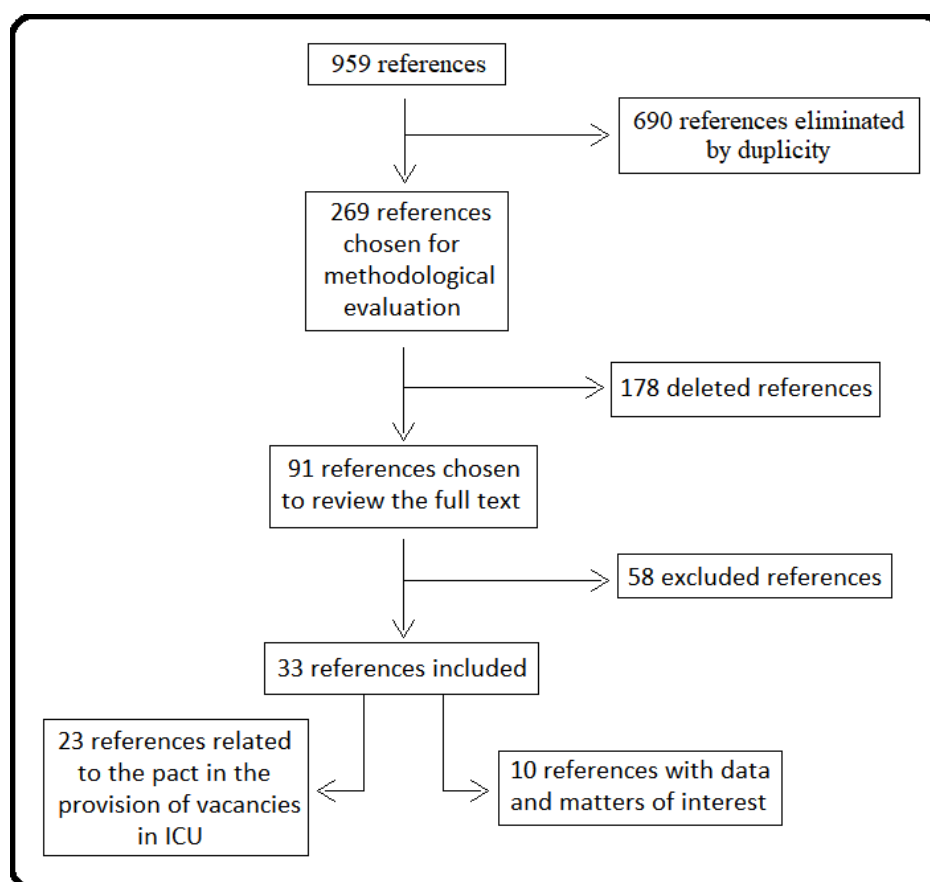


Fig.2 - Diagram of the selection flow of articles

The research was developed through the PRISMA recommendation [17] and consisted of the following steps: location of studies by reading the title and abstract, careful reading of the abstract of the pre-selected articles, selection of articles consistent with the objective of the present study, application of the *Jadad* scale [1] to evaluate the methodological quality and exclusion of randomized articles with a score of less than three points in it, interpretation and discussion of the results.

Initially, 959 articles were found that met the descriptors used, however, only 33 references were selected, where 10 were evaluated for theoretical basis and 23 met the above recommendations and evaluations, as Figure 2.

The present work did not need to be submitted to the ethics committee in research, according to resolution 466/12, because it does not have as its participant the human being, in its entirety or in parts, and does not involve it directly or indirectly, including the management of its data, information or biological materials.

### III. RESULTS AND DISCUSSION

#### ADMISSION OF ICUS PATIENTS

In 1999, the Society of critical care medicine [18] published guidelines for admission of ICU patients, dividing them into four criteria-based priorities, where patients with priority 1 (top priority) are those without any limits for therapeutic intervention and who usually require vasoactive drugs and/or ventilatory support, priority 2 patients are those who need continuous monitoring, also without any limitation to therapy and may require immediate interventions. Patients with priority 3 are those with a low probability of recovery and with limits on therapeutic intervention as patients without indication for orotracheal intubation or cardiopulmonary resuscitation. Patients 4 were allocated into 2 groups: 4A - those who may have little or no benefit of being admitted to the ICU as hemodynamically stable with ketoacidosis congenital heart failure, overdose or undergo peripheral surgeries. 4B - Patients with a terminal disease such as irreversible brain injury, multiple organ failure, metastatic cancer without response to chemotherapy, and/or radiotherapy, patients in a vegetative state who are in a permanent state of unconsciousness.

Based on these priorities, the Federal Council of Medicine published resolution No. 2,156 on November 17, 2016, in the Official Gazette, which establishes the criteria for admission and discharge in intensive care.

According to a survey by Caldeira *et al.* (2010) [19]

held in a tertiary hospital where the outcome of 359 patients admitted to ICU and related to their priority level, based on the guidelines of the American Society of Intensive Care, it was observed that the average permanence of patients with priority 4 was 28.8 days, against only 7.6 and 4.4 of the patients with priorities 1 and 2, respectively. Furthermore, the mortality rate among patients with priorities 3 and 4 was higher than 80%.

The lack of criteria for admission of patients in ICU can lead to reduced bed supply for patients who can potentially benefit from intensive care for life support, and reduce bed waiting in this population.

In 2016, Garcia-Gigorro [20] analyzed the impact of patients waiting in the emergency sectors by ICU beds, where 269 patients were included in the study for a period of 18 (eighteen) months. It was verified that 48% of patients remained in the emergency room waiting for an ICU vacancy for more than 5 hours and that they had a chance of death increased by 2.5 times due to time-dependent complications.

A cohort study conducted by Cardoso in 2011 [21] with 401 patients concluded that for each hour of waiting for an ICU vacancy, the risk of death increases by 1.5%.

Regarding the length of stay related to the level of priority for admission, Sinott *et al.* (2014) [22] in a retrospective study evaluating 8,973 (eight thousand, nine hundred and seventy-three) patients admitted to the ICU, found significant differences that correlated these factors.

#### ICU STAY TIME

Another important factor in this reduction of vacancies in ICU is the length of stay of patients admitted to this sector, in a randomized study conducted by Strom *et al.* in 1999 [23], where patients under mechanical ventilation who remained sedated were divided and compared with those who remained without sedation, it was observed that the ICU stay of those who remained under sedation was 22.8 days, against 13.1 days of those who remained without sedation.

In a meta-analysis developed by Junior & Park (2016) [24] where they analyzed the results of studies that compared the length of stay of patients in mechanical ventilation who underwent a sedation protocol against those undergoing only daily interruption of the same was observed a shorter duration of the days in mechanical ventilation of the groups submitted to the sedation protocol in relation to those who had only sedation interrupted once a day.

One of the causes of longer stay-related sedation is the diaphragmatic dysfunction that the same cause in patients under ventilatory support, Demoule *et al.* (2016)

[25] in a prospective cohort study noted that 79% of patients under mechanical ventilation developed diaphragmatic dysfunction, which potentially increased the time required for ventilator weaning due to muscle inefficiency for the development of spontaneous breathing.

In addition to diaphragmatic dysfunction, prolonged sedation may also develop delirium in intensive care patients. In 2001, Ely et al. [26] evaluated 48 patients who received midazolam, and evaluated (through diagnostic statistical manual IV - DSM-IV) than of these, 39 (81.3%) developed delirium, and that it was a strong determinant for the increase in their length of stay in relation to the group that did not develop delirium.

Another important factor that prolongs the length of stay of patients in ICU (in addition to increasing costs) are hospital infections. Dal Forno et al. (2012) [27]

compared the length of stay and costs of ICU patients who had hospital infection with those who did not develop, and the results showed that the group with hospital infection remained about 10.5 days longer in the ICU, and their costs were about \$65,993 (sixty-five thousand and nine hundred and ninety-three) dollars higher than the group that had no infection during the stay in the unit.

According to the survey by Chacko *et al.* (2017) [28], where it evaluated the incidence of ICU-acquired infection of 499 patients, the presence of infection doubles the hospital costs of these patients, in addition to increasing the average length of stay from 12.4 to 21.8 days.

The analysis of this review about the presence of hospital infection with the length of stay can be observed in Figure 3.

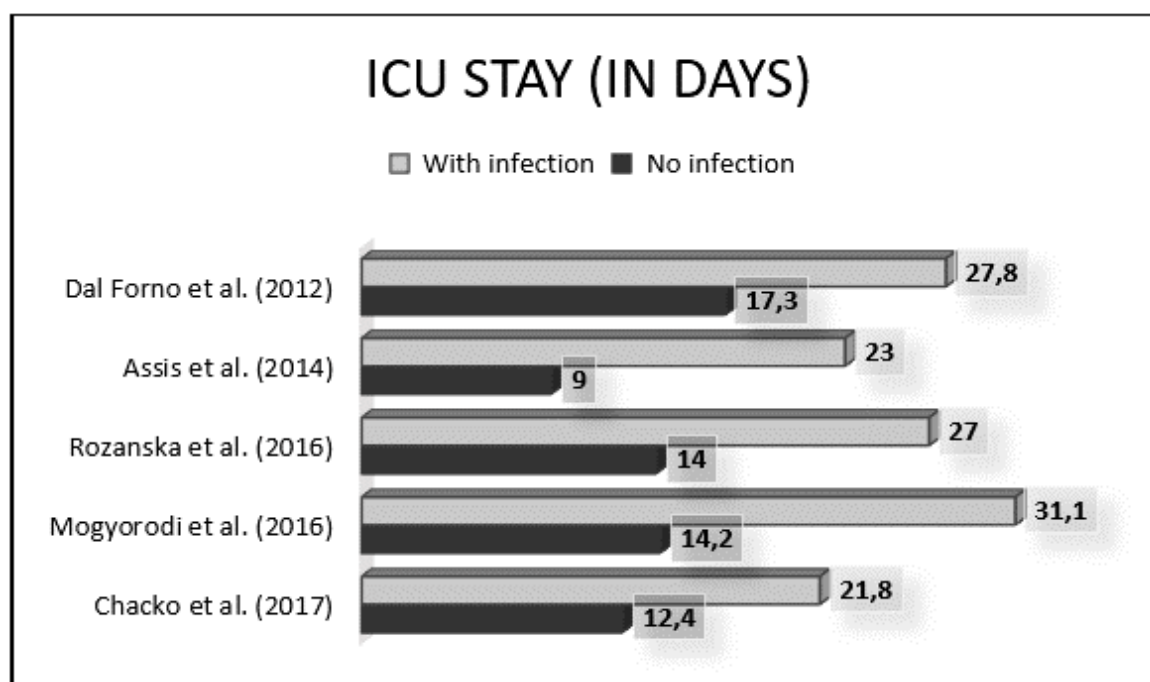


Fig.3 - Comparison of the average length of stay in the main studies collected

With databases in these data, the adoption of criteria for the admission of patients, sedation protocols and infection control can, directly and indirectly, ensure a greater supply of ICU beds.

#### IV. DISCUSSION

The last date of the National Register of Health Establishments (CNES-DATASUS) [13,3] describes that Brazil has almost 41,000 tertiary care beds, but only 25.2% are maintained directly by public management. In any case, based on Articles 5 and 196 of the Federal Constitution and also provided for in federal law

8,080/90, in the absence of a vacancy in a public hospital, it is the duty of the State to adopt measures to ensure care and the right to life, either through hospitalization and the cost in the private network.

Even with all the investment in ICU beds, most Brazilian regions lack vacancies in this type of health care, even though studies denote that the proportional number of beds in Brazil exceeds that of many developed countries.

This lack of ICU vacancies, which today is a major public health problem that spreads throughout the national territory, considerably increases the rate of



morbidity and mortality due to slowness in the transfer and regulation of severe patients for tertiary care.

Also, According to Lemos de Sá (2015) [12] in a paper presented in the annals of the IV International Symposium on Project Management, Innovation and Sustainability, the costs of a daily ICU, accounting for exams, medicines and direct labor, reaches the amount of R\$ 3,864,86. Therefore, it becomes a determining value within the current concept of decentralization of the SUS (Single System of Health) (SPEDO, 2009) [29] and in the face of the current financial crisis of the Brazilian states.

It is observed in the studies analyzed that priority criteria for admission of patients to the ICU may lead to the lower occupation of them since there is still a large percentage of patients admitted without life prognosis (criterion 4B) and/or without the need for intensive care or severity (criterion 4A).

Another important point of this research was that variables related to ICU-acquired infection and deep sedation directly increase the length of stay of patients in these units, which obviously drastically reduces the number in the availability of ICU beds for the population.

## V. FINAL CONSIDERATIONS

Evidence shows that the adoption of management measures based on technical knowledge, or technocracy, and the application of evidence-based medicine in the management of public health policies, especially in intensive care units, can corroborate better quality indicators, with higher bed supply and, consequently lower waiting time, lower mortality rate and lower costs, without large investments in new units and/or opening new beds.

Incisive studies on the efficiency in the management of tertiary health care are still scarce, especially with regard to the criteria of admission and control of sedation, however, due to the methodological quality of the articles used in this review, it is possible to conclude that there is still a lack of efficiency in this sector in our country and that political-administrative reform can infer in better conditions assistance to society.

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