Original Article

Direct costs of low back pain in hospitals financed by the Unified Health System

Custos diretos da dor lombar em hospitais financiados pelo Sistema Único de Saúde

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ABSTRACT | INTRODUCTION: Low back pain is a highly disabling symptom, which leads to a negative social impact for people who experience the symptom, and economic, for public coffers in several countries, with excessive and sometimes unnecessary expenses with non-resolving procedures. **OBJECTIVES:** To report the number of clinical and surgical procedures and the direct costs of low back pain in hospitals financed by the Unified Health System. **METHODS:** The data on clinical and surgical procedures were collected in the Hospital Information System on the DATASUS website between 2013 and 2018. A descriptive analysis of the data was carried. **RESULTS:** In the six years analyzed, the procedures for the treatment of low back pain cost R$ 24,427,238. These costs have increased significantly over the years observed. 1,689 surgical procedures were performed, and each cost an average of R$ 3,290. The southeastern region of the country was the one that had the greatest financial expenditure for the treatment of the symptom (R$ 12,442,930). **CONCLUSION:** The cost of low back pain over the years to the public system is increasing rapidly and is probably driven by the increase in the number of surgeries.

KEYWORDS: Direct costs. Low back pain. Hospitals. Brazil.

RESUMO | INTRODUÇÃO: A dor lombar é um sintoma altamente incapacitante, que leva a um impacto social negativo para as pessoas que experimentam o sintoma, e econômico para os cofres públicos de diversos países, com gastos excessivos e por vezes desnecessários com procedimentos não resolutivos. **OBJETIVOS:** Relatar o número de procedimentos clínicos e cirúrgicos e os custos diretos da dor lombar em hospitais financiados pelo Sistema Único de Saúde. **MÉTODOS:** Os dados sobre os procedimentos clínicos e cirúrgicos foram coletados no Sistema de Informações Hospitalares no website do DATASUS, no período entre 2013 e 2018. Realizou-se análise descritiva dos dados. **RESULTADOS:** nos seis anos analisados os procedimentos para tratamento da dor lombar custaram financeiramente R$ 24.427.238. Estes custos aumentaram de forma expressiva ao longo dos anos observados. Realizou-se 1.689 procedimentos cirúrgicos e cada um custou em média R$ 3.290. A região sudeste do país foi a que teve maior gasto financeiro para o tratamento do sintoma (R$ 12.442.930). **CONCLUSÃO:** O custo da dor lombar ao longo dos anos para o sistema público está aumentando rapidamente e provavelmente é impulsionado pelo aumento no número de cirurgias.

PALAVRAS-CHAVE: Custos diretos. Dor lombar. Hospitais. Brasil.

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Introduction

Low back pain (LBP) is the main reason for physical disability throughout the world[1] and results in high costs for healthcare systems as well as individuals[2]. These costs can be both direct (e.g. medical care) and indirect (e.g. missed days of work and loss of productivity)[3]. Recent studies have sought to establish the overall cost of LBP and compare results with data from other countries. There is variation in these estimates due to different operational and data collection methods across health care systems in different countries[4].

What is described in the current literature is that the number of cases of LBP has increased in high-income countries, and thus it is likely that the economic impact of the symptom is also increasing in these countries[5–7]. In Sweden, the estimated total direct and indirect cost of LBP was €740 million in 2011, which corresponded to €78 per person in the country[3]. In the United States of America, the medical costs of LBP increased from US$4695 per person in 1997 to US$6096 in 2015[2]. In Germany, the average total LBP costs per patient were estimated to be €1322 per year[8].

However, in the middle and low-income countries, conclusive data are lacking. In Brazil, for example, few epidemiological studies have attempted to describe the characteristics or costs of LBP[9]. Thus, data on the use of resources in the management of LBP at the three levels of health care are inconclusive. To the best of our knowledge, there is very limited information in the literature on the direct costs of LBP or whether these costs are increasing or decreasing over time.

This study aims to analyse and present data of cases of LBP in hospitals financed by the Brazilian public healthcare system, describing the frequency of clinical and surgical procedures as well as the financial costs of these procedures from 2013 to 2018.

Methods

Study design and data collection

A longitudinal ecological epidemiological study of panel type was conducted using publicly accessible information available on the DATASUS (Informatics Department of the Brazilian public healthcare system) website[12]. We downloaded data from 2013 to 2018 on the Hospital Information System, which has information on hospitalizations financed by the public healthcare system[10]. The methods followed the guidelines of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: Guidelines for Reporting Observational Studies[11].

Data extraction and coding according to the International Classification of Diseases (ICD-10)

After downloading hospital information from the DATASUS website, the data were transferred to the TABWIN 4.1.3 program. TABWIN 4.1.3 is provided by the Brazilian Health Ministry and enables exploratory analysis of data from publicly-funded hospitals, providing epidemiological and sociodemographic characteristics on health conditions for the country as a whole and by region.

In TABWIN 4.1.3, the codes from the ICD-10 were used for data extraction. The ICD-10 is used in the DATASUS system, which standardises diseases and health-related problems using the International Nomenclature of Diseases of the World Health Organization (WHO) as reference. The following codes from ICD-10 chapter XIII [Diseases of the Musculoskeletal System and Connective tissue (M00-M99)] were used in this study: M54.4 (lumbago with sciatica), M54.5 (low back pain), M54.8 (other dorsalgia) and M54.9 (unspecified dorsalgia). We used a coding strategy similar to previous studies to designate the symptom “low back pain”, as in the study by Jöud et al.[12], since in this study these codes were chosen through consensus among specialists in the field, as the most relevant for LBP.

For each ICD-10 code used to describe a hospital notification, a hospital procedure performed is recorded. In the case of the present study, for each ICD-10 code used at the time of completing the Hospitalization Authorization (AIH), which is the document that feeds the DATASUS database, either a clinical or a surgical procedure was recorded for the admitted patient.

Variables of interest

The following data were extracted for the five macro-regions of Brazil (southern, south-eastern, northern, north-eastern, central-western) and the country as a whole for LBP notifications in the Hospital Information System from 2013 to 2018:

Frequency and costs of clinical procedures (i.e. patients receiving non-surgical / non-invasive care). That includes the cost of all procedures performed from the moment of admission until hospital discharge, such as: hospital materials, medicines used and auxiliary diagnostic and therapy services, imaging exams, non-invasive orthopaedics procedures, and treatment of clinical complications.

Frequency and costs of surgical procedures (i.e. patients receiving invasive manual or instrumental intervention on the patient's body to diagnose, treat or cure). This includes the costs of all procedures performed before and after the patient's surgery, such as biopsy, arthrodesis, disctomies, vertebral element resections, post-surgical treatments and management of surgical complications, hospital materials, anaesthesia and drug treatments related to LBP[13].

Data analysis

Descriptive analysis of the data was performed, and these were presented in a table containing the total number and the direct costs of the clinical and surgical procedures, and the average cost of each procedure performed. The graphs represent the total number and the direct costs of the procedures in the six years, in the five Brazilian regions and the country (calculations are shown below). Financial costs were presented in two ways, in Brazilian currency (R $) and also converted into US dollars (US $) at the exchange rate of August 29, 2019: US $ 1 = R $ 4.172 (Brazilian currency). Graphs and tables were presented in US $.

$$\text{Cost of procedures per year} = \frac{\text{Total cost of clinical or surgical procedures in the year for low back pain}}{\text{Total number of clinical or surgical procedures in the year for low back pain}}$$

The results were calculated separately for the five regions of Brazil. Data analysis was performed using SPSS version 22.0 (SPSS Inc., Chicago, USA).

Ethical aspects

The study was registered with the Ethics and Research Committee of the Federal University of Vales do Jequitinhonha and Mucuri (case number: 99571018.8.0000.5108), and was released for execution, since it is a study with public data.

Results

Number of surgeries and clinical procedures

From 2013 to 2018, 59,954 cases of LBP were registered in the Brazilian public hospital system. They involved 1689 surgical procedures and 58,265 clinical procedures. There was an increase in the number of surgeries for cases of LBP over the six years, from two surgeries in 2013 to 642 in 2018 (Figure 1). Regarding clinical procedures, these remained stable over the six years, with a small increase when compared to 2013 with 2018 (Table 1).

Direct costs of clinical and surgical procedures

Over the 6 years analysed, the financial costs of LBP to the Brazilian public healthcare system was R$ 24.427.238 (US$5,857,851) with an increase in direct costs of hospitalizations for this condition from R$ 2.795.851 (US$670,468) in 2013 to R$ 4.907.198 (US$1,176,786) in 2018 (an increase of R$ 2.111.346/ US$506,318).

The total direct costs of both clinical and surgical procedures increased over the years, from 2013 to 2018. Clinical procedures increased from R$ 2.793.854 (US$669,989) in 2013 to R$ 3.065.926 (US$735,234) in 2018 and surgical procedures increased from R$ 1.997 (US$479) in 2013 to R$ 1.841272 (US$441,552) in 2018 (Figure 2). The mean direct cost in the six-year was R$ 321 (US$77) for each clinical procedure and R$ 3.290 (US$789) for each surgery performed.

Number of procedures in different regions of Brazil

Among the five regions of Brazil, the south-eastern region performed the most procedures over the six years (n = 30,055), with 1095 surgeries and 28,960 clinical procedures for LBP. The northern region of the country had the lowest number of procedures over the six years (n = 4,567), of which 4,558 were clinical procedures and 9 were surgeries (Figure 3).

Direct costs of clinical and surgical procedures in different regions of Brazil

The highest total cost in the six years for LBP was in the south-eastern region R $ 12.442.930 (US$2,979,120) and the lowest in the northern region R $ 1.087.144 (US$260,706) (Figure 4). The central western region spent the most on each surgery (mean: R $ 5.571 -US$1,336/surgery) while the north-eastern spent the least (mean: R $ 2.214 - US$531/surgery). Regarding clinical procedures, the southern region spent the most (mean: R $ 388 - US$93/clinical procedure) and the northern region spent the least (mean: R $ 229 - US$55/clinical procedure).

Figure 1. Total number of surgeries reported for low back pain cases over the years in hospitals financed by SUS

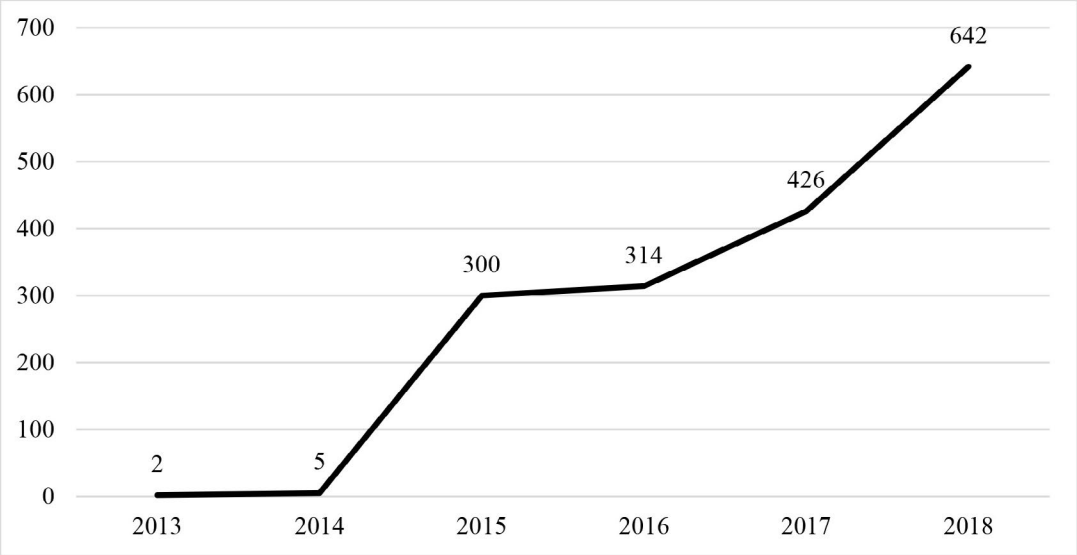

Table 1. Total number of notified clinical and surgical procedures; direct costs of clinical and surgical procedures; and average direct cost with each clinical and surgical procedure performed between 2013 and 2018 for LBP notifications in hospitals financed by SUS in Brazil

	2013	2014	2015	2016	2017	2018
Total surgical procedures per year	2	5	300	314	426	642
Total clinical procedures per year	9,358	10,122	9,867	9,634	9,699	9,585
Total procedures	9,360	10,127	10,167	9,948	10,125	10,227
Total cost of surgical procedures per year	$479	$2,880	$228,706	$280,559	$388,624	$441,552
Total cost of clinical procedures per year	$669,989	$813,864	$797,031	$764,008	$734,925	$735,234
Total costs	$670,468	$816,744	$1,025,737	$1,044,567	$1,123,549	$1,176,786
Mean direct cost of each surgery performed	239.64	576.10	762.36	893.50	912.26	687.78
Mean direct cost of each clinical procedure performed	71.59	80.41	80.78	79.30	75.77	76.71

Values are presented in US $ dollars. Currency: US$ 1 = R$ 4,17.

Figure 2. Total direct cost, direct cost with clinical and surgical procedures over the years for low back pain notifications in hospitals financed by SUS (US$)

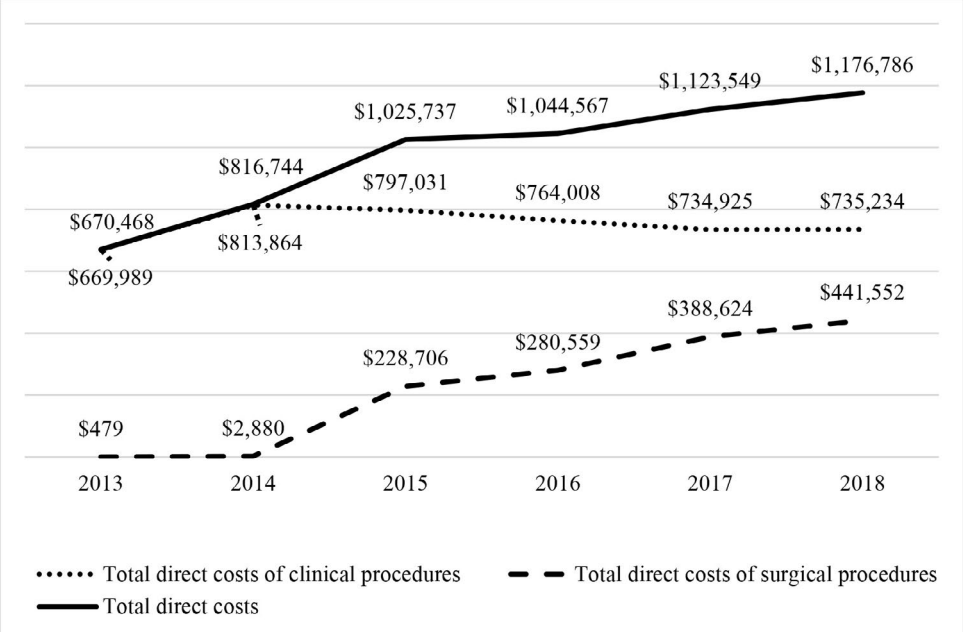

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Figure 3. Total number of clinical and surgical procedures performed in the five Brazilian regions from 2013 to 2018 in hospitals financed by SUS

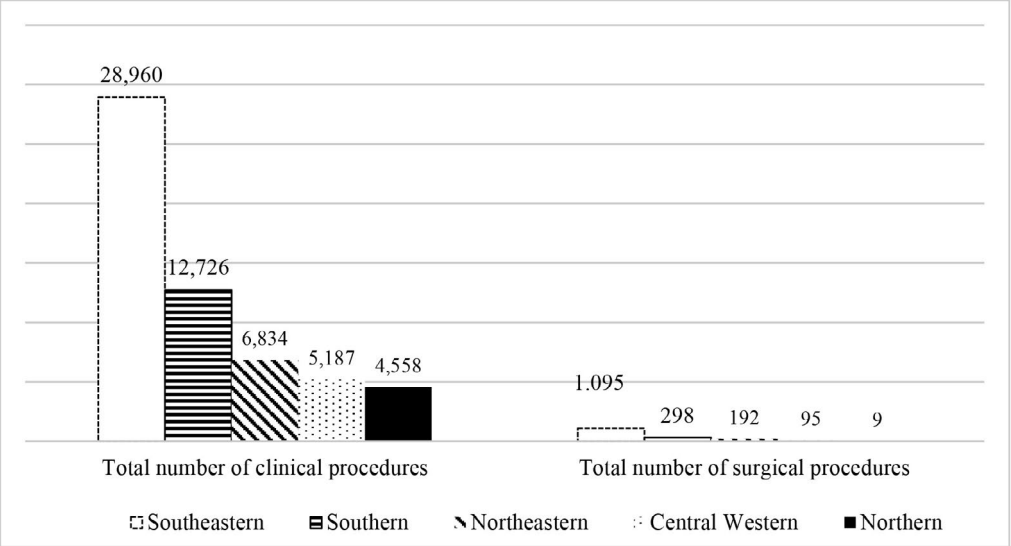
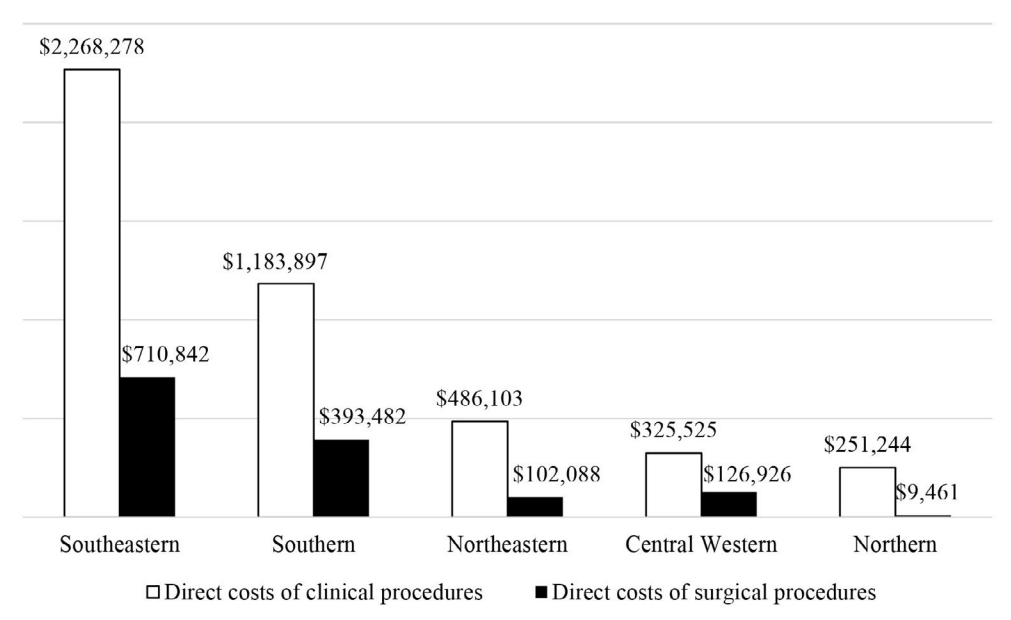


Figure 4. Total cost of procedures in each region over the years analyzed (US$)



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Discussion

This study has shown that while the number of LBP cases in Brazilian public hospitals has remained stable between 2013 to 2018, a substantial increase in the number of surgeries for LBP was performed. The total direct costs due to LBP in the Brazilian public hospital network almost doubled between 2013 and 2018, with the highest number of cases and the highest direct costs in the south-eastern region of the country.

The efficacy of surgical procedures for cases of LBP has been questioned in recent literature. In many cases, surgical intervention is based on imaging exams, resulting in unnecessary procedures and costs, a greater number of missed days of work and a low degree of resolution of the symptoms, which is associated with reoperations[14,15]. The findings of the current study demonstrate a large increase in the number and the costs of surgeries over the years from 2013 to 2018, which is at odds with current evidence for LBP. These findings are extremely important to the Brazilian public healthcare system and the implementation of new policies aimed at changes in the treatment of LBP in hospital centres in order to avoid unnecessary surgery and its high costs, by following current clinical recommendations[16,17].

For instance, "second opinion" programs for back surgery may play an important role in reducing unnecessary treatment[18,19]. The aim of such programs is to obtain a second medical opinion regarding patients with an indication for primary surgery[18,20]. In a study involving 166 patients with indications for surgery at the Back Treatment Reference Center of the Albert Einstein Israelite Hospital in Brazil, 112 patients did not undergo surgery after receiving a second assessment and received conservative treatment instead leading to an economy of saving of 158.6% as a result of a program of "second opinion", according to the authors[19].

Still on the number of surgeries, it is important to note that from 2015 there was a very significant increase in the number of surgeries for LBP. This increase may be conditioned by the lack of adequate coding before 2015, with the incorrect ICD-10. This finding is important for doctors and professionals who work directly with the symptom, so that in the future they can formulate and have a consensus on the most appropriate coding for cases of LBP, not only in public hospitals, but throughout the health care network Brazilian.

Regarding the number of notifications and costs in Brazilian regions, the south-eastern region of the country performed the most clinical and surgical procedures and spent the most direct financial resources for the treatment of LBP. In a study on diseases of the spinal in Brazil in 2016, Carregaro et al.[21] also found that the south-eastern and southern regions spent the most financial resources for the treatment of these conditions. The south-eastern region, which is the most populous in the country[22], has the largest number of health professionals and specialized hospital services, which may result in a larger number of records in the system that feeds the DATASUS database. However, further observational, population-based studies are needed in order to determine why there are such large differences in costs among regions in Brazil.

Comparison of cost-disease studies between countries is complicated by differences in healthcare systems[8,23,24]. A systematic review of studies from high-income countries addressing the direct, indirect and total costs of LBP reported that, despite the methodological differences among the studies analysed, the economic costs represent a substantial burden to society[25]. In Portugal, the estimated indirect costs for disability in cases of LBP in the year 2010 was €458.91 million[23]. In the Netherlands, direct costs were €3.5 billion in 2007, despite changes in legislation aimed at lowering costs related to this condition[24].

The findings of this study show lower direct costs when compared to some high-income countries[8,14]. However, this difference in financial costs may be explained by the fact that we only used data from a specialized public healthcare service (hospitals). Thus, these values would likely be higher if we considered other levels of the Brazilian healthcare system (primary and secondary care) as well as the private sector and indirect costs related to the condition.

Carregaro et al.[21], in a study on the costs of spinal disorders in Brazil in 2016, reported different results from those presented in this study, with a cost of US$71.4 million that year. This difference in values is justifiable since their study considered all spinal disorders and in the present study only four ICD-10 codes were used to represent the symptom of LBP. In addition, Carregaro et al.[21] included secondary health care while the present study only used data from the Brazilian public hospital network. Nevertheless, the results from both studies indicate a substantial financial burden on Brazilian health care systems and suggest that further research could identify the main causes of this burden and areas where the burden can be reduced.

Limitations

The database used (SIH / SUS) is fed with information inserted by different health professionals who work in the Brazilian hospital system. Thus, some cases may have been underreported or incorrectly filled in, with other ICD-10 codes, in addition to those that were used in the present study. In the database, there is no exact information about the pain characteristic (acute, subacute or chronic). This limits the understanding of the association of the type of pain versus the allocation of resources for the treatment of the symptom. Finally, it is important to consider that we use only four ICD-10 codes to designate the symptom "low back pain". Knowing that health professionals encode the symptom in different ways, not having a universal standardization for this codification, it is plausible to consider the loss of some notifications. However, despite the possible limitations listed, it is necessary to consider that the SIH / SUS database is reliable and is currently the best way to have epidemiological knowledge of the health of the Brazilian population.

Conclusion

The surgical procedures for LBP almost doubled in of six years, and consequently, the direct costs for treating the symptom increased considerably in the Brazilian public hospital service. The results presented here are important for future discussions on the best way to manage and treat LBP, in order to minimize these costs and procedures.

Author contributions

Mendonça AG participated in the conception and design of the research project, collection and statistical analysis of the data, interpretation of results and writing of the scientific article. Oliveira VC and Oliveira MX participated in the conception and design of the research project, preparation and review of the scientific article. Fonseca LS participated in data collection and analysis.

Competing interests

No financial, legal, or political conflicts involving third parties (government, companies and private foundations, etc.) have been declared for any aspect of the submitted work (including, but not limited to, grants and funding, participation in advisory council, study design, preparation of manuscript, statistical analysis, etc.).

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