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Hospital Costs of Immunopreventable Diseases in the Elderly in Brazil

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ABSTRACT

Introduction: Immuno-preventable diseases are a public health reality in Brazil and worldwide. The main objective is to discriminate the hospitalizations associated with immuno-preventable diseases in Brazil and their care costs, within the Scope of the SUS, between 2008 and 2018, in the population over 60 years.

Methods: A population, observational, descriptive, retrospective study was conducted with secondary information from DATASUS.

Results: It was analyzed 457,479 hospitalizations; there were 112,104 hospitalizations (24.50% of all hospitalizations) in elderly over 60 years of age, totaled R$103,461,788.75 (26.58% of the total values). The trend analysis of the time series presented a stationary trend.

Conclusion: It was identified a necessity of increasing the immunization coverage in the population with 60 years and older for decrease the hospitalizations and their costs by immunopreventable diseases.

INTRODUCTION

The World Health Organization (WHO) estimates that a quarter of deaths in children under 5 years are caused by immunopreventable diseases [1-7]. According to international literature [8-10] a considerable proportion of health care is attributed to communicable diseases, one in six cases attended by primary care and about 128,000 hospitalizations (84% in public hospitals) were related to these conditions in 2010. Vaccination is important in the care of these diseases, since it makes it possible both to avoid their incidence and to their complications and sequelae. Only basic sanitation and drinking water have greater public health benefits than vaccination [5,6] Vaccines prevent between 2 and 3 million deaths per year worldwide [10]. It is clear in the international literature [11-13] that aging is associated with the decline in the effectiveness of the immune system (immunosenescence) and increased susceptibility to communicable diseases, which are also preventable (by vaccines, hygiene, drinking water and medicines, for example). Another relevant effect of aging is its impact on the effectiveness of vaccines, both individually and on the community of the elderly population (e.g. in the case of outbreaks in nursing homes and long-term care institutions). In addition, the greater chance of hospitalization, complications and deaths when this population is exposed to communicable diseases.

In this context, the main objective of this manuscript will be to discriminate the direct costs of hospitalizations under the Unified Health System, immunopreventable diseases (diphtheria, tetanus, pertussis, mumps, rubella, measles, hepatitis B, yellow fever, influenza virus respiratory syndrome, meningococcal disease, chickenpox), through DATASUS data, from 2008 to 2018, emphasizing the impact of preventable diseases in the population aged 60 years or older, in Brazil. This analysis is important in the sense that it can guide specific public health policies for this population group.

METHODS

In this manuscript, data referring to Brazil were chosen for analysis. According to data from the Brazilian Institute of Geography and Statistics (IBGE, 2019/2020 panorama and), Brazil has an estimated population in 2020 of 211,755,692 people, with a population density of 22.43 inhabitants/km^2, with a predominance of the population in the age groups of 10 to 29 years, a predominance of the female population, with life expectancy at birth of 7 years more for females (80 years on average). It has a predominantly urban population, with GDP per capita of R$31,833.50 (year 2017) and Human Development Index (HDI) of 0.761 (79th position in the world in 2019.

Study Design

A population observational descriptive, retrospective study was conducted with multiple groups and time series, with aggregated secondary data, through information provided by the information system website of the Department of the Unified Health System (DATASUS)The research methodology on the DATASUS website was established according to the tools available in the consultation system: through the following links: "Health Information (TABNET)", "Epidemiological and Morbidity"; "Hospital Morbidity of the SUS (SIH/SUS)"; "General with place of hospitalization - from 2008"; "Brazil by Region and Federation Units"; Line = "Age group 1"; Column = "not active", content = "Hospitalizations; Hospital Admission Authorizations (AIH) approved; Total value; Value of hospital services; Value of professional services; Average AIH value; Average hospitalization value; Days stay; Average permanence; Deaths; Mortality rate"; available period from January 2008 to December 2018; Chapter of ICD 10 = "I Infectious and parasitic diseases"; list of morbidities ICD 10 = "Neonatal tetanus and other tetanus; Diffrhyphtheria, Whooping. Yellow Fever; Meningococcal infections; Measles; Rubella; Mumps; Human Rage; Chickenpox/Herpes Zoster; Acute hepatitis B" (diseases chosen because they have preventive vaccines available in the National Vaccination Calendar of the Brazilian Ministry of Health). The variables analyzed were the immunopreventable diseases mentioned above, year, age group, gender and economic variables. The socio-demographic data were tabulated and evaluated by descriptive statistics (mean, standard deviation, median and percentages), by excel® (Microsoft Corp., United States version 2007), Stata® (StataCorpLP, College Station, United States version 14.0), and Epi info 7®, by the research team itself. For the continuous (numerical) variables, linear regression analysis was used in the cases of verification of the correlations of the economic variables of each immunopreventable disease. The time trends (Yt) of the economic variables in relation to hospitalizations, age groups and genders were also analyzed, defined by the equation of linear regression given by Yt = b0 + b1t + and t. In this expression, parameter b0 corresponds to a constant, b1 corresponds to the slope of the line, and t is a random error by the Prais-Winsten method. When the Beta parameter was positive, the time series was considered increasing; when negative, was considered descending; and stationary when there was no significant difference between its value and zero. To measure the rate of variation of the line that adjusts the points of the time series, the basic logarithmic transformation 10 of the coefficients (Y) was performed, as it contributes to the reduction of the heterogeneity of the variance of the residuals of the linear regression analysis. [14-18]

RESULTS

Data were analysed for 457,479 hospitalizations broken down by age groups, as described in the Technical Note of DATASUS system 11 "Age group 1 comprises: Under 1 year, 1 to 4 years, 5 to 9 years, 10 to 14 years, 15 to 19 years, 20 to 29 years, 30 to 39 years, 40 to 49 years, 50 to 59 years, 60 to 69 years, 70 to 79 years, 80 years and older and ignored age". Data were analysed for 457,479 hospitalizations registered in the data sus public system, from 2008 to 2018. Of these, there were 112,104 hospitalizations (24.50% of all hospitalizations) in elderly over 60 years of age, according to **Table 1**, according to the IBE classification (IBGE, 2018). This population group had 112,104 hospitalizations (with maximum amounts of 79,795 hospitalizations, minimum of 10 hospitalizations in the analysed period, mean of 10,191.27, median of 406, SD of +/-24,145.76, with 95% CI of 141.34). Referring to the total values attributed to all hospitalizations for immunopreventable diseases analysed in this age group, total R$103,461,788.75 (26.58% of the total values, with maximum values of R$64,700,646.43 in the period analysed, minimum of R$ 2,270.90, average of R$9,405,617.16, median R$1,145,949.60, SD +/- R$ 19,576,854.16, with 95% CI of R$ 3,772.25), according to **Table 2.** Of this population studied, from 2008 to 2018, 51.48% were registered as male and 48.52% female. 71.18% of hospitalizations in this age group were associated with influenza disease; 21.49% to varicella/herpes zoster infection and 4.12% to acute hepatitis B infections. The trend analysis of the time series of hospitalizations related to immunopreventable diseases, in the period from 2008 to 2018, emphasizing the reality of the elderly population (over 60 years) presented a stationary trend (without statistical significance), both for hospitalizations (p-value 0.223 with 95% CI from -0.026 to 0.100) and for the total values referring to these hospitalizations (p-value 0.149 with 95% CI from -0.019 to 0.284).

Table 1. Description of hospitalizations for immunopreventable diseases researched in Brazil, broken down by disease and age group (over 60 years), in the period from 2008 to 2018.

Immunopreventable Disease	60-69 Years	70-79 years	80 years and above
Mumps	99	79	109
Whooping cough	45	38	41
Diphtheria	141	148	117
Yellow fever.	252	54	27

Influenza	23441	27388	28966
Hepatitis b	2616	1442	556
Meningococcal disease	887	532	354
Rubella/German measles	5	3	2
Measles	18	16	7
Neonatals and accidental tetanus	361	192	89
Chickenpox/herpes zoster	7517	8214	8357
Total	35382	38097	38625

Table 2. Description of the total values related to hospitalizations for immunopreventable diseases researched in Brazil, broken down by disease and age group (over 60 years), in the period from 2008 to 2018.

Immunopreventable Disease	Ages		
	60 - 69 years	70 - 79 years	80 years and above
Mumps	R$ 45.747,32	R$ 22.703,21	R$ 33.112,36
Whooping cough	R$ 83.854,19	R$ 77.700,31	R$ 63.884,36
Diphtheria	R$ 391.053,22	R$ 414.719,77	R$ 340.176,61
Yellow fever	R$ 338.766,44	R$ 57.338,77	R$ 24.329,44
Influenza	R$ 19.294.215,10	R$ 22.550.804,62	R$ 22.855.626,71
Hepatitis B	R$ 2.509.042,08	R$ 1.398.213,37	R$ 445.579,87
Meningococcal disease	R$ 2.486.468,38	R$ 1.494.703,67	R$ 779.637,38
Rubella/German measles	R$ 1.279,37	R$ 563,26	R$ 428,27
Measles	R$ 7.909,65	R$ 5.730,48	R$ 1.469,52
Neonatal and accidental tetanus	R$ 2.481.101,47	R$ 1.187.290,92	R$ 410.857,38
Chickenpox/Herpes Zoster	R$ 7.234.072,39	R$ 8.136.352,90	R$ 8.287.055,96
Total	R$ 34.873.509,61	R$ 35.346.121,28	R$ 33.242.157,86

DISCUSSION AND CONCLUSION

In the present study, deaths from immunopreventable diseases were observed, that is, they present effective and widely available means of prevention: vaccines. Within the reality of the elderly population, 112,104 hospitalizations (24.50% of all hospitalizations) were observed in elderly people over 60 years of age, which totalled R$103,461,788.75 (26.58% of the total values of hospitalizations for immunopreventable diseases in the period from 2008 to 2018. These data bring a reality that vaccination coverage in this population is not adequate, because otherwise there would be 112,104 hospitalizations for preventable diseases. In international studies [19] this reality is repeated. There are no data available in the DATASUS system specifically on vaccination coverage in this age group over 60 years, however, the fact that there are hospitalizations and there are direct expenses with hospital care in this population can be considered an indirect indicator that there is an opportunity for improvement in vaccination coverage of the elderly. The elderly population is continuously increasing, so public policies to prevent morbidity and mortality in this age group become increasingly important in the reality of health systems. A high incidence of hospitalizations for influenza, chickenpox, zoster, meningococcal disease and hepatitis B was observed in this study. Reality was also observed in the international literature [20] and influenza and chickenpox infections are among the three main immunopreventable diseases in this age group. It is noteworthy that in the elderly population, there is a greater chance of hospitalizations, complications and deaths from immunopreventable diseases, precisely due to numerous factors such as immunosenescence, comorbidities, drug interaction, among many factors that can lead to the worsening of an infection in an elderly person. The main objective of this manuscript is not to determine the causal relationship for hospital costs for preventable diseases. The merit of this study is that it signals a reality that often goes unnoticed by the managers of the health system and the population: that diseases that are effectively preventable by vaccines still affect the Brazilian population, in a relevant amount, adding financial costs also relevant to the country's public health system, regardless of gender and age (because here in this analysis we observe cases of immunopreventable diseases not only in children, but also in adults and the elderly, a reality observed internationally[21-27] These costs are not showing downward trends, but rather, they are proving stable over the time studied, even though vaccines are available free of charge to the entire population by the National Immunization Program for many years. An opportunity for improvement that is observed is importance of employing awareness campaigns (public and private) for the importance of specific vaccination of this population group. This awareness gains even more importance when observing the drop-in vaccination coverage globally during the 2020/2021 pandemic and falls in the notifications of other immunopreventable diseases 25, predisposing to the resurgence and increase in the incidence of immunopreventable diseases, a reality that is not exclusive to children, but affects the entire world population, regardless of age group or gender. Its important sign that when one people with 60 years and older get sick for a preventable disease, his family and his community suffer with this situation. This is a commitment that must be made by all countries, because immunizing the population is an investment to create a healthier, safer and more prosperous future for all, as the WHO [27,28] guides.

LIMITATIONS OF THE STUDY

All studies based on public secondary databases have the limitation, already known, of underreporting and underreporting of the analyzed system itself, because these are dependent on the databases being fed by the employees responsible for the system. In the case of the SUS, these data are feeders in a decentralized manner and regionalized by States and Municipalities. However, despite the notorious underutilization of the system, these are the official data that are used for the development of public health policies in Brazil.

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