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Increase in the burden of dengue in Brazil and federated units, 2000 and 2015: analysis of the Global Burden of Disease Study 2015

Aumento da carga de dengue no Brasil e unidades federadas, 2000 e 2015: análise do Global Burden of Disease Study 2015

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ABSTRACT: *Objective:* To describe the main metrics on dengue generated by Global Burden of Disease (GBD) Study 2015, for Brazil and its 27 federated units, in the years 2000 and 2015. *Methods:* The metrics described were: incidence and mortality rates by dengue, standardized by age, years of life lost (YLL), years lived with disability (YLD), and disability-adjusted life years (DALY) (in absolute frequency and age-standardized rates). The estimated metrics were presented with uncertainty intervals (UI 95%) for the years 2000 and 2015, accompanied by the relative percentages of changes. *Results:* The number of cases increased 232.7% and the number of deaths increased 639.0% between 2000 and 2015 in the country. The incidence rate varied 184.3% and the mortality rate was low, but with an increase of 500.0% in the period evaluated. The YLL, YLD, and DALY rates increased 420.0, 187.2, and 266.1%, respectively. In 2015, DALY was similar among women and men (21.9/100,000). The DALY increased more than double in all the Brazilian federated units. *Conclusion:* The marked increase in dengue over the years is associated with the introduction and/or circulation of one or more serotypes of the transmitter virus and an increasing proportion of patients affected by the severe form of the disease. Despite the low mortality rate of the disease in comparison between the years of study, the disease contributes to the loss of healthy years of life in Brazil as it affects a large number of people, from all age groups, causing some degree of disability during the infection and deaths, especially, in children.

Keywords: Dengue. Incidence. Mortality. Population estimates. Brazil.

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RESUMO: *Objetivo:* Descrever as principais métricas sobre dengue geradas pelo *Global Burden of Disease* (GBD) *Study* 2015, para o Brasil e suas 27 unidades federadas, nos anos de 2000 e 2015. *Métodos:* As métricas descritas foram: taxas de incidência e de mortalidade por dengue, padronizadas por idade, *years of life lost* (YLL), *years lived with disability* (YLD) e *disability adjusted life years* (DALY) (frequência absoluta e taxas padronizadas por idade). As métricas estimadas foram apresentadas com intervalos de incerteza (II 95%) para 2000 e 2015, acompanhadas da variação relativa percentual. *Resultados:* Verificou-se aumento de 232,7% no número de casos e de 639,0% no número de mortes entre os anos de 2000 e 2015 no país. A taxa de incidência variou 184,3% e a taxa de mortalidade mostrou-se baixa, mas com aumento de 500,0% no período avaliado. As taxas de YLL, YLD e DALY aumentaram 420,0, 187,2 e 266,1%, respectivamente. Em 2015, DALY foi semelhante entre mulheres e homens (21,9/100.000). O DALY aumentou mais que o dobro em todas as unidades da federação. *Conclusão:* O aumento acentuado de dengue ao longo dos anos associa-se à introdução e/ou circulação de um ou mais sorotipos do vírus e crescente proporção de pacientes acometidos pela forma grave da doença. Apesar da baixa taxa de mortalidade, a dengue contribui para considerável perda de anos saudáveis de vida no Brasil por acometer elevado número de pessoas, de todas as faixas etárias, ocasionando algum grau de incapacidade durante a infecção sintomática, e em razão dos óbitos, principalmente, em crianças.

Palavras-chave: Dengue. Incidência. Mortalidade. Estimativas de população. Brasil.

INTRODUCTION

Dengue, a tropical neglected disease, considered the vector-borne disease with the greatest growth in the world, occurs in 128 countries, putting approximately 4 billion people at risk[1,2]. It is an acute, infectious, non-contagious, systemic disease of viral etiology, caused by four serotypes of the dengue virus (DENV) (DENV-1, DENV-2, DENV-3, and DENV-4) belonging to the *Flavivirus* genus, *Flaviviridae* family. The virus is transmitted by the bite of female mosquitoes of the *Aedes* genus, *Aedes aegypti* being its primary vector, which is spread in tropical and subtropical regions of the world, predominantly in urban and semi-urban areas[3].

In recent years, between 50 and 100 million apparent cases per year and 22,000 deaths by dengue are estimated, especially among children[4,5]. The estimates vary and, according to a recent model, approximately 390 million (confidence interval of 95% (95%CI) 248–528) people are infected annually, of which 96 million people are apparent infections[6]. The analysis of the Global Burden of Disease (GBD) Study of 2013 estimated 8.3 million (uncertainty interval of 95% (95% UI) 3.3–17.2) apparent cases of dengue, in 1990, and 58.7 million (95% UI 23.6–121.9) in 2013[5]. There was also a mean of 9,221 deaths per year between 1990 and 2013, ranging from the lowest value of 8,277 (95% UI 5,353–10,649) in 1992 to the highest one of 11,302 (95% UI 6,790–13,722) in 2010. In 2013, the disability due to acute, moderate, and severe cases of dengue, and cases of post-dengue chronic fatigue contributed to the loss of 566,000 years of healthy life (95% UI 186,400–1,414,600) and resulted in 576,900 years of life lost to premature death attributed to the disease (95% UI 330,000–701,200)[5]. In the Americas, the Panamerican Health Organization reported, in 2016, 2,249,842 cases of dengue, 64.5% of which in Brazil[7].

However, estimates of dengue do not reveal the actual occurrence of the disease owing to the underreporting of cases[5]. The symptomatic cases of dengue present a wide variation in the disease spectrum and approximately 70% of patients do not seek treatments[6].

In Brazil, the first dengue epidemic, clinically and laboratorially documented, occurred in 1981 and 1982, and was associated to serotypes DENV-1 and DENV-4. Within the last decades, the country has experienced four major epidemics, associated with the predominant viral serotype: DENV-1, DENV-3, DENV-2, and DENV-4, in 1998, 2002, 2008, and 2010, respectively[8]. In the past few years, dengue epidemics were caused by the circulation of more than one serotype[9-11]. In 2015, 1,649,008 cases of dengue were reported in the country. The southeast region had the highest number of reported cases (1,026,226 cases, 62.2%), followed by the northeast (311,519 cases, 18.9%), mid-west (220,966 cases, 13.4%), south (56,187 cases, 3.4%), and north (34,110 cases, 2.1%) regions[9]. In January and September 2016 (up to the 37th epidemiological week), 1,438,624 confirmed cases of dengue throughout the country were reported to the Ministry of Health, of which 762 cases were severe and 7,449 cases with alarm signals[12]. As it is a disease with epidemics of great proportions and difficult control in urban environments, studies on the quantification of dengue burden in Brazil, which are still scarce, would allow a more adequate analysis of the dimensions of the disease and their impacts[13-15]. The GBD initiative is a descriptive epidemiologic study which, since 1990, has the objective of quantifying and comparing the magnitude of health loss due to diseases, injuries, and risk factors by location, gender, and age, at specific moments in time[16].

This study analyzed the main metrics on dengue generated by GBD 2015, for Brazil, describing the situation of the disease in the 27 federated units in the years 2000 and 2015.

METHODS

GBD 2015 includes multiple evaluations of the disease burden from 1990 to 2015. The estimates presented in this article were obtained by observation of the results from the Institute for Health Metrics and Evaluation[16].

This study describes the metrics generated by GBD 2015 on dengue, for Brazil and their federated units, in 2000 and 2015. The methods used by GBD 2015 were detailed in previous publications[16-20].

For Brazil, the main source of information on deaths is based on the Ministry of Health's Mortality Information System (*Sistema de Informações sobre Mortalidade* – SIM), adjusted by other national and international sources. For the GBD 2015 estimates of mortality[17], a list with 247 specific causes was used, presenting hierarchical structure, with levels of aggregation and mutually exclusive categories of causes. Details on the groups of death causes were obtained by the ninth and tenth reviews of the International Statistical Classification of Diseases and Health Related Problems (ICD10 A90-A91), and the errors in classification were previously described[17]. The modeling for mortality by dengue used the data from the

database for basic causes of death and the modeling tool for joint causes of death (Ensemble)[5]. In short, the covariates were selected based on the associations expected for mortality by dengue, according to published scientific evidence and biological plausibility. Among these covariates, some environmental variables (precipitation, proportion of population living between 15° north and 15° south, proportion of population living below 100 m altitude and proportion of population living in urban areas), and variables related to the level of development of each country (*per capita* income, access to the health system, and average years of education) were included. Finally, the mean probability of transmission by the virus of dengue, weighted by the population, was included[6]. In the GBD 2015 study, it was estimated, first, the mortality by all causes and, next, by age, gender, and year[5,19].

The main sources of data in Brazil for morbidity are Notifiable Disease Information System (*Sistema de Informação de Agravos de Notificação* – SINAN), Hospital Information System of the Unified Health System (*Sistema de Informações Hospitalares do Sistema Único de Saúde* – SIH/SUS), and Outpatient Information System of the Unified Health System (*Sistemas de Informações Ambulatoriais do Sistema Único de Saúde* – SIA/SUS). Among others, the estimates of the Annual Reported Cases of Dengue in the Americas (PAHO) and bibliographical references, comprehensively and exhaustively researched, on the prevalence of diseases in Brazilian population-based studies are also used.

The correction of underreporting used a three-phased modeling. First, the spatial distribution expected for the disease (dengue) was used, based on principal components analysis of the population-weighted probability of dengue transmission and model-based estimates of dengue mortality. Next, the association between the expected distribution and the incidence observed was modeled by mixed effect negative binomial, with the premise that the expected deviations in distribution are a reflex of the completeness of the reported data. The model was calibrated by benchmarking these deviations against the factors of empiric expansion, based on published data. The total cases of dengue was modeled by country and year, and distributed into age–gender groups, based in the cases of dengue captured by SIH/SUS in Brazil[5,6,19].

The three estimates for burden of disease were analyzed: years of life lost (YLL) – years of life lost by premature death; years lived with disability (YLD); and disability-adjusted life year (DALY) – years of life lost by premature death or disability. YLL expresses the effect of premature deaths in the population and results from the multiplication of the number of deaths by dengue for each age range by the higher life expectancy at this age, regardless of gender. Life expectancy is based on a theoretical composition of the table, in which the life-goal perspective for each age is the same as the higher life expectancy reported among people of this age in any country. YLD expresses the sum of prevalence of each one of the sequelae related to dengue, multiplied by weighting of disability or incapacity. DALY is calculated with the sum of YLL and YLD[17,18,20].

One out of two acute health conditions were attributed for each dengue case: 94.5% of cases were considered as disability for "infectious diseases, moderate acute episode," with mean duration of 6 days; and 5.5% was considered a disability for "infectious disease, severe acute

episode", with mean duration of 14 days. The proportions for division between moderate and severe cases were defined from a meta-analysis of the subset of data, which also presented the total number of cases and also the number of severe cases (defined as hemorrhagic dengue fever or dengue shock syndrome). The definition of severe case corresponded to the description of episode of severe acute infectious disease in the context of weight of disability and not to the case of severe dengue by the World Health Organization (WHO)[21]. In addition to that, 8.5% of cases were included as post-dengue chronic fatigue, and the weight of disability was attributed to "infectious diseases with post-acute consequences," with mean duration of six months[5,19].

The metrics analyzed in this article were incidence and mortality by dengue rates, which were standardized by age, YLL, YLD, and DALY (absolute frequency and age standardized rates). The estimated metrics were presented with their respective 95% UI. The estimates were presented for the years of 2000 and 2015, accompanied by their relative change percentages.

RESULTS

Table 1 presents the main metrics for dengue and the percentage variation between 2000 and 2015. An increase of 232.7% in the number of cases and of 639.0% in the number of deaths was observed. The incidence rate ranged 184.3% and the mortality rate was low,

Table 1. Number of cases of death by dengue. Standardized rates of incidence and mortality, years of life lost, years lived with disability e disability-adjusted life years, relative change, and uncertainty interval of 95% in Brazil between 2000 and 2015.

Indicators	Absolute number (95% UI)		Relative change (%)	Rate per 100,000 (95% UI)		Relative change (%)
	2000	2015		2000	2015	
Cases	790,834 (571,689.1 – 1,073,542.9)	2,631,767 (2,280,618.1 – 3,054,259.2)	232.7	446.6 (322.6 – 606.6)	1,269.1 (1,100.3 – 1,473.5)	184.3
Deaths	68 (59.5 – 109.4)	504 (248.9 – 689.3)	639.0	0,04 (0.03 – 0.06)	0.24 (0.12 – 0.33)	500.0
YLL	3,485 (3,042.6 – 5,441.3)	21,581 (10,205.5 – 29,484.1)	519.2	2.0 (1.7 – 3.1)	10.7 (5.0 – 14.5)	420.0
YLD	7,059 (3,521.9 – 12,403.6)	23,366 (12,725.2 – 39,194.5)	231.0	3.9 (2.0 – 7.1)	11.2 (6.1 – 18.9)	187.2
DALY	10,544 (6,861.2 – 16,226.4)	44,948 (28,527.6 – 63,214.0)	326.2	5.9 (3.9 – 9.1)	21.9 (13.7 – 30.4)	266.1

YLL: years of life lost; YLD: years lived with disability; DALY: disability-adjusted life years; 95% UI: uncertainty interval of 95%.

though with an increase of 500.0% in the period evaluated. DALY, YLL, and YLD rates per 100,000 inhabitants and standardized by age, increased 266.1, 420.0, and 187.2%, respectively. In 2015, the DALY rates were similar among women (21.9/100,000; UI 95% 13.3–32.4) and men (21.9/100,000; UI 95% 11.5–30.6).

Figure 1A shows the mortality rates by dengue per 100,000 inhabitants, by age range in Brazil, in 2000 and 2015. The mortality rate by dengue increased in the period evaluated in all age ranges. In 2015, the higher estimates for mortality rates were reported among children younger than 1 year of age (0.70) and elderly (ranging from 0.42, age range of 65–69 years, to 1.76, from 80 years of age on).

Figure 1B presents the rates of years of life lost by premature death (YLL per 100,000 inhabitants) by dengue. The higher rates were observed in children younger than 1 year of age, 11.8 and 59.9 in 2000 and 2015, respectively. It is noteworthy that, in this period, the increase was 407.6%. Figure 1C shows the burden of dengue due to the years lived with
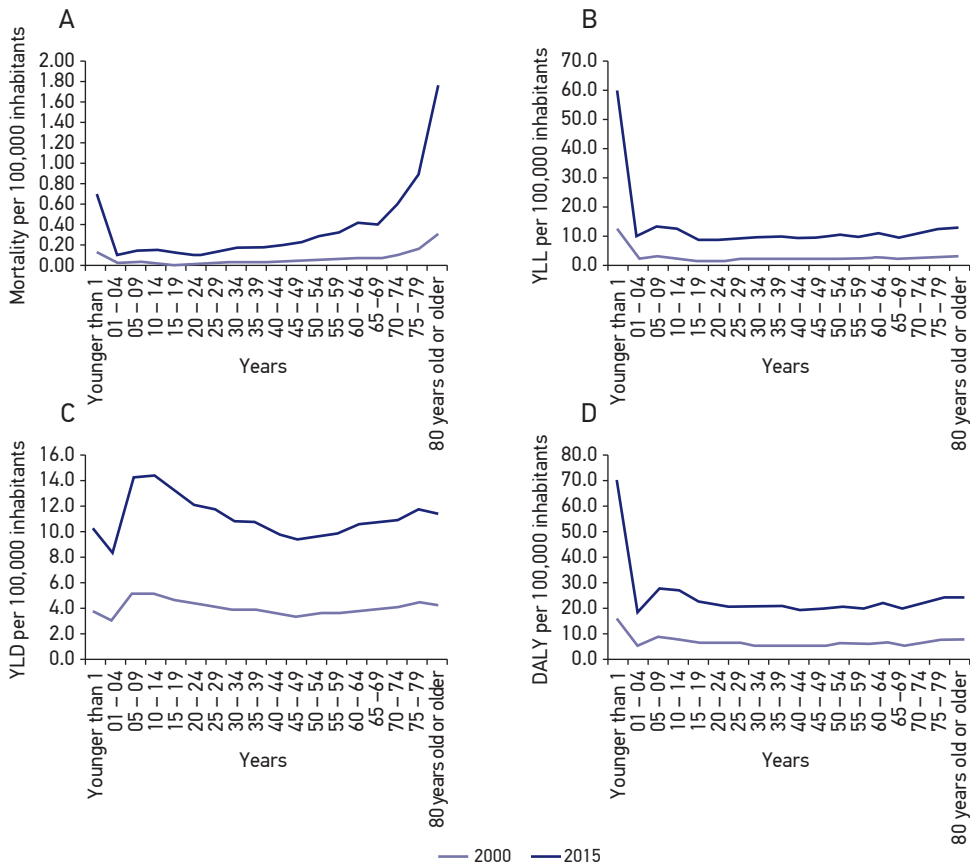
YLL: *years of life lost*; YLD: *years lived with disability*; DALY: *disability adjusted life years*.

Figure 1. Adjusted mortality rates (A) years of life lost; (B) years lived with disability; (C) disability adjusted life years; (D) per 100,000 for dengue Global Burden of Disease Brazil, 2015.

disability (YLD per 100,000 inhabitants). In 2015, the highest rates of YLD were observed in the age range between 5 and 19 years of age, ranging from 13.1 to 14.3.

Figure 1D presents the loss of healthy years of life due to premature death or disability by dengue (DALY per 100,000 inhabitants) according to age ranges. Between 2000 and 2015, the values of DALY increased in all age ranges. The higher values were observed for children younger than 1 year of age: in 2000 (15.3) and 2015 (70.1), corresponding to an increase of 358.2%. After this age, in both years evaluated, a decline of DALY in the age range of 1–4 years of age, and increase in the age range of 5–9 years of age, and stabilization of the DALY values in the subsequent ranges were observed.

Table 2 shows estimated values of DALY per 100,000 inhabitants in Brazilian states and relative variations between 2000 and 2015. In this period, the DALY more than doubled in all Brazilian states. The lowest increases are found in states of the south of the country — Santa Catarina (116.7%) and Rio Grande do Sul (176.1%). In the remaining states, the increase ranged from 200.0% (São Paulo, Southeast region) to 415.0% (Tocantins, North region). The highest increase percentages were in north (Acre – 378.8, Amapá – 365.6%, Rondônia – 327.8%, and Roraima – 313.6%); northeast (Bahia – 326.1%, Ceará – 322.3%, Piauí – 347.9%, and Rio Grande do Norte – 331.0%); and mid-west (Mato Grosso – 347.8%, Mato Grosso do Sul – 325.0%) regions. These data had greater relative variation than the average of the country in the period (266.1%; Table 1). In the southeast region, the increases ranged between 200.0% in São Paulo and 281.4% in Rio de Janeiro.

DISCUSSION

The dengue situation in Brazil have changed significantly throughout the last decades, with an alarming increase in the number of people affected by a succession of epidemics associated to the introduction and/or circulation of one or more serotypes of the etiological agent and growing proportion of patients affected by the severe form of the disease[10,22,23].

The Program of Dengue Control failed in controlling the vector in the country[15]. From 2000 to 2015, there was a considerable growth in dengue burden in Brazil, with the increased number of cases of death, incidence, and mortality rates, YLL, YLD, and DALY. During this period, the increased incidence of dengue (184.3%) is in contrast to the tendency to decrease of the burden of communicable diseases in Brazil, which has advances in the process of epidemiological transition, with increased burden of non-communicable chronic diseases[15,24].

Between 2000 and 2015, the mortality rate by dengue increased 500.0%, varying from 0.04 to 0.24 deaths per 100,000 inhabitants, though it is still considered low. Despite its acute nature and the low mortality rate, dengue is a great contributor to the loss of healthy years of life in Brazil, which corresponded to 44,948 years in 2015. This year, the DALY for dengue (21.9/100,000; 95% UI 13.7–30.4) contributed with 11.0% for the DALY of neglected tropical diseases and malaria (195.9/100,000; 95% UI 160.6–246.0), group in which dengue is included[16,17,25]. This may be explained by the elevated number of people, in all age ranges, with some degree

Table 2. Disability-adjusted life years per 100,000 inhabitants for dengue and percentage variation in Brazilian states between 2000 and 2015.

States per region	Years (95% UI)		Relative change (%)
	2000	2015	2000 x 2015
North region			
Acre	5.2 (3.5 – 7.7)	24.9 (8.6 – 38.4)	378.8
Amapá	9 (5.2 – 14.3)	41.9 (13.7 – 65.3)	365.6
Amazonas	4.9 (3.1 – 7.8)	19.3 (10.3 – 28.0)	293.9
Pará	6.7 (4.1 – 10.8)	24.5 (13.9 – 37.7)	265.7
Rondônia	7.2 (4.6 – 11.1)	30.8 (12.1 – 46.4)	327.8
Roraima	8.1 (5.0 – 12.9)	33.5 (12.1 – 49.7)	313.6
Tocantins	4 (2.7 – 6.1)	20.6 (8.9 – 30.1)	415.0
Northeast region			
Alagoas	9 (5.1 – 14.9)	34.5 (20.8 – 52.9)	283.3
Bahia	4.6 (3.0 – 7.2)	19.6 (11.2 – 28.8)	326.1
Ceará	9.4 (5.9 – 15)	39.7 (20.2 – 60.1)	322.3
Maranhão	12.4 (6.9 – 19.4)	41.3 (18.4 – 61.2)	233.1
Paraíba	5.7 (3.3 – 9.7)	21.6 (13.0 – 33.1)	278.9
Pernambuco	6.8 (4.1 – 11.2)	26.3 (16.2 – 39.6)	286.8
Piauí	4.8 (3.0 – 7.8)	21.5 (12.7 – 31.5)	347.9
Rio Grande do Norte	8.7 (5.5 – 13.9)	37.5 (17.5 – 57.3)	331.0
Sergipe	11 (6.6 – 18.1)	42.5 (21.7 – 64.8)	286.4
Mid-west region			
Distrito Federal	3.7 (2.2 – 6.2)	11.5 (7.3 – 17.2)	210.8
Goiás	9.2 (5.6 – 14.7)	37.3 (17.5 – 55.9)	305.4
Mato Grosso	8.1 (5.1 – 12.5)	36.1 (13.5 – 55.8)	345.7
Mato Grosso do Sul	6.8 (4.3 – 11)	28.9 (14.9 – 43.4)	325.0
Southeast region			
Espírito Santo	9.2 (5.3 – 15.9)	33.1 (18.6 – 51.0)	259.8
Minas Gerais	5.3 (2.8 – 9.0)	18.2 (11.0 – 28.5)	243.4
Rio de Janeiro	9.7 (5.6 – 16.5)	37 (20.9 – 56.9)	281.4
São Paulo	4.4 (2.2 – 7.5)	13.2 (7.5 – 22.4)	200.0
South region			
Paraná	2.3 (1.3 – 4.1)	7.6 (4.5 – 11.8)	230.4
Rio Grande do Sul	2.2 (1.2 – 4.1)	6.1 (2.9 – 11.8)	177.3
Santa Catarina	1.8 (1.0 – 3.3)	3.9 (1.8 – 8.7)	116.7

95% UI: uncertainty interval of 95%.

of disability during the symptomatic infection and deaths, especially, of children. In 2000, premature deaths (YLL) contributed with 34.0% of the DALY by dengue, and disabilities (YLD) contributed with 66%. In 2015, these indicators contributed with 49.0 and 51.0%, respectively. This growth in YLL between 2000 and 2015 expresses an increase in the number of deaths by dengue (639.0%), higher than the increase in the number of cases (233.0%). Furthermore, the mortality rate among children younger than 1 year of age has a great impact in YLL.

The increase of 266.1% in the DALY of dengue, between 2000 and 2015, reinforces its position as an important public health issue in Brazil. This percentage of increase, when compared with other countries in Latin America, was higher than the one found in Peru (123.1%), Colombia (91.6%), Ecuador (91.6%), and Venezuela (80.4%); lower than the percentages of increase in Bolivia (366.6%) and Paraguay (803.5%); and similar to the one of Argentina (326.7%) in the same period[16].

In Brazil, elevated mortality rates by dengue have been observed in extreme age ranges (children younger than 1 year of age and elderly aged 56 years old or older). However, since the first epidemics, the highest incidence rates of the disease occurred among young adults. As of 2006, some states presented the recirculation of the type 2 dengue virus (DENV-2) after some years of predominant serotype DENV-3. This change of serotypes is believed to be responsible for the increase, from 2007 on, in the number of severe cases among children[26-29]. However, it is possible that the introduction of DENV-4 has postponed this tendency according to the arguments supported by the models of viral susceptibility[29]. In the state of Minas Gerais, after the introduction of DENV-4, in 2011, despite the greater proportion of cases occurring in patients aged between 15 and 49 years, the highest mortality rates occurred among patients aged 50 years or more. The risk of death, in this group, is associated to the difficulty in handling the disease in a population with high frequency of comorbidities[30]. In addition to that, in areas where the occurrence of dengue is relatively new, such as in Minas Gerais and in most part of Brazil[31], older people are not entirely immune and therefore, they have an increased risk of secondary infection[32] and, consequently, greater risk of a more severe disease.

In Brazil, the co-circulation of viral serotypes of dengue is frequent, with alternated predominant serotypes. For instance, in 2015, among the 23,976 samples processed for viral isolation, 39.3% of them were positive, with predominance of DENV-1 (94.1%), followed by DENV-4 (4.8%), DENV-2 (0.7%), and DENV-3 (0.4%)[33]. In 2016, the country went through a severe public health situation associated to the simultaneous circulation of two other emerging arboviruses: Zika and Chikungunya. The co-circulation of these three arboviruses (DENV, CHIKV e ZIKV), which is facilitated by having the *Aedes* mosquito as the main vector, hinders the management of clinical patients, increases mortality and morbidity of more vulnerable populational groups, such as elderly, pregnant women, and children, and hinders laboratorial diagnosis. In addition, the same vector also transmits the yellow fever virus. Still in 2015, there was an unexpected increase in microcephaly cases associated with intrauterine exposure to Zika virus[34-37]. In February 2016, this severe epidemiological situation, after occurrence of a similar situation in French Polynesia, in 2014, was declared a public health emergency of international concern (PHEIC) due to possible associations to Zika virus[38].

Besides being a public health problem, dengue have a significant economic and social impact in the country. It was estimated that the cost of morbidity and mortality by dengue in Brazil, between 2001 and 2005, was US$ 322 million and that, on average, it led to a loss of 1,391.68 potential years of life[39]. The economic impact of dengue in different regions in Brazil for the epidemic period between 2012 and 2013 was US$ 371 million (90% CI 349–590) or US$ 1,212 million (90% CI 904–1.526) after adjustment for underreporting[40].

The mortality rates and estimated incidences in Brazil for dengue in the years evaluated differ in magnitude from those estimated by GBD 2015. The incidence rate of dengue, in 2015, estimated by the Ministry of Health (813.3/100,000), was a little lower than the one estimated for GBD 2015 (1,269.1/100,000) in the same year[33]. The mortality rates for dengue in the years of 2000 and 2015 (0.04 and 0.24/100,000) differ from those calculated for 2000 (0.14/100,000 inhabitants)[22] and the mean rate estimated for the period 2000–2011 (0.16/100,000 inhabitants)[41]. These differences may be explained by the use of distinct methodologies. The GBD 2015 combined multiple sources of data and available evidence on the incidence of deaths by dengue, including the probability of dengue occurrence, adjustments for underreporting, and substantial refinements of the models for estimating incidence and mortality[5]. However, limitations due to the quality of surveillance systems may compromise the estimates, especially in Brazilian regions.

CONCLUSIONS

The results allowed the better understanding the burden of dengue in the country and federated units, according to the metrics estimated by the GBD 2015. The epidemics of dengue throughout the years have been associated to the introduction and/or alternate circulation of one or more serotypes of the virus, in addition to the increased number of patients affected by severe forms of the disease. This analysis is a contribution to health policies, which should prioritize the prevention and appropriate management of patients in order to reduce the burden of dengue in the country.

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