https://doi.org/10.1590/0004-282X20200059

ARTICLE

Dementias in Brazil: increasing burden in the 2000–2016 period. Estimates from the Global Burden of Disease Study 2016

Demências no Brasil: aumento da carga no período de 2000 a 2016. Estimativas do Estudo Carga Global de Doenças 2016

Simone Cecília de MELO[1], Ana Paula Silva CHAMPS[2], Rúbia Ferreira GOULART[1], Deborah Carvalho MALTA[3], Valéria Maria de Azeredo PASSOS[1,3]

ABSTRACT

Introduction: Dementia is a globally relevant health problem, which places a great burden on patients and their families. This study aimed to estimate the burden associated with Alzheimer's disease (AD) and other dementias in Brazil. **Methods:** In this descriptive study, we investigated the estimates obtained by the Global Burden of Disease study. We described the prevalence of AD and other dementias, years lived with disability (YLDs), age-standardized mortality, years of life lost (YLLs), and disability-adjusted life years (DALYs) among individuals aged 60 years or older between 2000 and 2016, with their respective 95% uncertainty intervals (95%UI). **Results:** During this period, the age-standardized prevalence of AD and other dementias per 100,000 people increased by 7.8%, from 961.7 (95%UI 828.3–1,117.5) to 1,036.9 (95%UI 882.0–1,219.5), with approximately 1.5 million people living with dementia in Brazil. The incidence increased by 4.5%. Similarly, all age-standardized rates had an upward trend (mortality: 3.1%; YLLs: 5.8%; YLDs: 7.9%; and DALYs: 6.3%). Mortality profiles increased with age in both years. Dementias were ranked fourth among the leading causes of death in people aged ≥70 years in 2000, rising to second place in 2016. In 2016, it also represented the second and third leading causes of disability among older women and men, respectively. **Conclusion:** Population growth and aging have resulted in an increased burden of AD and other dementias in Brazil. Preventive and early diagnostic measures are essential to mitigate the burden associated with these diseases.

Keywords: Dementia; Alzheimer's Disease; Burden of Disease; Epidemiology.

RESUMO

Introdução: A demência é um problema de saúde globalmente relevante, com grande carga para os pacientes e suas famílias. Este estudo teve como objetivo estimar a carga associada à doença de Alzheimer (DA) e outras demências no Brasil. **Métodos:** Neste estudo descritivo, foram avaliadas as estimativas obtidas pelo estudo de Carga Global de Doença (*Global Burden Disease*). Descrevemos a prevalência de DA e outras demências, anos vividos com incapacidade (AVIs), mortalidade padronizada por idade, anos de vida perdidos por morte prematura (AVPs) e anos de vida perdidos ajustados por incapacidade (AVAIs), com respectivos intervalos de incerteza de 95% (95%II), em idosos com 60+ anos, entre 2000 e 2016. **Resultados:** No período, a prevalência padronizada por idade de DA e de outros tipos de demência aumentou 7,8%, de 961,7 (95%II 828,3–1.117,5) para 1.036,9 (95%II 882,0–1.219,5) por 100.000 pessoas, com aproximadamente 1,5 milhão de pessoas vivendo com demência no Brasil. Houve um aumento de 4,5% na incidência. Todas as taxas padronizadas por idade apresentaram tendência de aumento (mortalidade: 3,1%; AVPs: 5,8%; AVIs: 7,9%; e AVAIs: 6,3%). Os perfis de mortalidade demonstraram aumento com o envelhecimento, em ambos os anos. As demências ocuparam o quarto lugar entre as principais causas de morte em pessoas com 70+ anos em 2000, subindo para a segunda posição em 2016. Em 2016, também representou a segunda e terceira principais causas de incapacidade entre mulheres e homens mais velhos, respectivamente. **Conclusões:** O crescimento e envelhecimento populacional resultaram em aumento da carga de DA e de outras demências no Brasil. Medidas preventivas e de diagnóstico precoce são essenciais para atenuar a carga associada a essas doenças.

Palavras-chave: Demência; Doença de Alzheimer; Carga da Doença; Epidemiologia.

[1]Faculdade de Ciências Médicas de Minas Gerais, Belo Horizonte MG, Brazil.

[2]Hospital Sarah Belo Horizonte, Belo Horizonte MG, Brazil.

[3]Universidade Federal de Minas Gerais, Belo Horizonte MG, Brazil.

Simone Cecília de MELO https://orcid.org/0000-0003-2022-0783; Ana Paula Silva CHAMPS https://orcid.org/0000-0003-2557-8813; Rúbia Ferreira GOULART https://orcid.org/0000-0002-1941-0398; Deborah Carvalho MALTA[3] https://orcid.org/0000-0002-8214-5734; Valéria Maria de Azeredo PASSOS https://orcid.org/0000-0003-2829-5798

Correspondence: Valéria Maria de Azeredo Passos; E-mail: passos.v@gmail.com

Conflict of interest: There is no conflict of interest to declare.

Support: The Bill & Melinda Gates Foundation supported the GBD-2016 study. The Brazilian Ministry of Health and the Brazilian National Health Fund (Fundo Nacional de Saúde, grant 25000192049/2014-14) supported the GBD-Brasil study.

Authors' contribution: SCM: contributed to the investigation, formal analysis and writing of the original draft. APSC: contributed to the investigation, formal analysis and review of the original draft. RFG: contributed to formal analysis and review of the original draft. DCM: contributed to the funding acquisition, conceptualization, and review of the original draft. VMAP: contributed to the conceptualization, investigation, methodology, formal analysis, supervision, and writing of the original draft.

Received on January 28, 2020; Received in its final form on April 30, 2020; Accepted on May 31, 2020.

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Dementia is a neurological condition that results in a great burden to patients and their families[1,2]. By 2015, around 40 million people in the world had been living with dementia. This figure is estimated to double by 2040, with lower socioeconomic status (SES) countries as home to most dementia patients. The increasing dementia population is a great concern for health professionals and policymakers worldwide[1,2].

Although the main causes of dementia — Alzheimer's disease (AD) and vascular dementia — are strongly associated with non-modifiable risk factors such as advancing age and positive family history, they are also related to preventable conditions such as atherosclerotic disease, cardiovascular disease, diabetes, and dyslipidemia[3]. In 2016, Brazil's leading risk factors related to the burden of chronic noncommunicable diseases were obesity, systolic hypertension, and hyperglycemia; all of them are associated with dementia risk and preventable[4].

The Global Burden of Disease (GBD) study investigates the burden of diseases worldwide, using a standardized methodology that allows spatial and timely comparisons of estimates. Since 1990, this study has annually described the loss of health due to more than 300 diseases across 195 countries, facilitating comparisons between regions, countries, and states. Loss of health is expressed by "disability-adjusted life years" (DALYs) — the potential years of life lost due to death or disability — which combines information on mortality and morbidity[5,6].

Estimates of dementia in Brazil varied greatly, even when only results of population-based or community-dwelling studies were taken into consideration. In some studies, the prevalence of dementia among Brazilian people aged 65 years or older was similar to that observed in other Latin American countries (around 7%)[7,8]. Most Brazilian studies were conducted in the state of São Paulo. The prevalence rates of dementia among patients aged 60 years or older in the cities of Ribeirão Preto[9], São Paulo[10], and Tremembé[11] were 12.5, 12.9, and 17.5%, respectively. In a small city in the state of Minas Gerais, the figure for those aged 75 years and older was 27.5%[12]. Incidence studies are scarce. The incidence of dementia among random-selected older adults (≥65 years) was around 14 per 1,000 person-years, twice as high as the estimate for AD[13,14,15]. A higher incidence of AD (14.8, 95% confidence interval [95%CI] 9.04–22.94) was found among community-dwelling older adults (≥60 years) from Porto Alegre[16]. These differences may reflect the lack of standardization concerning study design, diagnosis of dementia, age composition of the populations, and year of data collection.

Understanding the spatial distribution and temporal trend of the burden of dementia is the first step to implement preventive and therapeutic measures. Using the estimates of the GBD-2016 study, this investigation aimed to determine the burden of AD and other dementias in Brazil and its regions.

METHODS

This study aimed to describe the GBD-2016 estimates of the burden of AD and other dementias. All estimates derived from national and subnational data obtained and analyzed through the collaboration of a Brazilian network of researchers, the Brazilian Ministry of Health, and the Institute of Health Metrics and Evaluation (IHME) of the University of Washington[17]. In our study, we only used demographic and health data from the Brazilian population aged 60 years and older between 2000 and 2016 because they are more reliable than those collected in the earlier period of 1990–2000.

To express the diversity of the burden of disease across the five regions in the country, we presented the metrics of the two states of each region with the highest proportion of older people according to the 2010 census[18]: 1) North Region: Pará (7.0%) and Rondônia (6.3%); 2) Northeast Region: Paraíba (11.9%) and Bahia (10.3%); 3) Southeast Region: Rio de Janeiro (13%) and São Paulo (9.7%); 4) South Region: Rio Grande do Sul (13.6%) and Paraná (11.2%); and 5) Midwest Region: Mato Grosso do Sul (9.7%) and Goiás (9.3%).

Although GBD estimates are annually provided, we investigated Brazilian estimates from GBD-2016, as a detailed description of methodology and a comprehensive worldwide analysis of AD and other dementias were performed with these estimates[19]. Dementia was defined based on the codes of the Diagnostic and Statistical Manual of Mental Disorders, 4th and 5th editions (290, 291.2, 291.8, 294, and 331), and the International Classification of Diseases (F00, F01, F02, F03, G30, and G31), 8-10th editions[19]. Unlike most disease definitions used in the GBD study, the estimates of AD and other dementias were analyzed and modeled together, without considering specific causes[19].

Demographic and vital data for mortality analysis were mainly provided by the Brazilian Institute of Geography and Statistics and the Mortality Information System (Brazilian Ministry of Health)[17]. Primary mortality data were adjusted first for underreporting and then for garbage codes. The methods for adjusting death underreporting were described by Foreman et al.[20]. Codes that should not be considered basic causes of death, including ill-defined causes (stated in Chapter XVIII), are classified as garbage codes. They are redistributed to other defined causes called target diseases. All garbage codes are redistributed to target diseases using statistical algorithms, judgments based on literature reviews, or proportional distributions. Details of the modeling and model validation were also published[20,21]. Besides the absolute number of deaths and standardized mortality by year, gender, and age, the metric years of life lost (YLLs) expresses the effect of premature deaths, which is obtained by multiplying the number of deaths by the years lost before the standard life expectancy in each age group. Life expectancy was determined based on the reference life table of the GBD study[21].

The number of years lost due to disability (YLDs) is calculated by multiplying the prevalence of each disease sequela by its disability weight[6,19]. Three sequelae and their respective disability weights derived from a systematic review of seven studies using the Clinical Dementia Rating (CDR) Scale: mild (CDR1), moderate (CDR2), or severe (CDR3) dementia[19]. All data on the prevalence, incidence, and association with AD and other dementias included Brazilian population-based studies[7,8,9,10,11,12,13,14,15] to model the estimates. The data are available at http://ghdx.healthdata.org/gbd-2016/data-input-sources.

Age-standardized rates were directly standardized by the age structure of the world population used by the GBD study. The metrics are presented with 95% uncertainty intervals (95%UIs). Uncertainties may stem from data sources and modeling steps, such as sample size variability, adjustments for mortality sources, parameter uncertainty in model estimation, specification of uncertainty for causes of death models, and differences in data availability by age, gender, year, and location[6]. To determine the UIs, all GBD metric calculations were performed 1,000 times so that the 95%UIs were set at the 25th and 97.5th of the estimated values of 1,000 estimates[6,19]. All results can be accessed at http://vizhub.healthdata.org/gbd-compare.

The GBD study was approved by the Institutional Review Board of the University of Washington. It also received approval from the Institutional Review Board of the Universidade Federal de Minas Gerais under the protocol CAAE — 62803316.7.0000.5149. We were not required to submit our research proposal to local institutional review boards because we accessed the GBD study data from public domain secondary databases. Individual patient data were not collected in this study; hence, informed consent was waived.

RESULTS

In Brazil, AD and other types of dementia were ranked fourth among the leading causes of death in people aged ≥70 years in 2000, rising to second place in 2016. However, they were not leading causes of death among people aged 50–69 years (Figure 1). Dementia was an important cause of disability among older adults, representing the second and third leading causes of disability among older women and men, respectively (Figure 2).

In 2016, estimates indicated that 1,691,024 (95%UI 1,440,967–1,983,529) people were living with dementia in Brazil. Table 1 shows the age-standardized estimates for the entire country and its different states in the 2000-2016 period. Age-standardized incidence per 100,000 people increased by 4.5%, from 168.8 (143.1–199.8) to 176.4 (147.3–210.8). The prevalence of dementia per 100,000 people in Brazil increased by 7.8%, from 961.7 (95%UI 828.3–1,117.5) to 1,036.9 (95%UI 882.0–1,219.5). The figures also increased across all states during the same period, and only small differences were identified among them. In 2000, the highest prevalence per 100,000 people was seen in Rio Grande do Sul (972.9 — 95%UI 822.6–1,146.4) and the lowest in Bahia (938.8 — 95%UI 794.8–1,114.8). Meanwhile, in 2016, the corresponding figures were found in São Paulo (1,156.5 — 95%UI 994.2–1,329.1) and Rondônia (994.7 — 95%UI 833.9–1,181.4).

Between 2000 and 2016, the increase in incidence and prevalence of dementia per 100,000 people led to a 7.9% rise in YLDs in Brazil, from 139.9 (95%UI 98.6–185.3) to 150.9 (95%UI 105.8–200.2). São Paulo had the highest YLDs rates per 100,000 people in this period (144.3 — 95%UI 104.3–188.2 in 2000 vs 167.2 — 95%UI 118.3–220.8 in 2016). Rio Grande do Sul was ranked second with respective YLDs rates per 100,000 people of 141.8 (95%UI 99.0–188.3) and 149.0 (95%UI 104.7–197.7). The lowest figures were detected in Bahia (137.0 — 95%UI 95.2–181.3 in 2000 vs 143.2 — 95%UI 99.5–191.0 in 2016) and Pará (137.1 — 95%UI 95.9–182.8 in 2000 vs 143.6 — 95%UI 100.4–191.0 in 2016) (Table 1).

During this 16-year period, the age-standardized mortality rate (per 100,000 people) increased by 3.1%, from 52.5 (95%UI 45.3–61.3) in 2000 to 54.2 (95%UI 46.4–63.7) in 2016. The highest mortality rate per 100,000 people was found in Rio de Janeiro in 2016 (53.4 — 95%UI 45.1–63.6) and the lowest in Pará in 2000 (50.1 — 95%UI 42.5–59.5) (Table 1). Besides, the national age-standardized YLLs rates per 100,000 people increased by 5.8%, from 491.9 (95%UI 424.6–583.3) in 2000 to 520.4 (95%UI 445.8–617.5) in 2016 (Table 1).

In particular, the DALYs per 100,000 people were 631.8 (95%UI 538.4–744.3) in 2000, compared to 671.3 (95%UI 565.6–799.7) in 2016. As expected, São Paulo presented the highest DALYs increase per 100,000 people (13.0%), from 657.5 (95%UI 574.6–747.6) in 2000 to 743.2 (95%UI 628.2–870.6) in 2016. In contrast, Paraná showed the lowest increase over this period (3.0%) (Table 1).

During this time, the rate of DALYs increase among men was higher than among women. Men presented a 7.4% increase in the burden of disease (DALYs per 100,000 people), from 623.8 (95%UI 524.5–742.5) in 2000 to 670.0 (95%UI 560.8–799.7) in 2016. As to women, the increasing rate was lower (5.6%), from 636.8 (95%UI 542.1–748.4) in 2000 to 672.2 (95%UI 567.9–793.1) in 2016.

In 2016, the national mortality rate per 100,000 older people aged 60–64 years was 20.9 (95%UI 15.0–20.9), compared to 421.9 (95%UI 316.7–543.6) in those aged 75–79 years and 1,747.7 in those aged ≥80 years. Subnational rates presented the same gradient (Table 2).

DISCUSSION

This study identified a consistent increasing trend in all estimates, despite the confluence between UIs. This reality should not be neglected by health managers. In 2016, dementia was the fifth leading cause of death and the 23rd leading cause of DALYs worldwide[19]. Between 1990 and 2016, the prevalence of AD and other dementias doubled globally, from 20.2 million (95%UI 17.4–23.5 million) to 43.8 million (95%UI 37.8–51.0)[18]. The proportion

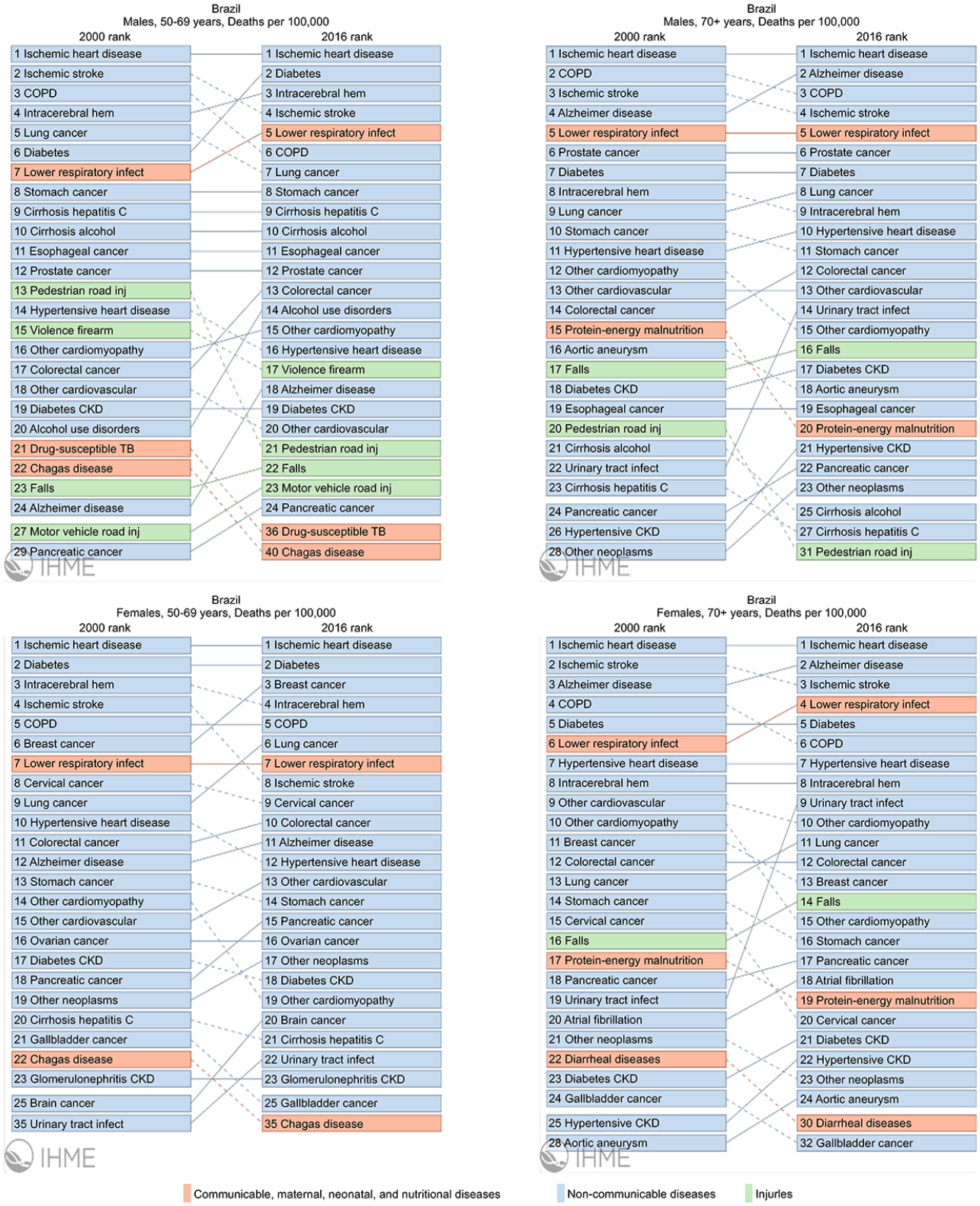

Figure 1. Leading causes of death among the middle-aged and older Brazilian population, from 2000 to 2016.

of older people from a younger age group (age 65 to 69) in Latin American countries, including Brazil, was higher than in developed countries[4]. Besides, developed countries have more resources and social structures to face the challenges of this demographic shift; therefore, a greater impact of AD and other dementias could be predicted in Latin American countries.

Dementia mortality profiles by age were very similar between 2000 and 2016, but presented an important increasing gradient with age. In addition, we detected a higher

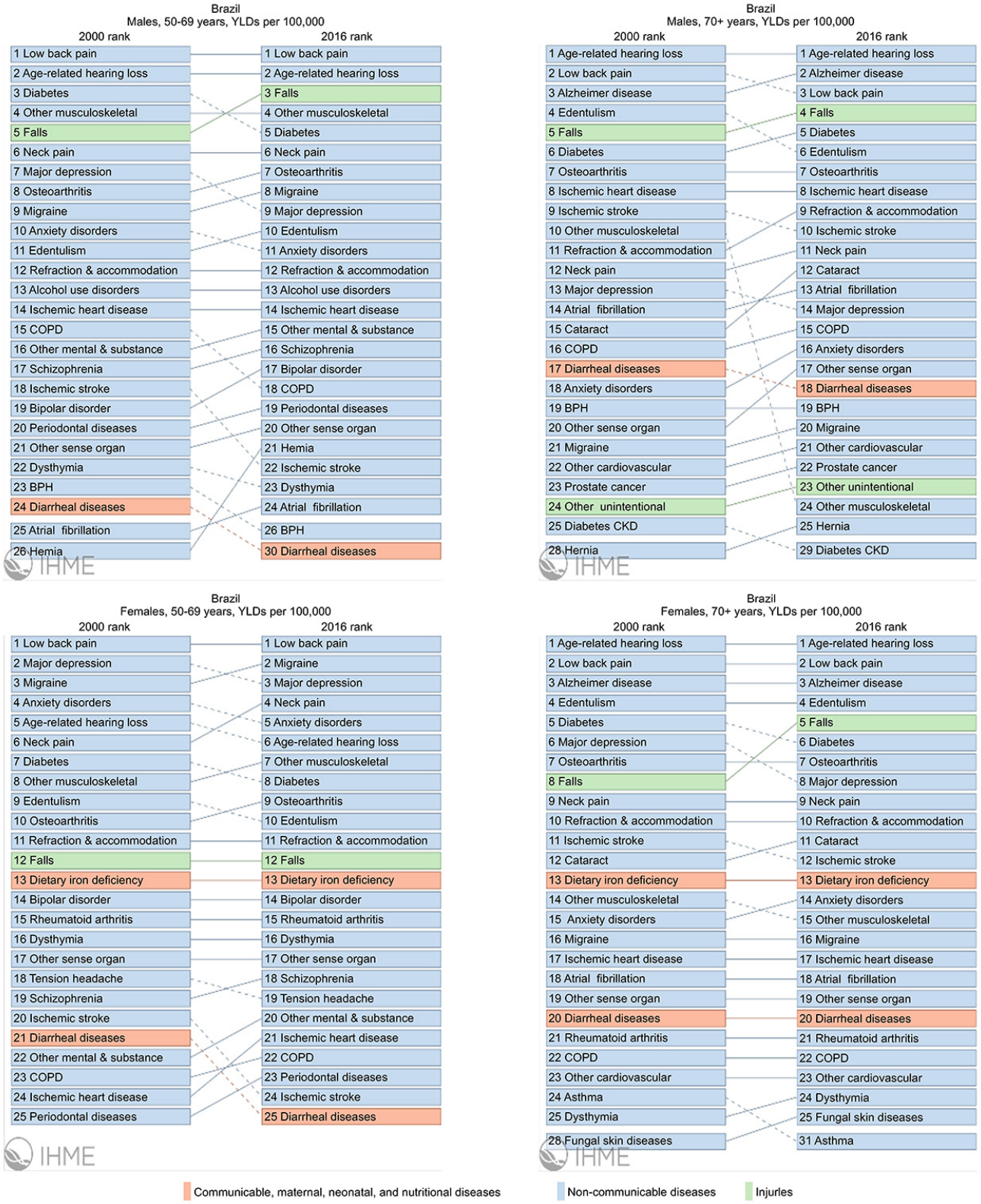

Figure 2. Leading causes of disability among the middle-aged and older Brazilian population, from 2000 to 2016.

increase in the age-standardized prevalence than in the incidence of AD and other dementias. This finding probably results from population growth and aging rather than an increase in the risk of disease in this period.

Aging represents a victory for humanity; however, it may also represent a greater risk of chronic diseases and disability. This situation may compromise the autonomy of older people. Brazil has been experiencing a rapid and marked aging process. Its older population in 1940 consisted of 1.7 million people (4%), increasing to 14.5 million (8.6%) in 2000. The aging rate is higher among those aged 80 years or older and shows female predominance (55%)[22]. As a result, in 2016, Brazil had the second highest age-standardized prevalence of AD and other dementias per 100,000 people (1,037 — 95%UI 882–1,220), after only Turkey (1,192 — 95%UI 1,007–1,405)[19].

The burden of AD and other dementias increased by 6.3% in Brazil. Chronic degenerative diseases such as dementia are associated with higher morbidity, prevalence, and YLDs than mortality and YLLs. Increased longevity implies that the gain in life expectancy is followed by a greater degree of health loss[22,23]. Prevalence increase will become a reality, as most dementias are progressive in nature and have no treatment to modify their course.

To face the burden profile of dementia, health financing must increase ***pari passu*** with population growth and aging. A recent study showed that the overall cost of dementia in Brazil ($1,405.72 ***per capita***) is significantly

Table 1. Age-standardized incidence, prevalence, mortality, years lived with disability, years of life lost, and disability-adjusted life year of Alzheimer's disease and other dementias in Brazil from 2000 to 2016.

Location	Incidence (95%UI) × 100,000 inhabitants			Prevalence (95%UI) × 100,000 inhabitants			Mortality (95%UI) × 100,000 inhabitants			YLDs (95%UI) × 100,000 inhabitants			YLLs (95%UI) × 100,000 inhabitants			DALYs (95%UI) × 100,000 inhabitants		
	2000	2016	Δ%	2000	2016	Δ%	2000	2016	Δ%	2000	2016	Δ%	2000	2016	Δ%	2000	2016	Δ%
Brazil	168.8 143.1-199.8	176.4 147.3-210.8	4.5	961.7 828.3-1117.5	1036.9 882.0-1219.5	7.8	52.5 45.3-61.6	54.2 46.4-63.7	3.1	139.9 98.6-185.3	150.9 105.8-200.2	7.9	491.9 424.6-583.3	520.4 445.8-617.5	5.8	631.8 538.4-744.3	671.3 565.6-799.7	6.3
Men	159.5 135.2-188.1	169.9 142.1-204.7	6.5	909.0 780.2-1061.0	995.6 846.6-1175.3	9.5	52.2 44.3-61.8	54.3 46.2-64.4	4.1	131.9 92.9-175.1	144.6 101.0-192.0	9.6	491.9 420.8-586.4	525.4 449.6-627.0	6.8	623.8 524.5-742.5	670.0 560.8-799.7	7.4
Women	174.5 148.0-206.7	180.6 150.8-214.9	3.5	993.2 857.5-1156.3	1064.2 905.0-1245.3	7.1	52.7 45.4-61.4	54.1 46.5-63.1	2.5	144.5 102.1-190.6	154.9 108.1-204.8	7.2	492.2 425.7-579.2	517.3 441.9-611.8	5.1	636.8 542.1-748.4	672.2 567.9-793.1	5.6
Midwest																		
Goiás	165.6 138.4-199.7	168.7 140.8-203.8	1.9	944.5 797.7-1116.8	989.2 829.3-1174.7	4.7	52.2 43.5-62.3	53.2 44.2-63.5	1.8	137.5 96.0-182.3	143.7 100.3-191.5	4.5	487.1 408.7-586.3	508.0 420.1-612.1	4.3	624.7 520.0-747.8	651.8 538.5-789.7	4.3
Mato Grosso do Sul	166.9 139.1-201.4	170.5 141.3-207.3	2.2	952.0 806.3-1125.0	998.8 839.8-1180.3	4.9	53.4 44.3-64.0	53.8 44.9-64.5	0.8	138.7 97.2-184.1	145.3 101.6-192.9	4.8	500.6 418.4-605.4	513.9 424.2-617.2	2.7	639.2 533.9-768.8	659.2 541.1-787.1	3.1
North																		
Pará	164.7 137.1-200.1	168.1 39.0-202.7	2.1	939.8 796.0-1112.7	984.9 818.6-1168.9	4.8	50.1 42.5-59.5	51.6 42.9-62.3	3.1	137.1 95.9-182.8	143.6 100.4-191.0	4.8	467.5 394.1-559.6	494.2 412.0-605.9	5.7	604.6 503.6-723.2	637.8 528.4-777.6	5.5
Rondônia	166.2 138.8-199.1	169.9 140.4-206.0	2.2	948.1 803.0-1119.0	994.7 833.9-1181.4	4.9	54.7 45.7-65.3	55.1 45.5-66.3	0.8	138.2 95.7-182.4	145.3 100.8-194.1	5.2	512.0 430.2-616.3	527.6 435.4-643.2	3.0	650.2 543.8-780.5	672.9 552.1-817.4	3.5
Northeast																		
Paraíba	166.3 138.8-200.3	170.0 141.4-205.6	2.2	948.1 801.2-1121.1	996.5 841.6-1179.4	5.1	51.8 43.6-62.0	52.5 43.6-63.1	0.5	138.5 97.2-184.3	145.5 101.9-193.0	5.0	487.9 411.1-591.0	502.4 416.6-608.0	3.0	626.4 526.4-761.2	647.9 534.8-785.1	3.4
Bahia	164.6 137.0-198.6	167.9 139.0-204.1	2.0	938.8 794.8-1114.8	983.4 822.2-1116.4	4.7	50.2 42.6-49.8	50.6 42.4-61.1	0.8	137.0 95.2-181.3	143.2 99.5-191.0	4.6	468.9 393.8-563.3	485.0 400.9-594.9	3.4	605.9 510.0-725.3	628.2 515.1-760.6	3.7
South																		
Paraná	168.7 140.2-203.9	172.1 142.8-208.3	2.0	962.4 809.8-1138.4	1008.1 848.9-1199.0	4.8	53.0 44.4-63.3	53.3 44.7-64.2	0.5	139.8 96.7-185.2	146.4 102.8-193.9	4.7	497.0 415.7-599.0	509.6 416.7-618.3	2.5	636.8 530.0-767.0	655.9 537.1-793.3	3.0
Rio Grande do Sul	170.5 141.4-205.4	174.2 144.7-210.8	2.2	972.9 822.6-1146.4	1021.2 862.7-1205.7	5.0	52.8 43.9-63.1	53.3 44.7-63.9	0.8	141.8 99.0-188.3	149.0 104.7-197.7	5.1	494.1 412.2-598.5	510.3 425.2-619.6	3.3	635.9 526.5-764.6	659.3 545.5-787.1	3.7
Southeast																		
Rio de Janeiro	167.2 139.0-201.7	170.5 141.2-206.5	1.9	952.2 802.1-1129.2	999.3 839.3-1192.0	4.9	53.1 44.0-63.8	53.4 45.1-63.6	0.5	138.9 97.5-183.7	146.1 101.7-193.4	5.2	497.5 416.0-601.7	509.7 424.4-619.8	2.5	636.4 530.3-764.0	655.8 543.7-791.8	3.1
São Paulo	176.5 156.4-200.3	194.9 166.6-227.8	10.5	900.1 900.1-1106.0	1156.5 994.2-1329.1	15.8	55.1 47.4-63.8	59.4 50.7-68.9	7.7	144.3 104.3-188.2	167.2 118.3-220.8	15.9	513.3 446.2-590.9	575.9 491.0-673.8	12.2	657.5 574.6-747.6	743.2 628.2-870.6	13.0

YLDs: years lived with disability; YLLs: years of life lost; DALYs: disability-adjusted life years; 95%UI: 95% uncertainty interval; Δ%: annual percentage change.

Table 2. Mortality and morbidity rates of Alzheimer's disease and other dementias by age in Brazil, in 2000 and 2016.

Age in years by location	Mortality rates (per 100,000 inhabitants)					YLDs rates (per 100,000 inhabitants)				
Brazil	2000	95%UI	2016	95%UI	Δ%	2000	95%UI	2016	95%UI	Δ%
60–64	21.0	15.2–28.9	20.9	15.0–29.3	-0.1	158.7	104.6–236.2	159.0	104.1–233.8	0.2
65–69	54.5	40.1–72.7	59.4	43.3–80.0	9.0	325.7	212.9–475.8	357.7	232.2–532.2	9.8
70–74	145.0	106.5–193.9	167.1	123.5–223.8	15.2	733.2	484.5–1020.6	853.8	554.7–1199.9	16.4
75–79	371.3	280.9–473.5	421.9	316.7–543.6	13.6	1298.2	869.2–1825.3	1507.2	995.4–2157.2	16.1
80–84	846.6	656.5–1090.6	921.2	711.7–1178.9	8.8	2549.9	1724.6–3561.9	2824.5	1891.9–3997.8	10.8
85–89	1902.3	1496.3–2362.8	1916.7	1508.3–2378.8	0.8	3770.1	2526.1–5124.9	3881.0	2620.0–5334.5	2.9
90–94	4155.4	3340.1–4980.2	3938.6	3193.8–4698.7	-5.2	4939.5	3317.6–6683.1	4722.5	3157.4–6373.2	-4.4
95+	6303.6	4969.5–7876.2	5744.0	4545.2–7189.7	-8.9	5961.8	3913.2–8294.0	5449.5	3563.2–7637.1	-8.6
Midwest region										
Mato Grosso do Sul										
60-64	20.7	14.8–29.2	20.3	14.5–28.3	-2.1	153.3	97.2–231.2	151.6	95.0–228.6	-1.1
65–69	54.9	39.3–75.4	57.8	40.8–79.8	5.2	319.9	201.8–470.5	339.1	212.5–503.2	6.0
70–74	148.5	104.9–204.8	162.7	114.5–223.4	9.6	731.3	468.4–1042.5	816.7	540.5–1154.5	11.7
75–79	382.0	277.6–510.5	415.4	297.5–554.5	8.7	1298.7	860.4–1831.9	1450.6	947.2–2046.5	11.7
80–84	864.5	639.1–1143.7	905.0	675.9–1201.3	4.7	2549.7	1680.9–3632.6	2727.1	1821.3–3836.0	7.0
85–89	1926.8	1452.3–2461.8	1910.2	1485.8–2414.0	-0.9	3740.5	2501.7–5147.6	3764.3	2533.0–5193.4	0.6
90–94	4220.0	3269.6–5201.0	3990.3	3122.5–4909.5	-5.4	4841.9	3217.3–6643.3	4577.3	3065.3–6261.8	-5.5
95+	6305.6	4862.3–8162.3	5817.5	4544.8–7437.8	-7.7	5818.0	3781.3–8254.4	5320.7	3485.5–7465.1	-8.5
Goiás										
60–64	20.2	14.3–28.8	20.1	14.3–28.5	-0.2	152.6	94.9–231.5	150.8	95.1–225.0	-1.2
65–69	53.0	38.3–72.1	56.9	40.0–79.3	7.2	318.2	202.7–472.5	336.7	213.6–505.4	5.8
70–74	144.0	102.1–198.2	160.3	111.7–220.3	11.3	723.8	465.8–1032.0	806.8	509.5–1163.4	11.5
75–79	366.4	266.5–484.1	409.6	296.6–546.7	11.8	1288.0	849.3–1836.8	1435.0	937.1–2073.1	11.4
80–84	837.1	630.8–1101.1	899.8	674.2–1195.0	7.5	2520.1	1672.0–3557.6	2699.0	1779.7–3828.6	7.1
85–89	1894.9	1439.3–2425.2	1888.2	1432.2–2362.1	-0.4	3710.0	2471.7–5132.1	3720.9	2491.6–5132.3	0.3
90–94	4170.2	3192.0–5252.1	3923.9	3077.0–4800.1	-5.9	4823.4	3186.0–6565.2	4519.8	2983.7–6092.0	-6.3
95+	6384.3	4866.7–8265.8	5751.1	4421.8–7422.3	-9.9	5815.3	3744.6–8244.5	5246.5	3387.2–7428.5	-9.8
North region										
Pará										
60–64	19.7	14.3–27.6	19.8	13.9–27.6	0.5	151.5	95.0–226.5	148.8	91.9–221.3	-1.7
65–69	51.5	37.4–70.4	55.6	38.9–76.2	7.9	314.7	201.4–476.0	334.9	208.7–501.8	6.4
70–74	140.1	99.7–193.3	157.5	110.9–217.6	12.4	719.7	466.7–1017.4	803.5	521.1–1134.7	11.6
75–79	355.9	263.6–471.3	399.5	290.3–544.2	12.2	1280.3	836.1–1834.9	1427.8	936.7–2041.8	11.5
80–84	811.7	617.2–1073.8	880.5	652.8–1173.3	8.5	2520.1	1665.4–3630.8	2696.4	1759.0–3826.6	7.0
85–89	1817.8	1400.1–2293.5	1830.2	1383.3–2335.2	0.7	3707.8	2488.5–5122.7	3736.6	2475.4–5208.8	0.8
90–94	3912.0	3131.3–4730.8	3760.4	2915.0–4545.0	-3.9	4831.0	3193.3–6625.5	4567.7	3035.3–6245.1	-5.5
95+	5983.7	4701.4–7677.2	5528.5	4315.8–7018.5	-7.6	5845.5	3773.0–8248.3	5330.4	3440.7–7572.1	-8.8
Rondônia										
60–64	21.5	15.3–30.4	21.2	14.9–29.7	-1.5	153.1	94.5–227.6	151.6	97.9–224.1	-1.0
65–69	56.6	40.2–76.7	58.9	40.9–80.7	4.0	320.1	199.6–477.6	339.2	213.7–511.8	6.0
70–74	151.3	106.5–204.7	165.4	116.9–231.6	9.3	730.3	468.2–1048.3	816.4	524.4–1188.3	11.8
75–79	389.7	286.9–517.4	424.7	309.6–569.5	9.0	1293.5	838.4–1846.3	1449.0	948.0–2071.3	12.0
80–84	872.3	658.5–1160.0	940.4	701.5–1237.7	7.8	2527.9	1666.8–3588.4	2724.3	1794.9–3847.7	7.8
85–89	1973.7	1491.2–2528.7	1966.6	1494.5–2488.4	-0.4	3722.1	2487.4–5141.2	3762.1	2507.8–5202.8	1.1
90–94	4352.5	3357.3–5495.0	4013.8	3174.7–4877.2	-7.8	4854.4	3218.7–6562.2	4592.3	3029.3–6285.1	-5.4
95+	6620.5	5086.4–8597.1	5958.2	4663.9–7552.1	-10.0	5809.7	3778.8–8162.4	5346.7	3487.6–7621.2	-8.0

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Table 2. Continuation.

Age in years by location	Mortality rates (per 100,000 inhabitants)					YLDs rates (per 100,000 inhabitants)				
Brazil	2000	95%UI	2016	95%UI	Δ%	2000	95%UI	2016	95%UI	Δ%
Northeast region										
Paraíba										
60–64	20.4	14.3–28.5	20.1	14.0–28.2	-1.7	153.0	97.0–234.4	151.8	95.1–228.3	-0.8
65–69	54.2	39.0–73.5	56.6	39.7–78.0	4.4	319.2	202.3–480.7	340.0	212.3–508.5	6.5
70–74	144.3	102.8–200.9	158.7	112.6–218.1	10.0	729.5	474.3–1035.6	814.1	519.8–1168.4	11.6
75–79	369.8	270.9–493.9	404.3	298.8–542.6	9.3	1297.8	845.4–1862.1	1449.6	946.7–2074.4	11.7
80–84	852.9	639.1–1120.7	897.0	667.4–1181.2	5.2	2544.8	1669.6–3624.6	2730.6	1791.7–3903.4	7.3
85–89	1895.0	1458.3–2379.5	1874.4	1433.2–2412.1	-1.1	3736.5	2502.1–5156.4	3774.1	2542.6–5248.7	1.0
90–94	4091.3	3212.6–4952.9	3826.1	3031.0–4656.9	-6.5	4846.1	3217.4–6526.6	4608.4	3056.3–6226.8	-4.9
95+	6239.1	4828.7–7969.4	5568.5	4286.8–7167.4	-10.7	5855.3	3791.5–8275.6	5355.8	3402.3–7624.0	-8.5
Bahia										
60–64	19.6	13.9–27.5	19.7	13.6–27.8	0.4	150.5	96.4–226.6	148.9	95.3–225.3	-1.1
65–69	51.9	37.3–71.5	55.2	38.5–74.7	6.4	314.9	201.1–467.0	334.0	211.7–492.4	6.0
70–74	139.6	99.9–192.8	155.3	112.0–217.4	11.3	721.0	462.3–1027.0	802.1	517.5–1142.5	11.3
75–79	358.2	264.1–471.5	394.0	283.4–527.2	10.0	1279.9	834.7–1811.1	1425.6	921.2–2059.7	11.4
80–84	814.9	616.3–1078.8	857.6	642.5–1120.3	5.2	2514.0	1676.0–3545.4	2687.4	1784.1–3814.6	6.9
85–89	1815.5	1401.7–2267.8	1787.3	1367.6–2273.8	-1.6	3706.0	2451.2–5155.8	3722.7	2508.7–5098.5	0.5
90–94	3943.4	3077.8–4839.3	3688.0	2942.2–4486.6	-6.5	4826.0	3212.8–6558.5	4549.8	3014.8–6211.7	-5.7
95+	5975.3	4674.1–7535.9	5401.9	4225.3–6821.3	-9.6	5823.3	3771.4–8216.1	5299.7	3423.6–7510.4	-9.0
South region										
Rio Grande do Sul										
60–64	20.4	14.5–28.2	20.3	14.1–28.8	-0.6	155.9	100.5–233.4	155.5	99.4–230.2	-0.3
65–69	53.6	38.4–73.9	57.6	40.6–81.0	7.4	327.3	209.4–486.7	347.6	223.5–516.3	6.2
70–74	145.7	102.7–200.8	163.9	116.5–223.9	12.5	746.6	480.4–1066.1	834.7	539.6–1183.9	11.8
75–79	374.4	270.2–503.2	413.1	303.1–550.2	10.3	1328.0	866.9–1894.2	1482.5	955.3–2094.1	11.6
80–84	857.1	646.2–1132.6	904.6	681.6–1188.3	5.5	2606.9	1691.7–3727.1	2799.9	1867.7–4002.8	7.4
85–89	1922.1	1459.1–2465.9	1886.8	1423.1–2406.6	-1.8	3837.1	2573.4–5262.7	3865.6	2623.1–5379.3	0.7
90–94	4166.0	3203.3–5220.7	3885.0	3088.4–4738.8	-6.7	4974.6	3293.1–6778.5	4724.5	3193.0–6406.0	-5.0
95+	6319.0	4743.8–8390.1	5699.8	4473.3–7286.4	-9.8	5957.4	3804.4–8481.2	5453.4	3567.4–7714.5	-8.5
Paraná										
60–64	20.5	14.3–28.8	20.2	14.1–28.7	-1.3	154.7	97.2–230.7	153.1	98.1–231.7	-1.0
65–69	54.0	38.3–74.6	57.1	40.2–78.0	5.7	323.2	201.4–481.4	343.0	222.3–514.5	6.1
70–74	146.2	104.5–202.5	162.1	113.9–223.4	10.9	736.2	476.2–1041.9	820.5	526.3–1182.7	11.5
75–79	376.8	273.1–498.2	411.7	298.8–547.4	9.3	1309.4	855.6–1880.2	1458.4	944.1–2072.0	11.4
80–84	858.8	646.3–1136.1	900.1	682.4–1194.7	4.8	2567.5	1688.5–3650.8	2747.2	1799.3–3903.6	7.0
85–89	1923.3	1465.5–2490.1	1893.1	1458.2–2365.4	-1.6	3774.8	2496.9–5220.5	3793.3	2573.4–5231.4	0.5
90–94	4182.7	3208.6–5217.3	3924.6	3125.0–4761.9	-6.2	4891.3	3280.3–6592.3	4613.2	3056.3–6258.3	-5.7
95+	6355.5	4752.3–8355.6	5748.7	4421.2–7372.9	-9.5	5864.4	3824.5–8338.3	5339.9	3455.7–7629.4	-8.9
Southeast region										
São Paulo										
60–64	23.3	17.1–31.6	23.6	16.8–33.5	1.2	178.0	117.9–259.0	181.0	116.8–268.8	1.7
65–69	57.6	43.6–74.3	68.0	49.8–92.8	18.0	344.5	233.3–498.9	413.1	269.4–616.2	19.9
70–74	146.8	112.7–189.7	190.0	139.6–252.6	29.4	742.1	508.7–1020.3	981.1	638.6–1356.5	32.2
75–79	374.2	288.7–470.5	470.9	352.9–604.3	25.8	1297.7	893.2–1773.6	1694.5	1128.6–2401.8	30.6
80–84	862.9	675.4–1098.7	1010.3	784.6–1292.8	17.1	2555.2	1766.2–3433.9	3088.0	2099.6–4231.1	20.9
85–89	1983.3	1534.4–2509.2	2071.3	1620.9–2560.7	4.4	3859.6	2672.8–5186.4	4167.0	2813.4–5679.1	8.0
90–94	4503.8	3589.7–5597.6	4232.6	3389.2–5070.3	-6.0	5276.3	3711.0–7024.9	5043.8	3438.7–6779.2	-4.4
95+	6991.0	5450.6–8842.7	6175.9	4877.7–7705.9	-11.7	6501.1	4362.0–8788.0	5778.8	3883.9–8027.0	-11.1

Continue...

Table 2. Continuation.

Age in years by location	Mortality rates (per 100,000 inhabitants)					YLDs rates (per 100,000 inhabitants)				
Brazil	2000	95%UI	2016	95%UI	Δ%	2000	95%UI	2016	95%UI	Δ%
Rio de Janeiro										
60–64	20.4	14.4–28.9	20.1	14.1–28.8	-1.4	152.1	96.4–229.7	96.5	96.5–225.0	-0.2
65–69	54.1	38.1–73.6	56.9	40.0–78.1	5.3	318.0	201.6–476.0	214.0	214.0–507.0	7.4
70–74	146.2	104.3–197.2	161.3	114.5–222.1	10.3	727.1	470.0–1028.6	533.1	533.1–1164.9	12.5
75–79	378.2	275.9–499.1	411.2	301.4–548.5	8.7	1298.4	840.5–1854.4	946.2	946.2–2079.5	11.8
80–84	855.4	639.1–1144.4	903.5	676.8–1191.2	5.6	2556.7	1695.6–3647.7	1807.5	1807.5–3902.1	7.3
85–89	1934.6	1462.3–2467.0	1897.1	1461.8–2419.6	-1.9	3776.6	2513.3–5248.8	2566.4	2566.4–5231.1	0.7
90–94	4206.5	3195.3–5295.2	3945.7	3118.7–4823.5	-6.2	4888.6	3250.8–6733.8	3039.1	3039.1–6306.0	-5.1
95+	6364.6	4828.5–8234.8	5761.9	4459.6–7346.2	-9.5	5870.6	3791.3–8273.6	3457.6	3457.6–7621.8	-8.6

YLDs: years lived with disability; 95%UI: 95% uncertainty interval; Δ%: annual percentage change.

lower than the global dementia cost *per capita* (approximately $5,284)[24]. Most of these costs are indirect, as the social costs associated with the loss of caregiver productivity, aside from the time and stress experienced by them, are usually informal[24]. Besides patient suffering, the lack of specific coping strategies, whether in primary or specialized care, leads to increased family demand; family members or relatives become informal and untrained caregivers. These caregivers face many challenges, such as diagnosis acceptance, family conflict management, future reprogramming, and, most importantly, engagement in all activities that involve caring for the patient, from providing medications to securing financial and legal support. The overload experienced by caregivers, largely young women, is undoubtedly an indirect cost that can be prevented if taken over by trained professional caregivers[25].

In this study, although women presented a greater burden of disease, men experienced a greater increase in the burden of AD and other dementias in the period. Most Brazilian studies showed a higher prevalence of dementia in women, even though the difference was not statistically significant[8,9,13]. The current best explanation for this difference is that women outnumbered men; however, future studies are necessary to clarify this scenario[26].

The analysis of estimates from the GBD study has certain advantages. Its standardized methodology allows comparisons over time and across places. In addition, UIs reflect the amount and quality of health information for each location and period.

However, one important limitation concerns the paucity of population-based studies on dementia, not only in Brazil but worldwide. We underline that São Paulo presented rates two or three times higher than those of other states, clearly affecting the national average. This finding may be responsible for the great homogeneity of metrics between the states, which prevented a more careful analysis by region. The diversity of diagnostic methods used for dementia is the second limitation. Across the 237 data sources used by the estimates of the GBD-2016 study, 230 diagnostic procedures were used[19].

The third limitation relates to the impossibility of classifying dementia into subtypes, as different causes of dementia have different clinical and epidemiological profiles accompanied by different prevention and treatment strategies[19]. The primary analysis showed sharp discrepancies between the prevalence of dementia and the cause-of-death data on the specific cause of dementia[19]. In the future, further discrimination between AD, vascular dementia, and other dementia types may be advisable. Doctors are advised not to report dementia as an underlying cause of death on death certificates because this practice can lead to underreporting of deaths, which is difficult to correct[27]. We also highlight the challenge of measuring disability weights since brief descriptions of health status may not fully capture the complexity of diseases such as dementia and AD[19].

In conclusion, this study calls attention to the increase in the burden imposed by AD and other dementias in Brazil, along with the paucity of studies in the country. This reality requires health facilities to invest in prevention and research to ensure a better quality of life not only for those with dementia but also for their families.

ACKNOWLEDGMENTS

We would like to thank Editage (www.editage.com) for English language editing.

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