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RESEARCH ARTICLE

Mapping the Numbers of Dementia in Brazil: A Delphi Consensus Study

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ABSTRACT

Objectives: As the global dementia crisis intensifies, especially in low-and middle-income countries (LMICs), there is a pressing need for comprehensive prevalence data across diverse regions, including Brazil, where studies have been predominantly limited to affluent urban centers. This study aimed to conduct an expert consensus to determine the prevalence of all-cause dementia in Brazil, considering various age groups, sexes, and geographical areas.

Methods: A Delphi consensus process with clinical and academic experts from across Brazil was conducted to provide dementia prevalence estimates in people aged ≥ 60 years living throughout Brazil for 2019. Each round consisted of answering structured questionnaires that incorporated information from the literature. A priori criteria were used to ascertain the point in which consensus was achieved for > 70% of the 15 prevalence estimates—for (1) total, (2) women and men, and (3) the five Brazilian macro-regions. The current and projected dementia cases in Brazil were calculated based on age and sex population distributions.

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Results: Fifteen experts, with a mean professional experience of 25 ± 10 years, reached a consensus in the fourth round. Experts agreed with a mean all-cause dementia prevalence of 8.5% among Brazilians aged ≥ 60 years, which comprised 2.46 million people in 2019 in this age. They reported higher dementia rates in women (9.1%) than men (7.7%); the highest total prevalence was in those over 80 where it exceeds 20%. Regional variations were also noted, with lower prevalence in the South (7.3%) and higher in the North (8.9%) and Northeast (10.1%). Projections estimate that considering Brazil's rapidly aging population, dementia cases will rise to 8.89 million by 2060.

Conclusions: This Delphi study estimated that dementia already affects roughly 1 in 12 older Brazilians aged 60 and above, with slightly higher prevalence in women and significant geographical variations. These results underscore the urgency for targeted public health strategies in Brazil and offer a framework for similar challenges in other LMICs, especially given that dementia cases are projected to increase by approximately 3.6 times in 4 decades.

1 | Introduction

As populations age worldwide, dementia has become an enormous challenge. It has been estimated that 57.4 million people were living with dementia globally in 2019 [1], and these estimates are projected to reach 152.8 million by 2050. Alarmingly, 71% of these cases will occur in low- and middle-income countries (LMICs) [2]. This sharp increase in global dementia prevalence, with associated costs reaching 1.3 trillion USD in 2019, disproportionately impacts LMICs, where the direct costs represent 0.4% of the gross domestic product [1, 2]. In Brazil, the largest country in Latin America with a fast population aging, dementia has emerged as a pressing public health issue that demands a comprehensive assessment of its impact on patients, their families, and the broader society across the country [3].

Nevertheless, considerable gaps remain in the comprehension of dementia prevalence throughout the extensive territory of Brazil [4]. Epidemiological studies conducted in the country have primarily focused on select urban areas within the Southeast region, often overlooking broader, population-level insights [5–9]. This narrow focus raises concerns about the generalizability of findings, such as the reported 5%–17% prevalence rates among people aged 60 years and older in economically prosperous cities, compared to areas with greater economic disadvantages, particularly in the North and Northeastern regions of Brazil [5–9]. Unfortunately, research from other areas either lacks a population-level approach or is confined to a narrow demographic group [10]. Moreover, national dementia prevalence rates for people aged 60 and older from the Brazilian Longitudinal Study of Aging (ELSI-Brazil), of approximately 6%, were recently obtained through machine learning and algorithm classification, but face constraints such as the absence of a comprehensive neuropsychological battery and supplementary examinations [3, 11]. These inconsistencies leave our understanding of dementia prevalence in Brazil fragmented, which is troubling given the reported higher prevalence of dementia in Latin America compared to high-income countries [12–15].

In this context of uncertainties, the use of the Delphi technique to build a consensus among experts is particularly warranted [16, 17]. This method is effective for complex issues yet to be fully explored with observational studies. Its utility is further underscored by previous studies on dementia prevalence that have applied the Delphi technique both nationally and globally, reinforcing its relevance in shaping future research and public policy for dementia care [17, 18]. Therefore, we conducted an expert consensus on the prevalence of all-cause dementia in Brazil, encompassing various age groups, sex, and geographical macro-regions, using 2019 as the reference year.

2 | Materials and Methods

2.1 | Expert Panel

A total of 15 professionals were invited via email to participate in an expert consensus to estimate the prevalence of all-cause dementia among Brazilians aged 60 years and older. The term "expert" was defined based on the following criteria:

1. Having at least 5 years of experience in the field of dementia;
2. Possessing qualifications in a specialty that provides training in dementia, such as Neurology, Psychiatry, Geriatrics, or Public Health;
3. Having additional training in cognition and epidemiology, demonstrated by participation in previous epidemiological studies on dementia or by holding a master's or doctoral degree in cognition;
4. Serving as a faculty member in the area of cognition at an institution recognized by the Ministry of Education of Brazil.

To be deemed eligible to participate in the consensus, the professional had to meet criteria (1), (2), and (3), with criterion (4) being considered desirable. Although the selection of experts was performed through convenience sampling, the panel sought to reflect the representativeness of the five Brazilian macro-regions and to ensure that the professionals included came from a wide range of institutions [19].

2.2 | Consensus Development

The expert consensus was conducted using a modified Delphi technique, where the design of the questionnaires originated from a comprehensive literature review on the topic of interest by a group of independent researchers [16]. These researchers first conducted a preliminary analysis of the questionnaires and

Summary

- Population studies on all-cause dementia prevalence in Brazil are limited, predominantly conducted in the Southeast region, often in the state of Sao Paulo, the most affluent in the country.
- This Delphi consensus study estimated Brazil's all-cause dementia prevalence at 8.5% in those aged 60 and older, totaling 2.46 million individuals. Prevalence was higher in women (9.1%) than men (7.7%), and exceeded in 20% in those over 80 years old.
- Regional differences were proposed, with lower all-cause dementia prevalence in the South (7.3%) and higher in the North (8.9%) and Northeast (10.1%), the regions with greater socioeconomic disparities and face challenges in accessing quality healthcare services.
- Projections suggest that dementia cases in Brazil will escalate to about nine million in 4 decades, highlighting the need for sustained attention to mitigate its pressing impact effectively.

then implemented improvements to ensure the quality of the process before delivering them to the experts. From the outset, the experts were informed that the prevalence estimates agreed upon in the consensus would contribute to advancing dementia research in Brazil and underpin the development of public policies.

Up to four rounds of opinion were scheduled to achieve consensus on the prevalence of all-cause dementia in the five Brazilian macro-regions (South, Southeast, Midwest, Northeast, and North), categorized by age groups (60–64, 65–69, 70–74, 75–79, 80–84, 85–89, ≥ 90 years) and sex. All estimates were based on the calendar year of 2019. This was done to enable comparison with studies conducted in the same period and to avoid potential distortions in the estimates caused by the COVID-19 pandemic. The questionnaires followed a structured format to minimize the chance of inconclusive results. In the first round, the experts provided comments and estimates on the prevalence of all-cause dementia in the five Brazilian macro-regions, by age group and sex, after reviewing existing studies (primarily focused on the Southeast region) [5–9] and considering regional differences (age distribution, education level, per capita family income, and life expectancy) [20] in the country. In the second round, they were invited to revise their prevalence estimates based on the results of the previous round. In the third round, the experts adjusted their estimates by comparing their results with the total number of dementia cases in Brazil in 2019 estimated by the GBD dementia workgroup [1]. In the fourth round, they revised their estimates after considering opinions expressed by other experts involved in this consensus.

The four rounds were conducted using Microsoft Excel forms sent via email. All communications were conducted by independent researchers who were not part of the expert panel. There was an interval of one to 2 months between rounds. At the start of the process, the experts were introduced to the group via a video call, where the Delphi process and its organization were explained. For each round, participants received the previous round estimates showing anonymously each expert estimate and potential anonymous comments together with the subsequent round form for the revised estimates. It is important to emphasize that strict confidentiality was maintained regarding each expert's participation. No nominal identification was disclosed in any report or form at any stage of the process. Thus, the estimates provided by each expert remained fully anonymous to other participants throughout the Delphi process. The process would have been discontinued if there had been a dropout rate of 25% among the experts [16]. Exemplars of the Excel questionnaires used during each round of the consensus are presented as supporting information (Figure S1a–c).

2.3 | Statistical Analysis

The estimated rates from each round were presented using measures of central distribution, including both mean and standard deviation (SD), as well as median and interquartile range (IQR). The degree of agreement among the experts was assessed using the intraclass correlation coefficient (ICC) and the coefficient of variation (CV). The ICC is a measure that expresses the degree of similarity among multiple measurements of the same parameter made by different observers. We computed the ICC using the two-way random effects model for an absolute agreement based on the mean of multiple raters, considering the final prevalence rates represented the mean values of the experts' estimates. A high ICC suggests that the various measurements are in good agreement with each other, with values > 0.75 defined as adequate [21]. The CV measures the relative variability of a distribution with its mean. It is often expressed as a percentage (%) and a low CV suggests a low dispersion of the data, indicating that the estimates are very close to the mean. Although there are no defined cut-off points, in clinical studies CV values < 10% are considered excellent, between 10% and 20% good, 20%–30% acceptable, and ≥ 30% poor [22].

In each opinion round, 15 central estimates were considered to achieve consensus: the total prevalence rate of all-cause dementia, and separately for men and women, in each of the five Brazilian macro-regions. We defined a consensus to have been reached when more than 70% of these estimated rates displayed a level of agreement considered good [16], which was established by two parameters: an intraclass correlation coefficient above 0.75, indicating high reliability [21], and a coefficient of variation less than 20%, indicating low variability [22].

In the round where consensus was reached, we presented the mean all-cause dementia prevalence rates, accompanied by standard deviations, according to age group and sex for the entire Brazilian population and its five specific macro-regions. The average estimated rates for the total population and by sex in the South, Midwest, Northeast, and North regions were compared with those of the Southeast region, where most previous prevalence studies were conducted [5–7]. For this comparison, prevalence ratios and their respective 95% confidence intervals (CI) were used. The estimated rates were also used to calculate the number of people with dementia in Brazil in 2019, based on data from the Brazilian Institute of Geography and

Statistics (IBGE) on the population distribution by age and sex [22]. Additionally, to predict the number of Brazilians potentially affected by dementia in 2040 and 2060, population projections from the IBGE were utilized, assuming the current prevalence rates of the disease remain constant. Finally, by comparing the number of dementia cases in 2018 and 2019, the number of new cases of the disease in 2019 was estimated, thereby determining the incidence of dementia for that year.

All analyses were performed using the Stata version 17 (StataCorp, College Station, TX).

2.4 | Ethics Statement

All experts provided informed consent to share their expertise as part of the Delphi process. This manuscript involves expert opinion rather than research on human subjects, so we did not obtain ethical approval.

3 | Results

A total of 15 experts, nine men and six women, were invited to participate in the consensus, and all accepted the invitation. The panel was diverse and included physicians from various dementia-related specialties: seven neurologists, four psychiatrists, three geriatricians, and one professional with training in public health. These experts represented 13 different institutions distributed across the five Brazilian macro-regions, with seven in the Southeast, two in the South, two in the Northeast, one in the Midwest, and one in the North. In terms of experience, the mean number of years in professional practice among the experts was 25 $\pm$ 10 years. Fourteen members (93%) held doctoral degrees, while one (7%) held a master's degree. All experts were actively involved in clinical, teaching, or/and research activities. Additionally, 73% reported having a high or very high level of knowledge in epidemiology.

All 15 experts actively participated in the four rounds of consultation, ensuring a complete dataset without loss of information. When evaluating the estimated prevalence rates across the four opinion rounds, an improvement in the degree of agreement among the experts was observed from the first to the fourth round (Table 1). The fourth round was the only one in which the three central estimates (total prevalence and by sex) for the entire Brazilian population reached a good level of agreement. According to the consensus, the average prevalence rate of dementia in the Brazilian population in 2019 was 8.5%, with 9.1% among women and 7.7% among men (Table 1).

In the analysis of data specific to the five Brazilian macro-regions (Table 2), consensus was achieved only in the fourth round (first round = 27%; second round = 53%; third round = 20%; fourth round = 80%). In general, the mean all-cause prevalence rates were lower for the South region and higher for the Northeast region (Table 2). It is important to highlight that although the agreement in the fourth round was satisfactory for all parameters in the South, Southeast, and Midwest regions, the same was not observed for the North and Northeast regions. The mean prevalence rates across the five macro-regions of Brazil, stratified by sex and age group, are presented in Table 3.

The fourth-round analysis, stratified by sex and age group, showed a marked increase in all-cause dementia prevalence with age, particularly in very old ages (80 years and older), where it exceeded 20%, with slightly higher rates observed among women than men in these advanced age groups (Figure 1; Table S1).

The analysis of the prevalence ratios of all-cause dementia for the Brazilian macro-regions indicated that in comparison with the Southeast region, the experts reported a lower prevalence of the disease in the South region and a higher prevalence in the North and Northeast regions (Table 4). For example, the prevalence rate of all-cause dementia was estimated at 7.3% in the South compared to 8.2% in the Southeast, yielding a prevalence ratio of 0.92 (95% CI = 0.87–0.98) for the South relative to the Southeast. On the other hand, compared to the Southeast, the

TABLE 1 | Dementia prevalence rates in people aged 60 years and older living in Brazil in 2019, according to the Delphi consensus.

Rounds	Population	Mean (SD)	Median (IQR)	CV	ICC (95% CI)	Agreement
First	Total	10.9 (2.3)	10.8 (9.3, 11.6)	21.2	0.69 (0.60–0.77)	Acceptable
	Women	11.4 (2.5)	11.5 (10.0, 11.8)	22.3	0.69 (0.58–0.80)	Acceptable
	Men	10.2 (2.2)	10.4 (8.2, 11.7)	22.2	0.69 (0.58–0.80)	Acceptable
Second	Total	10.9 (1.9)	10.8 (9.2, 11.7)	17.7	0.86 (0.80–0.91)	Good
	Women	11.8 (1.9)	11.7 (10.4, 12.8)	15.7	0.87 (0.81–0.93)	Good
	Men	9.7 (2.1)	9.7 (7.9, 10.3)	21.3	0.85 (0.77–0.91)	Acceptable
Third	Total	9.8 (2.4)	9.4 (7.9, 11.4)	24.4	0.85 (0.79–0.90)	Acceptable
	Women	10.5 (2.4)	9.8 (8.7, 12.3)	22.8	0.86 (0.77–0.92)	Acceptable
	Men	8.9 (2.5)	8.7 (6.5, 10.3)	27.5	0.85 (0.76–0.91)	Acceptable
Fourth	Total	8.5 (1.3)	8.5 (7.5, 9.1)	15.0	0.87 (0.82–0.91)	Good
	Women	9.1 (1.4)	9.0 (7.9, 10.0)	15.2	0.87 (0.80–0.92)	Good
	Men	7.7 (1.3)	7.4 (6.5, 8.6)	17.2	0.87 (0.80–0.92)	Good

Abbreviations: CV = coefficient of variation; IQR = interquartile range; SD = standard deviation; 95% CI = 95% confidence interval.

TABLE 2 | Prevalence rate of dementia in Brazilians aged 60 years or older in 2019 in the five Brazilian macro-regions according to the Delphi consensus.

Round	Region	Population	Mean (SD)	Median (IQR)	ICC (95% CI)	CV	Agreement
First	Southeast	Total	10.3 (1.8)	10.2 (8.7; 11.3)	0.77 (0.62–0.90)	17.4	Good
		Women	10.8 (2.0)	11.0 (9.0; 12.0)	0.79 (0.58–0.95)	18.2	Good
		Men	9.6 (1.8)	9.5 (8.0; 11.0)	0.79 (0.58–0.95)	18.7	Good
	South	Total	9.3 (1.8)	9.2 (8.1; 9.6)	0.81 (0.68–0.92)	19.9	Good
		Women	9.7 (2.1)	9.0 (8.9; 11.0)	0.83 (0.65–0.96)	21.7	Acceptable
		Men	8.8 (1.8)	8.8 (7.3; 10.0)	0.83 (0.65–0.96)	20.4	Acceptable
	Midwest	Total	11.3 (2.7)	10.7 (9.1; 12.8)	0.72 (0.55–0.87)	24.1	Acceptable
		Women	11.8 (2.9)	12.0 (10.0; 12.5)	0.73 (0.51–0.93)	25.0	Acceptable
		Men	10.6 (2.6)	10.0 (8.0; 13.0)	0.73 (0.51–0.93)	24.9	Acceptable
	Northeast	Total	13.1 (3.8)	12.2 (10.9; 14.3)	0.70 (0.53–0.86)	29.2	Acceptable
		Women	13.9 (4.4)	13.0 (12.0; 14.3)	0.72 (0.49–0.93)	32.0	Poor
		Men	12.1 (3.6)	12.0 (9.5; 14.6)	0.72 (0.49–0.93)	29.4	Acceptable
	North	Total	10.5 (4.2)	10.1 (8.6; 12.7)	0.54 (0.35–0.76)	40.2	Poor
		Women	10.9 (4.4)	11.0 (9.0; 13.0)	0.55 (0.31–0.86)	39.8	Poor
		Men	10.0 (4.2)	10.0 (7.7; 13.0)	0.55 (0.31–0.86)	42.0	Poor
Second	Southeast	Total	10.4 (1.9)	10.2 (8.8; 11.3)	0.88 (0.77–0.95)	18.0	Good
		Women	11.4 (1.8)	11.0 (9.9; 12.5)	0.90 (0.78–0.98)	15.9	Good
		Men	9.3 (2.0)	9.2 (7.9; 10.2)	0.87 (0.71–0.97)	22.0	Acceptable
	South	Total	9.1 (1.2)	9.1 (8.5; 10.0)	0.91 (0.83–0.97)	13.3	Good
		Women	10.0 (1.2)	9.8 (9.2; 11.0)	0.93 (0.83–0.98)	11.7	Good
		Men	8.0 (1.4)	8.2 (7.6; 8.8)	0.91 (0.79–0.98)	17.2	Good
	Midwest	Total	10.8 (2.3)	10.2 (9.0; 12.0)	0.88 (0.77–0.95)	21.1	Acceptable
		Women	11.5 (2.3)	11.5 (9.9; 12.7)	0.89 (0.76–0.98)	19.8	Good
		Men	10.0 (2.4)	9.7 (7.9; 11.6)	0.88 (0.72–0.97)	23.7	Acceptable
	Northeast	Total	12.9 (2.6)	12.7 (11.2; 13.6)	0.85 (0.74–0.94)	20.1	Acceptable
		Women	14.0 (2.6)	14.0 (12.4; 14.4)	0.87 (0.72–0.97)	18.7	Good
		Men	11.6 (2.7)	11.7 (9.4; 12.7)	0.86 (0.69–0.97)	23.2	Acceptable
	North	Total	11.0 (2.4)	10.6 (9.1; 12.4)	0.83 (0.69–0.93)	21.3	Acceptable
		Women	11.8 (2.2)	11.5 (10.2; 13.4)	0.85 (0.68–0.97)	18.3	Good
		Men	10.2 (2.7)	9.9 (7.9; 11.5)	0.83 (0.64–0.96)	26.2	Acceptable
Third	Southeast	Total	9.4 (2.4)	8.7 (7.6; 11.4)	0.86 (0.74–0.94)	25.4	Acceptable
		Women	10.1 (2.4)	9.1 (8.3; 12.2)	0.87 (0.71–0.97)	23.9	Acceptable
		Men	8.5 (2.4)	8.0 (6.3; 10.7)	0.86 (0.69–0.97)	28.5	Acceptable
	South	Total	8.2 (1.4)	8.2 (6.8; 9.1)	0.88 (0.79–0.95)	16.7	Good
		Women	9.0 (1.4)	8.7 (8.0; 9.9)	0.89 (0.76–0.98)	15.8	Good
		Men	7.3 (1.4)	7.5 (6.0; 8.1)	0.89 (0.76–0.98)	19.5	Good
	Midwest	Total	9.7 (2.6)	9.6 (7.3; 11.1)	0.87 (0.77–0.95)	26.3	Acceptable
		Women	10.3 (2.5)	9.6 (8.3; 12.1)	0.89 (0.75–0.97)	24.6	Acceptable
		Men	9.0 (2.6)	9.2 (6.8; 9.9)	0.88 (0.73–0.97)	29.5	Acceptable
	Northeast	Total	11.7 (3.3)	11.4 (9.5; 13.6)	0.82 (0.69–0.93)	28.1	Acceptable
		Women	12.4 (3.3)	11.8 (10.1; 14.4)	0.84 (0.65–0.96)	26.5	Acceptable
		Men	10.8 (3.4)	10.8 (7.8; 12.7)	0.83 (0.64–0.96)	31.4	Poor

(Continues)

TABLE 2 | (Continued)

Round	Region	Population	Mean (SD)	Median (IQR)	ICC (95% CI)	CV	Agreement
	North	Total	10.3 (2.6)	9.8 (8.3; 11.7)	0.85 (0.74–0.94)	24.8	Acceptable
		Women	11.0 (2.5)	10.2 (9.5; 12.7)	0.87 (0.71–0.97)	22.6	Acceptable
		Men	9.5 (2.7)	9.3 (6.9; 11.0)	0.86 (0.70–0.97)	28.7	Acceptable
Fourth	Southeast	Total	8.2 (1.4)	8.0 (7.2; 8.8)	0.88 (0.79–0.95)	17.3	Good
		Women	8.8 (1.5)	8.9 (7.6; 9.6)	0.89 (0.76–0.98)	17.2	Good
		Men	7.3 (1.4)	7.2 (6.2; 7.8)	0.89 (0.75–0.98)	19.2	Good
	South	Total	7.3 (0.8)	7.2 (6.7; 7.7)	0.89 (0.81–0.96)	11.5	Good
		Women	7.9 (1.0)	7.7 (7.4; 8.3)	0.90 (0.78–0.98)	12.4	Good
		Men	6.5 (0.9)	6.4 (5.9; 7.1)	0.90 (0.78–0.98)	13.6	Good
	Midwest	Total	8.3 (1.3)	8.2 (7.3; 9.2)	0.89 (0.80–0.96)	16.1	Good
		Women	8.8 (1.4)	8.5 (8.0; 9.8)	0.90 (0.77–0.98)	15.8	Good
		Men	7.8 (1.4)	7.4 (6.7; 8.6)	0.90 (0.77–0.98)	18.1	Good
	Northeast	Total	10.1 (1.9)	10.4 (8.4; 11.5)	0.84 (0.73–0.94)	18.9	Good
		Women	10.7 (2.2)	11.3 (8.5; 12.0)	0.86 (0.69–0.97)	20.2	Acceptable
		Men	9.2 (1.9)	8.9 (7.7; 10.1)	0.85 (0.68–0.97)	20.8	Acceptable
	North	Total	8.9 (1.7)	9.1 (7.4; 10.1)	0.86 (0.76–0.94)	19.4	Good
		Women	9.4 (1.7)	9.7 (7.8; 10.1)	0.88 (0.73–0.97)	18.7	Good
		Men	8.3 (1.8)	8.0 (6.8; 9.8)	0.87 (0.72–0.97)	21.5	Acceptable

Abbreviations: CV = coefficient of variation; ICC = intraclass correlation coefficient; IQR = interquartile range; SD = standard deviation; 95% CI = 95% confidence interval.

prevalence rate of all-cause dementia in the Northeast was estimated at 10.1%, resulting in a prevalence ratio of 1.21 (95% CI = 1.13–1.29) for this region (Table 4).

When applying the expert consensus estimated rates to the Brazilian population distribution by sex and age, we found that approximately 2.46 million Brazilians aged 60 years or older were living with dementia in 2019. Assuming that the all-cause dementia prevalence rates will remain constant across age groups, sex, and macro-regions over two and 4 decades, the number of dementia cases is expected to increase to 5.45 million and 8.89 million in 2040 and 2060, respectively (Figure 2).

Finally, when comparing the number of dementia cases between 2018 and 2019, using the estimated rates from the consensus of experts and based on data from the IBGE on the population distribution by age, sex, and macro-region, it was calculated that there were approximately 97,000 new cases of dementia in Brazil in 2019. In other words, a new dementia case emerged every five minutes in Brazil between 2018 and 2019.

4 | Discussion

This study, utilizing a Delphi technique, estimated that dementia affects approximately 1 out of 12 Brazilians aged 60 years and older, with a slightly higher prevalence of all-cause dementia among women compared to men. The sex differences were mainly observed in much older people (≥ 80 years). Geographical variations were also determined by experts, particularly with lower dementia prevalences in the South and higher rates in the North and Northeast of Brazil. As the population ages, projections indicate that the number of dementia cases will more than double in 2 decades and nearly quadruple in 4 decades.

This Delphi study highlighted crucial aspects of dementia prevalence in Brazil. It demonstrated the complexity of the issue, requiring four rounds to reach a consensus. The findings indicated a dementia prevalence of 8.5% among Brazilians aged 60 years and older in 2019, with rates ranging from 2% for people aged 60–64 years to 44% for those aged 90 years and above. The experts' estimated rates were higher than the prevalence of approximately 6% shown in epidemiological studies based on a nationally representative sample of Brazilians aged 60 years and older, with data collected in 2015 and 2016 [1, 3, 4, 11]. In contrast, the experts' estimated rates tended to be slightly lower than prevalence rates found in epidemiological studies conducted in Southern region cities between 2008 and 2016, which ranged from 5% to 17%, with an average rate of about 9% in those aged 60 years and older [5–9, 23]. Consistent with epidemiological studies, experts also indicated a dementia prevalence that exponentially increased with advancing age, roughly doubling every 5 years [1–4].

Interestingly, the estimated rates from this Delphi study aligned closely with the findings reported in a systematic review encompassing 31 studies across 15 Latin American and Caribbean countries [23]. This comprehensive review, involving 96,396 participants aged 50 and older, found a pooled all-cause dementia prevalence of 8.2% (95% CI = 6.8–9.6%) in population-based representative studies. Building on these results, it is noteworthy that the experts' estimated rates for Brazil indicate a higher prevalence when compared to high-income regions.

TABLE 3 | Prevalence rate of dementia in the Brazilian population in 2019 according to age group, sex, and macro-region based on the Delphi consensus.

Macro-region and age range	Mean (standard deviation)		
	Total	Women	Men
Southeast			
60–64 years	1.7 (0.2)	1.6 (0.3)	1.9 (0.4)
65–69 years	3.2 (0.2)	3.1 (0.3)	3.3 (0.3)
70–74 years	6.7 (0.4)	6.5 (0.5)	6.9 (0.5)
75–79 years	12.8 (0.7)	12.5 (1.0)	13.1 (1.0)
80–84 years	19.8 (0.9)	19.5 (1.2)	20.0 (1.3)
85–89 years	27.7 (1.3)	27.7 (1.8)	27.7 (1.8)
90 years or more	42.6 (1.8)	43.0 (2.6)	42.2 (2.5)
South			
60–64 years	1.6 (0.2)	1.6 (0.3)	1.7 (0.3)
65–69 years	3.2 (0.3)	3.1 (0.4)	3.2 (0.4)
70–74 years	5.6 (0.2)	5.5 (0.3)	5.7 (0.3)
75–79 years	12.1 (0.6)	11.7 (0.8)	12.4 (0.9)
80–84 years	18.5 (0.6)	18.4 (0.9)	18.6 (0.9)
85–89 years	26.0 (1.1)	26.4 (1.7)	25.5 (1.6)
90 years or more	41.8 (1.7)	42.2 (2.5)	41.4 (2.4)
Midwest			
60–64 years	2.1 (0.2)	2.0 (0.3)	2.2 (0.4)
65–69 years	4.0 (0.3)	3.8 (0.4)	4.2 (0.5)
70–74 years	8.1 (0.3)	8.0 (0.5)	8.3 (0.5)
75–79 years	14.3 (0.4)	14.2 (0.5)	14.4 (0.5)
80–84 years	22.1 (0.8)	22.2 (1.2)	22.0 (1.2)
85–89 years	30.6 (1.2)	30.8 (1.7)	30.4 (1.6)
90 years or more	44.2 (1.9)	44.6 (2.8)	43.7 (2.7)
Northeast			
60–64 years	2.1 (0.2)	2.0 (0.3)	2.3 (0.3)
65–69 years	4.1 (0.3)	4.0 (0.5)	4.3 (0.5)
70–74 years	8.5 (0.4)	8.4 (0.6)	8.7 (0.6)
75–79 years	14.7 (0.8)	14.7 (1.1)	14.7 (1.1)
80–84 years	22.7 (1.1)	22.7 (1.6)	22.6 (1.6)
85–89 years	31.4 (1.5)	31.6 (2.1)	31.2 (2.1)
90 years or more	46.2 (2.4)	46.6 (3.4)	45.8 (3.4)
North			
60–64 years	2.4 (0.3)	2.3 (0.5)	2.5 (0.5)
65–69 years	4.8 (0.4)	4.6 (0.6)	5.1 (0.6)
70–74 years	8.5 (0.4)	8.3 (0.6)	8.7 (0.6)
75–79 years	15.2 (0.4)	15.1 (0.6)	15.3 (0.6)
80–84 years	23.4 (0.9)	23.5 (1.3)	23.3 (1.3)
85–89 years	31.9 (1.4)	32.1 (2.0)	31.7 (2.0)
90 years or more	45.9 (2.2)	46.4 (3.2)	45.4 (3.2)

Note: The values represent the final mean prevalence estimates with their respective standard deviations according to the 15 experts.

Specifically, these estimated rates surpass the prevalence observed in the United States (8.2% among those aged 65 years and older) [24] and Europe (7.1% among those aged 55 years and older) [25]. Furthermore, the experts' estimated rates for Brazilians exceeded that observed in Asian population countries, such as China, which reported a prevalence of 5.3% among people aged 60 years and older [26]. Overall, these findings underscore the importance of advancing epidemiological studies on dementia prevalence in Latin American countries like Brazil [14].

The sex differences in dementia prevalence proposed by the experts, with slightly higher rates observed in women (9.1%) compared to men (7.7%), are in line with results from epidemiological studies included in the systematic review of studies in Latin American and Caribbean countries reporting dementia prevalence rates of 9.0% among women and 7.3% among men [23]. This discrepancy can be partially attributed to women's longer life expectancy and the "gender paradox" in aging, where women often experience a more significant burden of chronic diseases and age-related impairments than men [27]. Gender inequalities, especially pronounced in LMICs, further contribute, leading to disparities in education, cognitive stimulating occupations, household activities, and healthcare access for women [28]. Additionally, a growing body of literature has suggested that women over 80 years may exhibit an increased susceptibility to Alzheimer's disease due to multiple factors (e.g., genetics, sex hormones, autoimmune responses, and brain structure), presenting stronger associations with the pathophysiology of the Alzheimer's disease in females than males [29–31]. This rationale encounters support in epidemiological studies from different countries showing a higher dementia prevalence in women compared to men in advanced age (≥ 80 years) [31–33], a trend also proposed by the experts in this consensus.

We also examined regional disparities in all-cause dementia prevalence in Brazil by soliciting expert opinions on prevalence rates within the country's five macro-regions. This stratification is particularly vital in large countries characterized by significant socioeconomic inequalities [15, 34]. Notably, the United States offers a relevant example, where dementia prevalence rates range from 7.1% in the West North Central division to 13.6% in the East South Central division, marking a substantial 91% relative difference associated with higher dementia rates among Black individuals and those with lower educational and socioeconomic backgrounds [34]. In Brazil, characterized by its diverse and multicultural population that is unevenly distributed across macro-regions, no previous work has explored how these regional variations impact the prevalence of dementia using direct data [3, 15]. Moreover, population-based studies on dementia are concentrated primarily in the Southeast, the nation's most affluent region [5–9]. Our expert panel reported considerable geographic differences, with lower prevalence rates in the South (7.1%) and higher rates in the Northeast (10.1%), indicating a relative difference of 38%. This discrepancy aligns with the distinct demographic profiles of these regions. In the South, 86% of the population aged 50 years and older is White, and 9% is illiterate. In contrast, in the Northeast, 71% are Black or admixed (mixed of Black and White), and 22% are illiterate [35–37]. Beyond regional disparities, stemming from economic

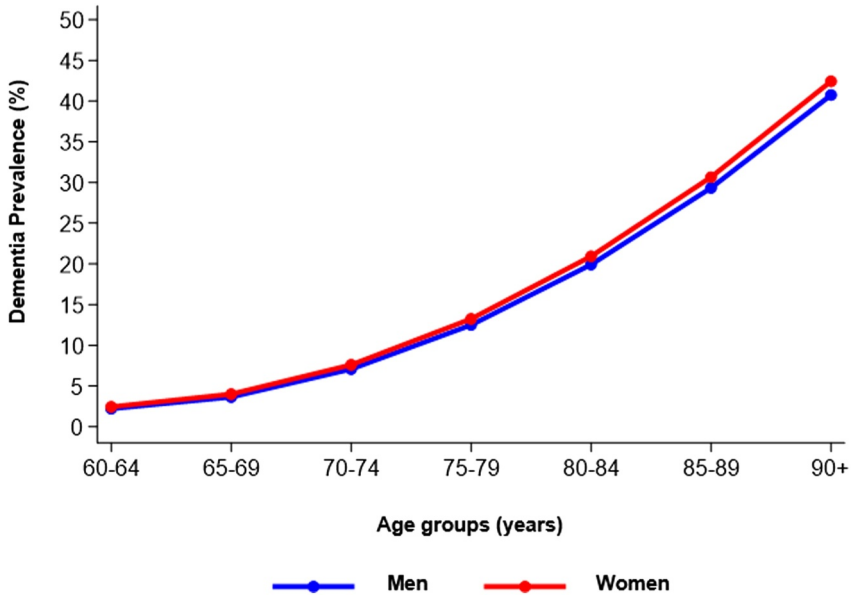

FIGURE 1 | Mean dementia prevalence rates in the Brazilian population in 2019 according to age group and sex based on the Delphi consensus. The values for each region represent the mean prevalence estimates of dementia provided by the 15 experts.

TABLE 4 | Prevalence ratios for dementia in four Brazilian macro-regions with the Southeast as the reference group.

	Mean prevalence ratio (95% confidence interval)
South	
Total	0.92 (0.87–0.98)
Women	0.91 (0.84–0.97)
Men	0.93 (0.88–0.98)
Midwest	
Total	1.06 (0.98–1.14)
Women	1.10 (1.01–1.19)
Men	1.04 (0.97–1.12)
Northeast	
Total	1.21 (1.13–1.29)
Women	1.26 (1.16–1.35)
Men	1.18 (1.11–1.26)
North	
Total	1.14 (1.05–1.24)
Women	1.19 (1.08–1.30)
Men	1.12 (1.03–1.22)

Note: The values for each region represent the final mean prevalence estimates of dementia provided by the 15 experts.

and racial inequality among the five regions, it is crucial to account for distinctions between rural and urban areas, as previous work has suggested that underrepresented populations living in rural areas can present high cognitive impairment prevalence [10]. In the North and Northeast, 25% and 27% of the people reside in rural areas, respectively, whereas this percentage decreases to 7% in the Southeast region [37]. Such divergent characteristics, which had probably influenced experts' opinions, underscore the importance of considering regional nuances in assessing dementia prevalence.

While these findings are valuable for informing public health policies and resource allocation in Brazil, it is crucial to acknowledge that an expert consensus cannot replace direct evidence and must be interpreted with caution due to its significant limitations. Expert estimates, particularly when primary data are scarce, exhibit inherent biases. The process is also prone to cognitive biases such as the bandwagon effect, where individuals adjust their responses to align with others regardless of their own beliefs, and belief perseverance, where beliefs remain unchanged even in light of new evidence [16, 38]. Despite these challenges, the primary objective of the Delphi method is to explore and generate novel insights, ideas, or estimates in areas where data is limited or non-existent [16]. For instance, it may aim to propose the prevalence of strategic disorders, like dementia, thereby augmenting the existing knowledge in the literature and shedding light on a central public health issue. According to the current experts' estimated rates, the number of dementia cases is projected to reach nearly nine million in Brazil in the next 4 decades. This estimate is alarming yet conservative. Even though dementia prevalence is stable or even decreasing in developed countries, it is on the rise in LMICs like Brazil [23, 39, 40]. The global projections of dementia prevalence between 2019 and 2050 show significant regional disparities tied to socio-demographic index (SDI) levels, with an increase of 113% (95% CI: 93%–134%) in high-SDI countries compared to a staggering 330% (95% CI: 295%–362%) in low-SDI countries [1].

It is also worth mentioning that this consensus strictly adhered to established protocols of the modified Delphi technique [16, 38]. The process involved independent investigators and a diverse panel of experts with extensive experience from various institutions and medical backgrounds and successfully achieved a high level of agreement (> 70%). Despite requiring four rounds

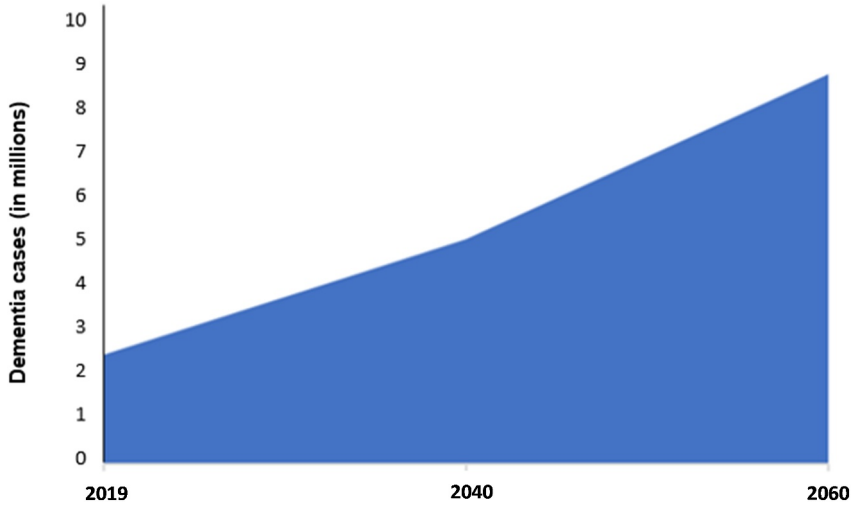

FIGURE 2 | Number of dementia cases in Brazil according to Delphi consensus. Projections from the Brazilian Institute of Geography and Statistics (IBGE) were used for the Brazilian population aged 60 or over, according to age group and sex, for 2019, 2040, and 2060.

of opinions, there was no attrition [16]. The framework utilized in this expert consensus, besides being instrumental in advancing the public health discourse on dementia in Brazil, also serves as a model that can be embraced by other LMICs, fostering a more expansive global dialog on dementia [16–18].

5 | Conclusions

Our use of the Delphi technique has identified a dementia prevalence of 8.5% among Brazilians aged 60 and older, with notable variations by sex and macro-regions. Future studies should prioritize standardized methodologies applied to nationally representative samples and regions currently underrepresented in research. Upcoming studies across Brazilian macro-regions should further explore how age and sex prevalence of dementia may be distinctively affected by social and economic development indices. These efforts will provide more insightful and comprehensive information on dementia prevalence in Brazil, also influencing other LMICs. The growing public health concern of dementia requires sustained attention in Brazil and worldwide to mitigate its impact effectively.

Author Contributions

Márlon Juliano Romero Aliberti: study concept and design, acquisition of data, data interpretation, and manuscript preparation. **Claudia Kimie Suemoto, Jerson Laks, Paulo Caramelli, Sonia Maria Dozzi Brucki, Nicolas Farina,** and **Ricardo Nitrini:** study concept and design, data interpretation, and manuscript preparation. **Luís Fernando Rangel**, and **Matheus Ghossain Barbosa:** acquisition of data, data interpretation, and manuscript preparation. **Daniel Apolinario, Einstein Francisco Camargos, Eleonora d'Orsi, Gilberto Sousa Alves, Karolina Gouveia César-Freitas, Márcia Lorena Fagundes Chaves, Marcos Antonio Lopes, Marcus Vinicius Della Coletta,** and **Norberto Anizio Ferreira Frota:** data interpretation, and manuscript preparation. **Cleusa Pinheiro Ferri:** acquisition of funding, study concept and design, supervision, data interpretation, and manuscript preparation.

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Ethics Statement

All experts provided informed consent to share their expertise as part of the Delphi process. As this manuscript involves expert opinion rather than research on human subjects, we did not obtain ethical approval.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.