PERSPECTIVE

Alzheimer's & Dementia
Translational Research
& Clinical Interventions

The (in)visible Brazilians: A perspective review on the need for brain health and dementia research with Brazilian immigrants in the United States

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Abstract

Introduction: The Brazilian population in the United States (U.S.), a Latinx subgroup, is rapidly growing and aging but remains underrepresented in U.S. health research. In addition to group-specific genetic and environmental risks, Brazilian immigrants and their offspring in the U.S. likely have cumulative risks for health inequities.

It is estimated that 71% of Brazilian immigrants in the U.S. are undocumented, which may limit healthcare access/utilization. Furthermore, mental health is reported as a health priority by Brazilian immigrants in the U.S., and there is a lack of research on Alzheimer's disease and related dementia (AD/ADRD) in this population.

Methods: We reviewed the scientific literature using traditional (e.g., PubMed) sources and databases generated by U.S. and Brazilian governments, as well as international organizations, and press articles.

Results: This perspective review lists recommendations for researchers, health providers, and policymakers to promote greater inclusion of U.S. Brazilian populations in health research and care. The review identifies research areas in need of attention to address health inequities and promote mental/brain health in Brazilian immigrants and their offspring living in the U.S. These research areas are: 1) epidemiological studies to map the prevalence and incidence of mental/brain health conditions; 2) research on aging and AD/ADRD risk factors among Brazilian populations in the U.S.; and 3) the need for greater representation of U.S-residing Brazilian population in other relevant research areas involving genetics, neuropathology, and clinical trials.

Conclusions: The recommendation and research efforts proposed should help to pave the way for the development of community-engagement research and to promote mental/brain health education, improvement of mental/brain health and AD/ADRD services, and the development of culturally-informed intervention to the U.S.-residing Brazilian communities.

KEYWORDS
aging, Alzheimer's disease, Brazilian immigrants, dementia, health disparities, health equity, Latinx, mental health, minority groups

HIGHLIGHTS

- The Brazilian population in the United States is growing but is underrepresented in U.S. health research.
- Approximately 71% of Brazilian immigrants in the United States are undocumented, with an increased risk for health inequities.
- Mental health is reported as a central health priority by Brazilian immigrants in the United States.
- There is a lack of research on Alzheimer's disease and other dementias (ADRD) in Brazilian immigrants in the United States.
- Epidemiological research is needed to map the prevalence/incidence of mental health conditions and ADRD risk factors among Brazilian immigrants in the United States.

1 | BACKGROUND

The Brazilian population in the United States is growing rapidly[1] and aging but remains an underrepresented group in U.S. health research. Brazilian immigrants in the United States likely have cumulative risks for health inequities. However, few studies have examined their health concerns and brain health factors. Furthermore, there is a lack of data on the prevalence of mental health conditions, neurodegenerative diseases, and dementia in this subgroup of Latino/Latina/Latine in the United States (hereafter referred to as Latinx). Although this perspective review focuses on first-generation Brazilian immigrants, it is essential to highlight that the Brazilian population in the United States includes foreign-born individuals and their U.S.-born offspring.

According to recent Brazilian official data (year 2021), the United States has the world's largest community of Brazilian immigrants.[1] The Brazilian consulates in the United States that serve the largest Brazilian communities are located in Boston, Miami, and New York City (serving New York, New Jersey, and Pennsylvania states), followed by other consulates serving communities in (or around) Atlanta, Los Angeles, Houston, Hartford, San Francisco, Chicago, and Washington D.C.[1,2]

Although the U.S. Census estimates ≈526,000 foreign-born Brazilians living in the United States in 2021,[3] the Brazilian Foreign Ministry estimates 1,905,000 Brazilian individuals living in the United States in 2021.[1] A potential reason for this discrepancy is the large proportion of undocumented Brazilian immigrants in the United States, estimated at 71% of the Brazilian population living in the United States,[4] as many Brazilians enter the country without documents or overstay their visas.[4,5] Undocumented status is recognized as a social determinant of health and is associated with limited health care access/utilization, which could affect physical and mental health.[6] In addition, it is relevant to consider discrimination and related biases, such as immigration status, native language, and accent. As a result, these social determinants of health influence how certain groups are perceived and treated, which can also influence health and well-being, regardless of health insurance status and access (for a review see[7]).

Furthermore, foreign-born status has been associated with an increased risk for dementia among immigrants with limited English proficiency in a nationally representative sample of older adults.[8] In that study, older immigrants had a 70% greater odds of having dementia, and 119% of odds of having undiagnosed dementia compared to U.S.-born residents after controlling for several dementia risk factors. However, limited English proficiency explained the greater prevalence of dementia and the higher rate of undiagnosed dementia among the foreign-born population. These data suggest that limited English proficiency is a key aspect to consider when investigating dementia risk in immigrant populations in the United States, including Brazilian communities.

The first large waves of Brazilian migration to the United States were in the late 1980s and mid-1990s.[9] They mainly included single young men and women seeking work opportunities and financial sta-

RESEARCH IN CONTEXT

1. **Systematic Review**: Literature was reviewed using traditional (e.g., PubMed) sources and databases generated by U.S. and Brazilian governments, as well as international organizations and press articles.

2. **Interpretation**: Our findings led to a perspective that there is limited health-related data on Brazilian populations in the United States, and conflicting information between U.S. and Brazilian demographic government data. These data reveal a lack of knowledge of Brazilian communities in the United States, which continue to be underrepresented in U.S. health research. In addition, there is an indication of a large and growing undocumented Brazilian population in the United States that is likely to be underserved, "invisible," and not reflected in the data available.

3. **Future Directions**: This perspective proposes a set of recommendations to providers, researchers, and policymakers to increase the inclusion of the Brazilian population in future research and clinical care in the United States. We highlight the need for future community-engagement research and epidemiological studies on areas related to mental health, aging, and Alzheimer's disease and related dementias as the Brazilian population in the United States may be facing cumulative risk factors for mental/brain conditions.

bility in the United States, with plans to return to Brazil or a pattern of "yo-yo" or circular migration with multiple comings and goings.[10] However, this pattern changed when visa restrictions were applied to Brazilian individuals in the 1990s and 2000s, leading to new waves of immigration, including families who planned to remain in the country.[11] Since the 2000s, research suggests that the increase in Brazilian immigration to the United States is due mainly to the economic and political turmoil in Brazil.[4] This trend has become more pronounced in the last decade, as data show that Brazilian immigration to the United States has increased consistently since 2015, particularly after 2018,[1] which possibly reflects the recent economic challenges and political shifts in Brazil. Moreover, because Brazil and the United States are continent-wide countries with several sociocultural differences within regions, the variety of geographic affinity (i.e., origin-destination) should be carefully considered[12] when including Brazilian populations in U.S. health research and care. For instance, the East Coast and Florida are typical immigration targets of Brazilian immigration, and immigrants come from different Brazilian cities and regions,[2] although most Brazilian immigrants have been estimated to come from the southeast, especially the state of Minas Gerais.[13]

Recent data indicate that Brazilian immigrants are considerably less likely than the overall immigrant population to be naturalized U.S. citizens,[2] which may contribute to the large population of undocumented Brazilian immigrants in the United States. In 2019, 35% of Brazilian immigrants had become U.S. citizens, compared to 52% of the total foreign-born population. This lower rate of citizenship among foreign-born Brazilians living in the United States partially reflects the recency of Brazilians' arrivals, with 47% entering the United States in 2010 or later. For comparison, 25% of immigrants of all nationalities arrived during the same period in the United States. Such differences may also be due to the pattern of circular Brazilian migration; it remains unclear how it may have affected individuals in different phases of life, including older adults.

Previous research has identified brain health risks and protective factors associated with immigration experiences in the United States. However, factors may vary considerably in the pan-ethnic Latinx population due to the significant heterogeneity along multiple dimensions within this population (e.g., nativity, race/ethnicity, culture, socioeconomic status, migration time/context, genetics).[14] Thus there is a need to investigate within-group heterogeneity considering the sociocultural dimensions in well-characterized Latinx subpopulations to understand the risks and protective factors on brain health outcomes. The Brazilian population represents a unique Latinx subgroup in the United States, meriting greater research attention due to the distinct linguistic background (Brazilian Portuguese) and cultural context within the U.S. Latinx diaspora (which originated mainly from Spanish-speaking countries in Latin America),[15] but also due to the high levels of income inequality. In 2019 and 2020, the World Bank ranked Brazil as one of the most economically inequitable countries in Latin America.[16,17] Additional research is needed to better compare the U.S.-residing Brazilian population to other Latinx groups in the United States. The U.S. Latinx population is the largest ethnoracial, minoritized population in the United States and will comprise almost one-third of the U.S. population by 2060.[18] Critically, in the context of aging, the Latinx population is one of the fastest-growing subpopulations of older adults in the United States[19] and is at risk for worse brain health outcomes when compared to the non-Latinx White population. For instance, the U.S. Latinx population is 50% less likely to receive mental health treatment[20] and presents a higher prevalence of Alzheimer's disease and related dementias (ADRD).[21] In addition, most studies with U.S.-Latinx samples in aging research rarely disaggregate the Latinx origin, but those that do identify a significant representation of Mexican, Caribbean, and Central American groups,[22–24] with limited data on Brazilian populations.

Therefore, this perspective review will highlight critical considerations for future brain health and dementia research on U.S.-Brazilian populations, such as Brazilian identity and ancestry, sociocultural factors, and inequities in Brazil and the United States. Finally, we discuss critical research areas needing immediate attention to address health inequities and improve care and quality of life for Brazilian immigrants and their offspring in the United States.

2 | CONSIDERATIONS FOR BRAIN HEALTH EQUITY RESEARCH IN THE U.S.-BRAZILIAN POPULATIONS

2.1 | Brazilian identity and ancestry

Brazil has a diverse culture and identity, given that Brazilians have distinct cultural influences as a former Portuguese colony and heterogeneous racial admixture, with strong ties to African, Indigenous, Asian, and European origins and cultures.[5,9] it is critical to highlight that Brazilian individuals typically are not considered a Hispanic subgroup in terms of language and culture. The term Hispanic refers to relating to Spain or other Spanish-speaking countries. Unlike other Latin American countries where Spain colonized, Brazil was colonized predominantly by Portugal and is the only country in Latin America to have Portuguese as an official language. Although Brazil is part of Latin America, Brazilians living in the United States self-identify only sometimes as Latinx, and fewer identify as Hispanic.[25] For instance, a study that analyzed U.S. Census data between 2006 and 2015, showed that Brazilian immigrants typically do not self-identify as Hispanic/Latinx ethnicity, although they overwhelmingly report "Brazilian" ancestry.[26] Although this can be most clearly attributed to the language and cultural differences between Brazilians and other Latinx groups, perceived associations between Latinx/Brazilian identity and discrimination or stigmatization may also play a role.[11,25]

It is critical to note that Brazilian identity within the Latinx diaspora in the United States has been controversial, since the terms Hispanic and Latinx (including the Latino/a/e), which refer to ethnicity/origin regardless of race, are used interchangeably depending on the context.[15,27] For instance, in the U.S. Census, the terms "Hispanic," "Latino," and "Spanish" are used interchangeably,[28] which is unlikely to encourage Brazilians to self-identify as Latinx. However, it is possible to self-identify separately with one of these three terms. Similarly, the National Alzheimer's Coordinating Center (NACC), established by the National Institute on Aging in 1999, defines the terms "Hispanic/Latino" as "having origins from mainly Spanish-speaking Latin American Country",[29] which does not mention other non-Spanish speaking Latinx community, as is the case of the Brazilian population. Despite that, more recently the National Institutes of Health (NIH) provides distinct definitions for Hispanic and Latinx, specifically mentioning the Brazilian population.[30] According to the NIH, "Latino/a or Latinx" is "a person whose origins are in Latin America, including Cuba, Mexico, Puerto Rico, South America, or Central America," whereas "Hispanic refers to those that descend from Spanish-speaking populations (…). Most people with origins in Brazil are considered Latino but not Hispanic because most Brazilians speak Portuguese."[30] Conversely, several genome-wide association studies (GWAS) have considered the Brazilian population as part of the Hispanic/Latinx community.[31,32] Therefore, the terminology used to refer to the pan-ethnic Latinx population differs depending on the context. It is highly relevant that it continues to evolve to

be more inclusive of the non–Spanish-speaking communities in the region.

It is possible that the differences in terminology and self-identification may have contributed to the limited health research in Brazilian communities in the United States. To our knowledge, there is a paucity of health research on Brazilian immigrants. In the past 20 years, fewer than 20 studies addressed the health needs of Brazilian immigrants in the United States,[5] and many including small samples.

In addition, ancestry-based genetic factors are relevant to be considered when studying Brazilian samples, as genetic risk factors are associated with mental health conditions and ADRD.[33,34] For instance, in a cohort of community-dwelling Brazilians, ancestry highly influenced the association between the apolipoprotein E (*APOE*) genotype, AD pathology, and clinical patterns.[33] Specifically, African ancestry was associated with a lower burden of neuritic plaques. However, in individuals who were *APOE* ε4 non-carriers with severe AD pathology (e.g., presence of neuritic plaques and tau neurofibrillary tangles), the higher the African ancestry proportion, the worse the functional cognitive scores.[33] Furthermore, ancestry may differ across Latinx populations, as individuals across the Caribbean, Mexico, and South America have different profiles of genetic ancestry. For example, a previous report indicated that admixed Brazilian population showed less Indigenous ancestry than several Latinx populations.[35]

Understanding how genetic marker sets are assigned to Brazilian genetic ancestry is relevant to historical and public health issues.[35] Large-scale genomic discoveries in mental health and ADRD are heavily biased toward individuals of European ancestry,[36] potentially exacerbating existing health inequities.[37] It is critical to add diversity to GWAS to better understand the generalizability and transferability across GWAS.[38] Considering the limited data on the genetic architecture of mental health conditions and ADRD in Latinx populations, studying Brazilian samples is an opportunity to advance this field and expand the understanding of the disease's pathophysiology and risks. In addition, polygenic risk scores will be much more accurate in non-European ancestry individuals if the discovery sample includes the relevant ancestral background. Therefore, future research with Brazilian immigrants in the United States should carefully consider Brazilian identity and ancestry when describing Brazilian samples and aspects that may influence health diseases risks.

2.2 | Sociocultural factors

A better understanding of the links between culture and health behaviors is needed to advance the research with Brazilian populations in the United States. Culture refers to a set of traditions, values, beliefs, and living styles shared by a group of individuals, which is integrated into people's behaviors and transmitted across generations.[39] Culture is a complex construct comprising factors, such as language, religion, spiritual beliefs, emotional expression, gender roles, geographical location or country of origin, education, upbringing, and migration history.[21,40] In addition, culture plays a crucial role in health behaviors, perception of illness/health, etiology of disease, and clinical presentation,[21]

all of which may affect how people seek and adhere to treatments. Critically, cultural nuances can contribute to delayed diagnosis, misdiagnosis, and modify the risk for brain/mental disorders. This has been well documented in anxiety and depressive disorders,[40] and in ADRD.[41]

A recent study reported that in Brazil there is a widespread belief that dementia is a part of aging, and caregivers for persons living with dementia reported low levels of knowledge and awareness about the condition.[42] These perceptions about aging and dementia likely influence how and when Brazilian individuals seek health treatments and adhere to dementia care. It remains unclear if these perceptions are also true among Brazilian immigrants. Beyond that, for the Brazilian population living in the United States, the risk for dementia misdiagnosis is likely to be influenced by other contextual factors, such as language barriers, limited health services (including assessment instruments) available in Portuguese, and limited health access faced by many undocumented Brazilian individuals.

Recent data (2021) from the U.S. Census Bureau - American Community Survey (ACS) suggest that Brazilian immigrants have been placed at increased risk for health inequities in comparison to the US-born population, particularly given the limited English language proficiency (34.3%), and health insurance coverage (20.5% uninsured, in contrast to 8.6% U.S.-born population).[3,43] However, regarding education attainment, according to the ACS 2021, Brazilians living in the United States do not show a disadvantage compared to the U.S.-born population. For instance, data indicate a similar rate of completing high school or fewer years of education (37.2% of Brazilians living in the United States vs 37.0% of the U.S.-born general population).[3] Regarding college or higher education, compared to the U.S.-born population, Brazilian immigrants report a slightly higher level of bachelor's degree attainment (25.8% vs 21.2%) and graduate or professional degree attainment (14.9% vs 13.1%).[3,44] These findings are consistent with reports that Brazil sends the highest number of students to U.S. higher educational institutions than any other Latin American country.[2]

It is critical to consider that Brazilian individuals living in the United States are not a homogeneous group and may show socioeconomic differences, likely reflecting inequities in Brazil, differences in the immigration context, and opportunities in the United States. For instance, although Brazilian immigrants tend to present higher median household incomes than both the overall immigrant and U.S.-born populations, at the same time, Brazilian immigrants experienced poverty at a higher rate (15.0%) than the U.S.-born population (12.0%), but at a similar rate to the overall immigrant population (14.0%).[2] In addition, the ACS data indicate that Brazilian individuals living in the United States have an unemployment rate (6.8%)[3] that is similar to that of the general U.S. population (6.3%).[45] However, it is unclear if this number represents and includes the large undocumented population of Brazilian immigrants living in the United States, who are more likely to depend on informal jobs with minimal work-related benefits and limiting health access/utilization. Furthermore, evidence suggests that Brazilian immigrant workers are at greater risk of exposure to chemical, ergonomic, physical, and psychosocial job hazards and may experience various health symptoms associated with work

environment exposures.[46] It is worth highlighting that although the U.S. Census Bureau/ACS may collect data from foreign-born respondents regardless of legal status, access to the undocumented population is more limited. Therefore, the ACS data on Brazilian immigrants should be interpreted carefully because it is likely to be biased and more representative of the documented U.S.-residing Brazilian individuals and may not reflect the Brazilian population in the United States.

Overall, these data are aligned with other evidence that foreign-born populations in the United States may experience health deterioration due to the cumulative (and potentially synergistic) effects of social, structural, and environmental stressors, such as immigration policies, lack of financial resources, unsafe and unhealthy housing, poor and hazardous working conditions, overexposure to harmful substances, poor health literacy, xenophobia/discrimination, and structural racism.[47] Other aspects being considered are social support, acculturative stress,[14] community resources, and educational and occupational opportunities.[48] Furthermore, the effect of acculturation seems particularly relevant among Brazilian immigrants in the United States (and their offspring) to better understand changes in lifestyle in a new country (e.g., diet), which may also impact health outcomes. For instance, a recent study showed that more time spent in the United States increased the odds of being overweight and obese among Brazilian immigrants living in Massachusetts.[49] To fully understand the general and brain health of the Brazilian population in the United States, it is critical to evaluate the unique contextual and social determinants of health as immigrants in the United States.

2.3 | Inequities in Brazil

It is imperative to consider the sociohistorical context in which Brazilian immigrants were living before they immigrated to the United States, such as political and socioeconomic conditions and demographics (e.g., age, gender, ethnoracial status, religion, education, and occupational background) that can influence health outcomes and inequity after immigrating to the United States. For instance, Brazilian education quality is highly heterogeneous. Brazilian national data[50] indicate that most people with functional illiteracy and elementary literacy levels (even those completing the middle and high school levels) are older than 50 years of age. These data suggest that even though older adults might report higher levels of education in Brazil, literacy might be under the corresponding expected level. This is a critical component when studying Brazilian immigrants in the United States, as education quality and literacy may modify dementia risk. For instance, in Brazil, higher literacy is associated with 15% lower odds of having dementia[51] and few years of education is associated with a higher risk of cognitive impairment.[52] In the United States, illiteracy has been associated with a higher incidence and prevalence of dementia, as illiterate older adults were twice as likely to develop dementia in comparison to literate individuals.[23] In addition, high school quality is associated with cognitive functioning six decades later.[53]

Another aspect to consider is the challenge of dementia underdiagnosis in Brazil. For instance, a study using a large nationally representative Brazilian sample (ELSI-Brazil), a Health and Retirement Study (HRS) partner in South America, found a prevalence of 5.8% for dementia in people 60 years and older in Brazil.[54] This rate is lower than the U.S.-HRS data, which indicates a prevalence of dementia in the United States at 8.8% in individuals 65 years of age and above. These data are not conclusive in indicating that the prevalence of dementia in Brazil is lower than in the United States, as only 1.2% of the selected sample in the ELSI-Brazil cohort had a previous self-report diagnosis of dementia,[54] reinforcing previous evidence that dementia underdiagnosis in Brazil is rampant and a major public health challenge.[55] It is worth mentioning that the prevalence of dementia in Brazil varies largely as indicated by a recent systematic review,[56] potentially due to differences in methodology, region, city, or setting studied (e.g., rural vs urban areas). For example, in contrast to the prevalence of 5.8% observed nationwide,[54] a large epidemiological study found a dementia prevalence of 17.5% in a small town in São Paulo state.[57] These data indicate that the prevalence of dementia in Brazil remains uncertain, an aspect that should be considered when comparing data on the Brazilian population living in Brazil and in the United States.

Ethnoracial health inequities in Brazil may persist in the U.S. context and should be considered carefully. Evidence from an epidemiological study using a nationally representative sample in Brazil indicated that Brazilians who self-identify as "Black" or "Brown" have, respectively, 20% and 10% higher prevalence of fair or poor self-rated health than Brazilians who self-identify as "White."[58] Similarly, other epidemiological evidence indicates that Black Brazilian individuals generally have higher rates of multimorbidity, lower rates of public health care utilization, and a higher risk of death than White Brazilian individuals.[59] These ethnoracial inequities persist following statistical adjustment for socioeconomic indicators, suggesting that race/ethnicity may independently affect health outcomes in Brazil, particularly the worse outcomes for the Black Brazilian population.[59] These observations highlight the need to consider ethnoracial inequities and systemic factors and biases (e.g., structural racism, ageism, and sexism/genderism) when investigating Brazilian immigrants in the United States, as these factors have been recognized increasingly in health research in Brazil and the United States.[7,60] In the context of dementia research in Brazil, the prevalence of dementia risk factors based on ethnoracial status seems variable. Previous work indicates no difference in the overall pattern of risk factors for White and Black people in Brazil, although the relative contribution for some risk factors varied.[61] For instance, in Brazil, lower education in early life was identified as the main contributor to dementia risk among Black people, whereas hypertension was the most important factor among White people.[61] Additional evidence also indicates a similar pattern in the prevalence of dementia risk factors between Black, Brown, and White individuals in Brazil.[62] However, the authors report Black and Brown Brazilian populations to present more risk factors related to socioeconomic inequality, such as higher rates of illiteracy and lower family income.[62]

It is important to consider the differences in ethnoracial identity and categorization in Brazil and in the United States,[63] aspects that

may influence how Brazilian individuals self-identify and are perceived in the United States. Beyond the challenges of Latinx identity among many Brazilians in the United States, mentioned earlier, differences in race identity may vary across countries as race can be considered a social construct and a proxy for exposure to systemic racism.[64,65] Critically, the differences in ethnoracial identity in Brazil and the United States may impact research participation, care access, and health outcomes.

Previous research has suggested that racial identity is more "fluid" in Brazil than in the United States,[66,67] and historical contexts are key to understanding these differences.[63] In the United States, definitions of racial identity historically tend to be more rigid, as racial admixture was either discouraged or widely outlawed during the segregation era.[66,67] In contrast, ethnoracial admixture between Black populations originally trafficked from Africa, White populations of European descent, and Native-Brazilian populations was more common in Brazil's history, contributing to a large proportion of Brazilians that come from multiracial families and self-identify as "Brown" ("Pardo") or "mixed-race."[66] This scenario likely influences the observation that the ethnoracial status of Brazilian individuals is typically determined by their phenotypic appearance rather than the ethnoracial background or phenotypic presentation of their parents or family members.[67] It is relevant to highlight that Brazil enslaved more people than anywhere else in the Americas (including the United States), and Brazil was the last in the Western Hemisphere to abolish slavery, in 1888.[66] Therefore, due to historical and cultural factors, ethnoracial identity may be experienced differently in Brazil and in the United States, as it is possible that an individual racialized as "White" in Brazil may be considered "Black" in the United States.

In addition, ethnoracial identity in Brazil has been changing in the past decade, likely due to the results of evolving affirmative action policies (e.g., racial quotas in universities) and the growth of a Brazilian Black empowerment movement. For instance, according to the Brazilian Institute of Geography and Statistics (IBGE),[68] between 2012 and 2022, the percentage of Brazilians who consider themselves White has dropped (from 46.3% to 42.8%), whereas the percentage of people who identify as Black or Brown has risen (from 53% to 56%). This rise was particularly marked for the individuals self-declaring Black (rise of 32%) in comparison to those self-declaring Brown (rise of 11%).[69] The historical differences between the United States and Brazil, and evolving changes in ethnoracial identity, should be considered when including Brazilian individuals in research and clinical care in the United States, thus highlighting the need for a more detailed sociocultural characterization of this population.

In addition, it is key to consider that Brazilian immigrants in the United States are not representative of the overall Brazilian population, as the immigration processes may significantly affect individuals. For instance, a previous study analyzing ACS data from 2006 to 2015 revealed that 75.0% of the Brazilian respondents in the United States self-identified as White,[26] in contrast to 47.7% of respondents from the Brazilian Census during a similar period (2010).[70] Similarly, ACS 2021 data show that 25.8% of Brazilians in the United States have a bachelor's degree, whereas Brazilian data from 2019 (IBGE) indicate a

lower rate of bachelor's degree attainment in Brazil (17.4%).[71] These discrepancies are even more marked for graduate education, as 14.9% of Brazilian individuals living in the United States reported a graduate or professional degree to the ACS in 2021,[3] whereas only 0.8% of the Brazilian population (between 25 and 64 years) have attained a master's degree, according to the Organization for Economic Cooperation and Development (OECD) 2022 report.[72] These data indicate that the Brazilian population that migrates to the United States reports higher levels of education and is more likely to self-report as White than the general Brazilian population, suggesting that investments in education and professional career are major drivers for Brazilian immigration to the United States. Nevertheless, these data are unlikely to capture the diversity among Brazilian immigrants and the reality of the large invisible population of undocumented individuals in search of more economic opportunities in the United States.[2] The implication of these findings for health research in the United States is that those who are more invisible are likely the most vulnerable, and efforts should be undertaken to include the undocumented Brazilian population in future research. Despite the lack of data on undocumented Brazilians in the United States, there are several community-based organizations (e.g., non-profit organizations and faith/religious centers) that offer services for undocumented and economically disadvantaged Brazilian individuals in the United States. Such organizations may be relevant sources of information for researchers, health providers, and policymakers.

2.4 | Brain health inequities in Brazilian populations in the United States

A recent qualitative study revealed that mental health was the most pressing health priority reported by Brazilian immigrants living in the Boston area, with many attributing high levels of stress, anxiety, and depression to worries about their undocumented status, fear of deportation, separation from social networks, and strenuous work schedules.[5] Domestic violence was a relevant topic in that study, as many women feared reporting it to the authorities due to their undocumented status. Although most participants reported good access to general medical care in this research, many pointed to challenges regarding interpersonal communication with providers and limited access to mental health services. In line with those findings, another study identified a high prevalence of depressive symptoms (35.3%) in a convenience sample of Brazilian immigrants in Massachusetts.[72] This prevalence is almost 10 times higher than the prevalence of depression reported in nationally representative surveys conducted in Brazil.[73] Furthermore, depression in Brazilian immigrants was correlated with low income, being single, poor English proficiency, and poor self-perception of health. These findings suggest the need for mental health services offered in Portuguese and culturally adapted to Brazilian populations in the United States.[72]

Despite the identified mental health needs among Brazilian immigrants living in the United States, this perspective review yielded limited research on the topic (e.g., see[11,74–76,72]) and a lack of data on

the prevalence of different mental health conditions among Brazilian immigrants in the United States.

Critically, there are also scarce data on other relevant aspects related to brain health, such as protective and risk factors for ADRD, considering the large community of Brazilian immigrants who may age in the country with potential increased risk for ADRD. This is also relevant considering that Latinx are one of the fastest-growing subpopulations among older adults in the United States.[19]

To better understand the ADRD risk factors among Brazilian immigrants and their offspring in the United States, it is critical to highlight the ethnoracial inequities in dementia research in the United States.[21,77] For instance, older Latinx and Black individuals in the United States are more likely to have ADRD than older non-Latinx White individuals.[78] Despite encompassing an estimated 19% of the U.S. population, Latinx individuals remain underrepresented in ADRD research and comprise <1% of the population in clinical trials for AD.[79] Prior research suggests that the Latinx population also has an increased risk of a missed or delayed diagnosis,[80,81] a high rate of misdiagnosis of cognitive disorders,[82] and a reduced likelihood of being informed of their dementia status by a physician.[83] Together these factors create barriers to timely diagnosis and practical recommendations and interventions, contributing to worse outcomes for patients and family/caregivers.[84,85] It is likely that these health inequities also occur among Brazilian individuals living in the United States, especially considering that services focused on ADRD typically offer evaluations in English and Spanish but not in Portuguese. Furthermore, data show that Brazilian immigrants perceive sociocultural differences in the delivery of care and communication barriers with health providers, including inconsistent quality of interpreting services.[86] Efforts in developing ADRD services for the Brazilian population in the U.S. will contribute to providing more specific cutoffs for neuropsychological tests and AD-related biomarkers to this population.

Thus, understanding risk factors for ADRD among Brazilian immigrants in the United States is an immediate need, considering the several modifiable factors that influence the risk for ADRD (e.g., lower education, hypertension, obesity, diabetes, physical inactivity, social interaction, depression, smoking, excessive alcohol consumption, traumatic brain injury, air pollution, and hearing loss).[87] These modifiable risk factors accounted for ≈40% of worldwide dementias,[87] 48% of dementia cases in Brazil in general, and 54% of dementia cases in the poorest Brazilian regions.[61] These data suggest that the potential for the prevention of dementia may be even higher in Brazil than in high-income countries,[61] an which should be considered carefully when working with Brazilian immigrants in the United States. In addition, contextual factors, like structural biases that may be linked to "minority stress," discrimination, and racism,[7] should be examined carefully when investigating ADRD risk factors among Brazilian immigrants in the United States. It is also relevant to consider the differences in health care systems between Brazil and the United States when including Brazilian immigrants in U.S. health research. Although Brazil has a universal public health care system (Sistema Único de Saúde [SUS]), the United States lacks a similar alternative. It is likely that the costs of the private health system in the United States create an additional challenge for many Brazilian immigrants living in the United States, regardless of immigrant status. This may contribute to a cumulative risk of ADRD.

Because the modifiable risk factors mentioned can differ across ethnoracial groups, effective brain health interventions could contribute to preventing or delaying the onset of ADRD in different populations. These may include regular physical activity, healthy diet, management of cardiovascular risk factors (i.e., diabetes, obesity, and hypertension), and engagement in cognitively challenging activities and social interaction.[88] These intervention targets are critical considering that the dementia incidence rate in Brazil is higher than in the United States and some other countries in Latin America, particularly in people younger than 65 years of age, potentially due to lower education levels and a high burden of cardiovascular diseases.[89] These findings are supported by data from a Brazilian brain bank that shows high rates of vascular changes among older people, including pathologically confirmed vascular dementia (35%) at higher rates than those typically reported in developed countries.[90] Considering this trend in people living in Brazil, it is possible that Brazilian individuals living in different countries also present a higher risk for dementia, with limited dementia care available in Portuguese.

It is critical to note that research with the Brazilian population in the United States can take advantage of the several instruments relevant for brain research (e.g., screening, cognitive tests, and behavior scales) already adapted and implemented in Brazilian populations (e.g., Mini-Mental State Examination[91] and Boston Naming Test[92]).

3 | FUTURE DIRECTIONS AND RECOMMENDATIONS

The development of future initiatives that can build partnerships between academic settings and the U.S.-Brazilian community has the potential to address health inequities by promoting health services/education and community-engagement research,[93] with the ultimate goal of improving health outcomes and quality of life of Brazilian immigrants and their offspring. To that end, we suggest a set of recommendations that may facilitate the inclusion of Brazilian populations in health-related research and advance care for this population in the United States.

Researchers, health providers, and policymakers may have a central role in promoting greater inclusion of the Brazilian population in the United States in health research and care. Beyond the typical Latinx/Hispanic classification, research protocols should include the country of origin or origin/heritage/ancestry, as many Brazilians identify as Brazilian but not always Latinx.[26] In addition, the specific immigration context should be considered carefully, such as the individual's life history (at home and host countries), community resources, English proficiency, and health care access, as these are critical aspects that may influence integration into U.S. society and health outcomes.

For future ADRD research with Brazilian immigrants in the United States, recruiting participants in middle age is relevant as the incidence of dementia in Brazil is particularly higher in individuals younger
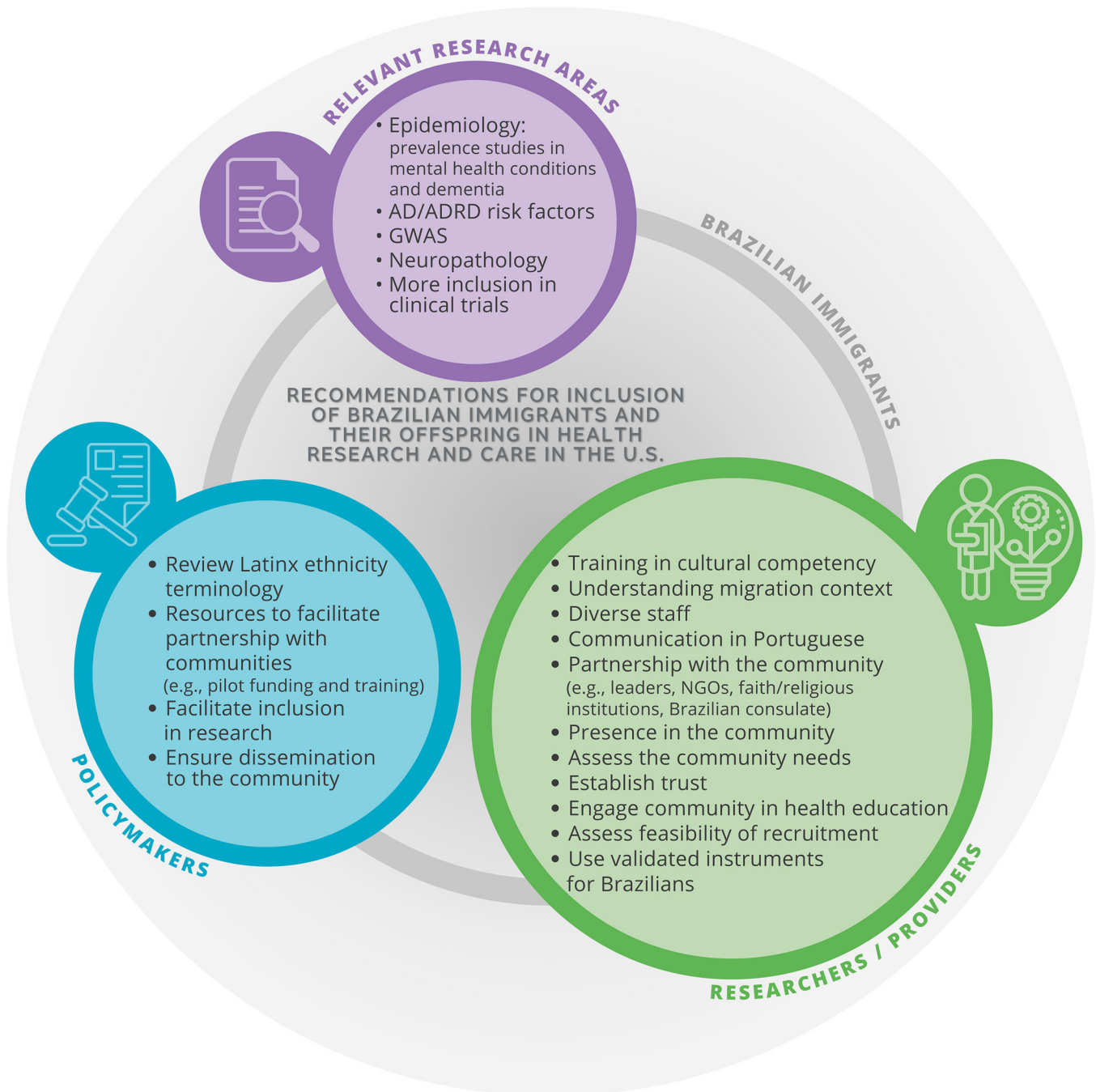
FIGURE 1 Summary of the review recommendations. GWAS, genome-wide association studies.

than 65 years of age.[89] Moreover, there is a need for funding mechanisms that allow the implementation and maintenance of bidirectional partnerships between Brazilian community resources (e.g., non-profit organizations, faith/religious organizations, and local leaders) and researchers. Training for researchers and health providers on cultural competency is also key to including minoritized groups in research and care beyond the existence of translational services. In order to include Brazilian populations and increase diversity in U.S. health research, it is key to develop training and funding opportunities that facilitate Brazilian scientists to connect with U.S.-Brazilian communities and research centers. Such opportunities could enhance cultural adaptation and

enable comparative studies and collaborations. This investment path may also foster dementia research in Brazil, which has faced several challenges.[94]

These recommendations are summarized and expanded on in Figure 1 and may be useful for future research and clinical training programs.[95] They may also be applied to other immigrant populations in the United States, especially those coming from low- and middle-income countries.

In addition, we identify two research areas that can be considered priorities to describe this underrepresented Latinx subgroup and examine health inequities for the U.S. Brazilian population. First, there

is a substantial need for epidemiological studies to understand the prevalence and incidence of mental/brain health conditions in this population. This is critical because mental health is reported as a central health priority by Brazilian immigrants,[75] and mental health conditions are associated with poor health behaviors, chronic physical conditions, and increased risk for ADRD.[96] It is also relevant to consider differences in the prevalence of mental/brain health conditions, including dementia, across Brazilian populations in Brazil and in the United States, which may advance the understanding of sociocultural and environmental risk factors for these health conditions. Future epidemiological studies of U.S.-residing Brazilian populations should consider the following issues as they pertain both to the host and home countries, including: (1) demographic and health-related data available; (2) immigration and public health policy implementation; and (3) differences in dementia prevalence, which tends to be more prevalent and occurs years earlier in low- and middle-income Latin American countries than in high-income countries.[97]

Second, there is a need to better understand cognitive aging trajectories and ADRD risk factors among Brazilian immigrants in the United States, particularly given the increased number of aging Brazilian immigrants. Although it is well-known that Latinx populations are at a higher risk for ADRD,[21] more information on the Brazilian population is needed. Future research can take advantage of previous Brazilian research that adapted culturally and validated several assessment instruments (e.g., cognitive tests, clinical and behavioral scales) that can be used with Brazilian populations living in different countries. Beyond these two initial areas, the research with Brazilian immigrants in the United States will advance by incorporating GWAS and neuropathology to better describe this population, as well as the risk and presence of different disorders (e.g., depression and ADRD). These areas should also consider the actual data in Brazil for comparisons. Critically, observational studies and clinical trials in the United States should carefully consider including more Latinx subgroups, such as Brazilian communities in the United States, beyond those typically studied (e.g., Mexican and Caribbean). These research paths should also consider the recent context of the coronavirus disease 2019 (COVID-19) pandemic, which exacerbated health inequities for minorities and vulnerable populations.[98] In older adults, the impact of the COVID-19 pandemic has been associated with reduced quality of life and increased isolation, depression,[99] and neuropsychiatric symptoms in Latinx/Brazilian populations with dementia.[100]

4 | CONCLUSION

There is a growing population of Brazilian communities residing in the United States, including foreign-born and U.S.-born individuals. Critically, the large percentage of undocumented immigrants with limited access/utilization of health care services is a concerning scenario. The dearth of health research on Brazilian immigrants makes them a largely invisible community, which, in turn, makes them more vulnerable and at greater risk for mental health disorders, poorer health outcomes, and suboptimal aging. As such, they possibly have an increased risk

for ADRD and long-term social and public costs. This perspective suggests the need for researchers, providers, and policymakers to promote greater inclusion of Latinx groups not considered Hispanic (i.e., from Latin America but not Spanish speakers) and, therefore, more "invisible" to the U.S. health research and care, as is the case of the growing Brazilian population living in the United States. This review also suggests two priority areas of research that deserve immediate attention to better describe this population and potentially address health inequities in the Brazilian population in the United States: (1) epidemiological studies to investigate the prevalence and incidence of mental/brain health conditions, and (2) studies addressing cognitive aging trajectories and ADRD risk factors. Beyond those, research with Brazilian immigrants in the United States will advance by incorporating GWAS and neuropathology to better examine health outcomes in this population, as well as to enhance the representation of Brazilian communities in clinical trials in the United States. It is worth mentioning that this perspective review is limited by the lack of data on Brazilian immigrants in the United States, especially data on the undocumented population and their mental/brain health, whose reality remains uncertain. Finally, the research efforts proposed here should help to pave the way for the development of community-engagement research,[93] and to promote brain health education, improvement of mental/brain health and ADRD services, and the development of culturally-informed intervention for the Brazilian population living in the United States.

CONFLICT OF INTEREST STATEMENT

The authors have no competing interests to declare.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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