

Changing Landscape of Alzheimer's Disease Mortality in the United States (1979– 2023): A CDC WONDER Analysis of Epidemiological Shifts, Disparities and ARIMA-Based Projections to 2050

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Abstract

Background:

Alzheimer's disease (AD) is the sixth leading cause of mortality in the United States, with significant variations across demographic and geographic factors.

Methods:

We extracted death certificates of adults aged ≥ 65 years from the CDC WONDER database with AD (ICD-9: 331.0 and ICD-10: G30) from 1979–2023 and analyzed them to forecast trends through 2050. Age-adjusted mortality rates (AAMR) per 100,000 populations were stratified by sex, race, census region, and age group. Join-point analysis was performed to estimate annual percent change (APC) with 95% confidence intervals. Autoregressive Integrated Moving Average (ARIMA) was used as primary forecasting models.

Results:

Between 1979 and 2023, AD caused 2,430,795 deaths in U.S. adults. From 1979 to 2050, the AAMR showed an overall rise with alternating phases of rapid rise, temporary stabilization, and projected reacceleration. Mortality increased sharply from 1979–1985 (APC: 54.1), rose more slowly from 1985–1997 (APC: 5.35), and surged again in 1997–2000 (APC: 30.6). Moderate growth continued from 2000–2008 (APC: 3.69), followed by a non-significant plateau in 2008–2013 (APC: -1.66), a brief rebound from 2013–2016 (APC: 10.17), and finally a modest decline from 2016–2023 (APC: -1.13). Projections show another significant increase from 2023–2050 (APC: 2.74), suggesting renewed long-term growth.

Conclusion:

Mortality rates due to AD have risen sharply, punctuated by periods of rapid rise, brief stabilization, and projected reacceleration. However, significant disparities still exist across sexes, race, age groups, and regions. These disparities highlight the need for targeted interventions and improvement of clinical care facilities in high-risk populations.

1.0 INTRODUCTION

Alzheimer's disease (AD) is still one of the biggest public health issues in the United States (US), a result of aging populations, better diagnosis, and changing disease classification schemes. Alongside the demographic shift towards an older population and the increasing cost of dementia-related disorders on society, AD mortality has shown a startling upward trajectory since the late 1970s.^{1, 2} Since the early 2000s, AD has continuously been one of the top ten causes of death, according to recent national statistics, and despite improvements in medical care and risk-factor management, the disease's mortality burden keeps rising.³

Over the past forty years, there have been significant changes in the epidemiological landscape of AD mortality. The true burden was underestimated early in the surveillance era due to diagnostic under-recognition and misclassification, which frequently labelled fatalities as "senility" or "other dementias".⁴ The 1999 switch from ICD-9 to ICD-10 significantly improved AD mortality data, which made it easier to identify trends unique to the condition.⁵ The country's age-adjusted mortality rates (AAMR) from AD more than doubled between 1999 and 2019, with women, non-Hispanic (NH) Whites, and people living in rural and southern U.S. areas experiencing the greatest increases.^{6, 7} These differences show how biological, social, and geographic factors interact to affect healthcare availability as well as the incidence of disease.

Particularly significant are racial and ethnic differences in AD mortality. Research shows that Black and Hispanic Americans had higher rates of AD incidence and death than their NH White counterparts.⁸ This is due to the combined effects of socioeconomic deprivation, comorbidities, and unequal access to healthcare. Because states in the Southeast and rural counties have disproportionately higher AD mortality rates than more urbanized and resource-rich areas, geographic variability further exacerbates inequality.⁹ The growing disparity between urban and rural areas is a reflection of larger issues facing the health system, such as inadequate infrastructure for dementia care, delayed diagnosis, and a lack of carers.

AD mortality rates were abruptly disrupted by the COVID-19 pandemic. Both direct SARS-CoV-2 infection and indirect factors such as decreased access to routine medical treatment, increased social isolation, and career exhaustion contributed to the higher mortality among older persons with dementia.¹⁰ This brief but important disruption highlights how vulnerable dementia-related mortality is to more general healthcare and social crises.

In this regard, assessing long-term trends in AD mortality and projecting future paths are crucial for healthcare planning. A reliable foundation for forecasting future mortality under various demographic scenarios is provided by time-series modelling, especially when employing autoregressive integrated moving average (ARIMA) techniques.¹¹ It is possible to quantify the anticipated trend of AD burden while taking into consideration structural changes, such as population aging and recent pandemic-related fluctuations, by combining historical surveillance data (1979–2023) with ARIMA-based forecasts to 2050.

2.0 METHODOLOGY

2.1 Study setting and population

Data on the AD related mortality in the U.S. from the year 1979 to 2023 was obtained from the Centers for Disease Control and Prevention (CDC) Wide-Ranging Online Data for Epidemiologic Research (WONDER) database which systematically gathered the national mortality records derived from death certificates maintained by the state vital registration systems.¹² We used the Underlying Cause of Death public use files to identify all deaths where AD was recorded as the primary cause of death. To maintain consistency across the study period, deaths were identified using the International Classification of Diseases (ICD) codes corresponding to the AD for each revision period as ICD Ninth Revision, Clinical Modification (ICD-9-CM; codes 331.0) for 1979–1998 and ICD Tenth Revision, Clinical Modification (ICD-10-CM; codes G.30) for 1999–2023. The CDC WONDER database is a publicly available, de-identified dataset and therefore the present analysis was not required for the institutional review board (IRB) approval. The study adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline.¹³

2.2 Data extraction

From the CDC WONDER database, we extracted the information on year of death, sex, age group, race, and region for all the deaths in which AD was recorded as the underlying cause of death. The study included the adults aged ≥ 65 years in the study and were categorized into 10 year intervals to ensure the comparability across decades. Racial groups included NH White and NH Black or African American. Geographical regions were classified as the Northeast, Midwest, South and West according to the U.S. Census Bureau classification.

2.3 Data synthesis and statistical analysis

Crude mortality rates (CMRs) for AD were calculated per 100,000 people by dividing the number of deaths each year by the U.S. population, and AAMRs were standardized to the 2000 U.S. population to allow unbiased comparisons over time and between different groups.¹⁴ Temporal trends in the AAMRs were examined using the Join-point Regression Program (v5.0.2, NCI, Bethesda, MD), which fits log linear regression models to detect the points where trends were changed significantly. To assess both the magnitude as well as the direction of trends in AD related mortality the annual percentage change (APC) and average annual percentage change (AAPC) with their 95% confidence intervals (CI) were calculated. Statistical significance was assessed using the Monte Carlo permutation test and two-tailed t-tests.^{15, 16} A significance level of $p \leq 0.05$ was considered as significant. This allowed us to identify the key inflection points in the trends of mortality that capture changes in population health, risk factors, and the impact of healthcare changes over time. Age-adjustment standardizes mortality rates to the 2000 U.S. population to facilitate temporal comparisons; however, it does not fully account for broader demographic changes such as increasing life expectancy or shifts in competing causes of death. Over the past several decades, substantial declines in cardiovascular mortality have resulted in greater survival to advanced ages, where AD becomes more clinically manifest and more likely to be recorded as an underlying cause of death. Consequently, some of the observed increases in AD mortality may reflect these demographic and competing-risk dynamics rather than changes in disease incidence alone. These factors were considered when interpreting long-term mortality trends.

2.4 Statistical Analysis

Mortality data for AD in the United States from 1999 through 2023 were extracted from the CDC WONDER database and analyzed to forecast trends through 2050. Data preprocessing included temporal aggregation by year and log-transformation to stabilize variance. Because CDC WONDER provides complete national mortality counts, no missing values were present in the annual aggregated dataset used for forecasting. In stratified queries where CDC WONDER suppresses cells with fewer than 10 deaths to preserve confidentiality, categories were aggregated across broader demographic groups or adjacent years to avoid suppression. Consequently, no statistical imputation procedures were applied to the final analytic dataset.

Time-series forecasting models were applied to estimate future mortality trends. Two classical approaches, ARIMA and Facebook Prophet, were developed and validated as primary forecasting models. ARIMA models were selected based on optimal parameter tuning of (p, d, q) using the lowest Akaike Information Criterion (AIC). The Prophet model incorporated both linear and logistic growth components, with yearly seasonality and changepoint detection to capture long-term trend variations.

Model performance was evaluated through an 80:20 train-test split, where observed data from 1999–2018 were used for model training and 2019–2023 for validation. Forecast accuracy was assessed using Mean Absolute Error (MAE), Root Mean Square Error (RMSE), Mean Absolute Percentage Error (MAPE), and the coefficient of determination (R^2). Among the models tested (ARIMA, Prophet, Random Forest, XGBoost, and LSTM), ARIMA and Prophet demonstrated the lowest RMSE and MAE, indicating superior predictive performance and stability for this dataset (**Supplemental Fig. 1 and Supplemental Table 1**).

The best-performing model (Prophet) was used to forecast AD mortality up to the year 2050. All analyses were conducted in Python (version 3.10) using the pandas, statsmodels, prophet, scikit-learn, and matplotlib libraries within the Google Colab environment. Statistical significance was defined as $p < 0.05$.

3.0 RESULTS

3.1 Annual trends

From 1979 to 2050, the AAMR showed a marked upward trajectory, punctuated by alternating phases of rapid rise, temporary stabilization, and projected reacceleration as shown in **Table 1**.

Mortality rose steeply from 1979–1985 (APC = 54.1; $p < 0.001$), with subsequent slower but significant increases till 1997 (APC = 5.35) and again during 2000–2008 (APC = 3.69), interrupted by a short surge in 1997–2000 (APC = 30.6). From 2008 and 2013, the trend remained flat (APC = -1.66; $p = 0.08$), followed by a short-term rebound in 2013–2016 (APC = 10.17; $p = 0.006$). Mortality then declined significantly during 2016–2023 (APC = -1.13; $p = 0.008$), with forecasts indicating a renewed rise through 2050 (APC = 2.74), signaling a return to long-term upward momentum (**Supplemental Table 2, Fig. 1**).

3.2 Trends stratified by sex

Between 1979 and 2050, AAMR displayed distinct patterns for males and females, marked by early rapid rises, mid-period stabilization, and projected re-acceleration (**Supplementary Table 2**, Fig. 2).

Among females, mortality surged sharply in the early 1980s (APC = 57.19; $p < 0.001$), followed by a sustained growth through the late 1990s. A brief spike occurred between 1997–2000 (APC = 30.61; $p < 0.001$), after which rates plateaued and later rebounded in 2013–2016 (APC = 9.80; $p = 0.002$). By 2023, rates slightly declined, with forecasts indicating stabilization around 229.70 AAMRs. Among males, AAMR was consistently higher, with early rapid increases in the 1980s (APC = 50.87; $p < 0.001$) and a pronounced spike in 1997–2000 (APC = 25.85; $p < 0.001$). Gradual declines followed mid-2000s, with a brief rebound in 2013–2016 (APC = 9.06), before projected stabilization near 166 by 2050 (APC = 2.76; $p = 0.001$). Overall, both sexes show parallel long-term trajectories, with males consistently higher and females peaking slightly later, highlighting persistent sex disparities in mortality despite recent convergence.

3.3 Trends stratified by race

Among Black or African American individuals, mortality rose sharply from 1.12 in 1979 to 21.32 in 1987 (APC = 39.63; $p < 0.001$), followed by slower but significant increases through 1997 (APC = 6.86) and 2000–2005 (APC = 9.17), with a brief surge in 1997–2000 (APC = 33.36). Rates plateaued from 2005–2013 (APC = -0.24) before a short rebound in 2013–2016 (APC = 11.94), stabilizing again during 2016–2023 (APC = -0.87). Forecasts indicate renewed growth through 2050 (APC = 2.63; $p < 0.001$).

In White individuals, mortality increased sharply from 1979–1985 (APC = 54.00; $p < 0.001$), followed by moderate but persistent gains through 1997 (APC = 5.22) and 2000–2008 (APC = 3.63), with a brief spike in 1997–2000 (APC = 31.21). Rates flattened between 2008–2013 (APC = -1.58) and rose transiently in 2013–2016 (APC = 10.02), before declining during 2016–2023 (APC = -1.07). Projections suggest a renewed rise through 2050 (APC = 2.73; $p = 0.001$) (**Supplemental Table 3**, Fig. 3).

3.4 Trends stratified by census region

From 1979 to 2050, the AAMR demonstrated pronounced regional disparities across the United States. All regions experienced steep increases during the early 1980s, followed by periods of slower growth, intermittent plateaus, and recent stabilization.

In the Northeast, mortality rose sharply from 1979 to the mid-1980s (APC = 48.02; $p < 0.001$), then increased moderately before declining after 2017, reaching projected stability near 129 by 2050. The Midwest showed the steepest long-term rise, with seven inflection points identified; after early acceleration, rates gradually stabilized post-2017, yet projections indicate continued modest growth, reaching 290 by mid-century.

The South experienced the highest overall burden, with an early surge followed by slower gains and a sustained decline after 2016 (APC = -2.55; $p < 0.001$). Despite this improvement, the region is projected to retain the highest mortality through 2050 (≈ 214). In the West, mortality followed a steady upward trajectory through 2020, then plateaued, with only minimal projected growth to 268 by 2050 (**Supplemental Table 4**, Fig. 4).

Comparatively, the South and West have maintained the greatest mortality burdens throughout the 21st century, while the Northeast achieved the sharpest post-2017 decline. By 2050, the Midwest and West are projected to have the highest rates nationally, underscoring persistent regional inequities despite recent stabilization trends.

3.5 Trends stratified by age groups

Among adults aged 65–74 years, CMR rose sharply from 1979 to 1984 (APC = 37.38, $p < 0.001$), stabilized through the mid-1990s, and surged briefly till 2000 (APC = 24.05, $p < 0.001$). Rates remained steady until 2013, followed by a moderate upturn to 2020 (APC = 5.32, $p < 0.001$). A short decline during the pandemic years (2020–2023; APC = -2.12) was followed by a projected gradual rise (APC = 1.39) extending through 2050.

In the 75–84-year cohort, rates increased rapidly through 1985 (APC = 57.71, $p < 0.001$) and continued a slower ascent until 1997 (APC = 3.24, $p < 0.001$). Another steep climb occurred from 1997 to 2000 (APC = 28.39, $p < 0.001$), followed by a persistent but moderate increase to 2020 (APC = 1.96, $p < 0.001$). Post-2020 rates dipped slightly (-4.67) and are expected to plateau thereafter.

For adults 85 years and older, rates grew rapidly from 1979 to 1986 (APC = 56.91, $p < 0.001$) and remained upward through 1997 (APC = 7.82, $p < 0.001$). After moderate gains to 2013 and a brief spike through 2017 (APC = 7.64, $p < 0.001$), rates declined steadily thereafter (APC = -2.23, $p < 0.001$), with projections suggesting a slight continued reduction through 2050 (APC = -0.20, $p = 0.006$) (**Supplemental Table 5**, Fig. 5).

Forecasting Summary (1979–2050)

From 1979 to 2050, the national AAMR is projected to maintain an upward trajectory, rising from 1979–1985 (APC = 54.1, $p < 0.001$) to an estimated 198.6 deaths by 2050 (APC = 2.74, $p = 0.003$).

Sex-stratified forecasts show persistently higher mortality among females (229.7) than males (165.6), with both exhibiting cyclical patterns of early increase, mid-term stabilization, and late reacceleration. By race, both White (215.0) and Black (190.6) populations demonstrate parallel trajectories with significant projected gains (APC ≈ 2.6 – 2.7 , $p < 0.01$). Regionally, the Midwest (290.3) and West (268.2) are forecasted to sustain the highest AAMRs by 2050, followed by the South (213.7) and Northeast (129.4), underscoring persistent geographic disparities. Age-specific projections reveal modest increases among adults aged 65–74 years (APC = 1.39), stabilization in those 75–84 years, and a gradual decline among adults aged ≥ 85 years (APC = -0.20, $p = 0.006$). Overall, the model predicts a continued national rise in AAMR through 2050, accompanied by widening demographic and regional differentials.

4.0 DISCUSSION

This longitudinal analysis reveals a complex and dynamic trajectory for AD mortality in the United States from 1979 to 2023, characterized by non-linear trends with distinct periods of acceleration, stabilization, and decline, and a projected reacceleration until 2050. This national pattern, however, conceals significant and persistent disparities across demographic and geographic groups, underscoring the multifaceted nature of AD mortality, which is influenced by a combination of diagnostic, clinical, social, and healthcare factors.

The observed non-linear trajectory both corroborates and extends existing epidemiologic evidence. The initial marked increase in mortality between 1979 and 1985 is likely attributable to increased clinical and public awareness of AD and the concurrent development of standardized diagnostic frameworks, such as the NINCDS–ADRDA criteria, which enabled more consistent and accurate certification of AD-related deaths.^{17, 18} Subsequent periods of stabilization and the notable decline from 2016 to 2023 may be multifactorial.^{19, 20} Contributing elements could include improvements in the management of cardiovascular and metabolic risk factors, which are significant contributors to cognitive decline, as well as competing mortality dynamics associated with exogenous causes like the COVID-19 pandemic and the opioid crisis, which disproportionately affected older adults with multi-morbidity.^{19, 20, 21, 22} The projected increase in AD mortality through 2050 aligns with demographic projections of the aging Baby Boomer cohort and the growing population-level prevalence of risk factors such as obesity and diabetes, which are anticipated to elevate the future burden of dementia.^{23, 24} Collectively, these trends highlight the intricate interactions between diagnostic procedures, chronic disease epidemiology, and demographic shifts in shaping long-term AD mortality.

Our analysis further confirms well-documented demographic disparities. A persistent gender gap was observed, with females exhibiting higher AAMRs than males throughout the study period.^{25, 26} This disparity may be partially explained by women's greater life expectancy, which increases their duration of risk exposure.^{27, 28} Other potential contributing factors could include biological differences, such as the impact of postmenopausal estrogen reduction on brain health, or higher rates of depression and social isolation among older women.^{29, 30, 31} The more noticeable reduction in mortality among males after 2020 could indicate sex-specific variations in COVID-19-related mortality, though this warrants further investigation.³²

The racial analysis reveals that both White and Black populations experienced significant increases in AD mortality, a trend supported by prior research.^{33, 34} The parallel trajectories suggest that systemic drivers, such as population aging, affect all groups. However, the consistently higher baseline rates among White individuals in our study—a finding also reported in other analyses of death certificate data,³⁵ presents a complex picture. This contrasts with research indicating a higher incidence of AD among Black Americans.³⁶ This discrepancy could be related to disparities in diagnosis and death certification practices, including the potential underdiagnosis of AD in Black older adults and a higher burden of competing mortality from causes like cardiovascular disease at younger ages, before AD is recognized as a primary cause of death.^{37, 38, 39}

The observed temporal patterns are further contextualized by the interaction between AD mortality and cardiovascular mortality. Because of improvements in the prevention and treatment of ischemic heart disease, hypertension, and stroke, cardiovascular mortality in the US has largely decreased over the past few decades.^{19, 20} The population at risk of acquiring age-related neurological diseases like AD has increased as a result of the decrease in early cardiovascular fatalities. Furthermore, through mechanisms involving chronic cerebral hypoperfusion, endothelial dysfunction, and neuroinflammation, cardiovascular risk factors such as hypertension, diabetes mellitus, obesity, and atherosclerosis are known to contribute to the pathophysiology of both vascular dementia and AD.^{40, 41, 42} Therefore, while improving cardiovascular risk reduction may eventually reduce the incidence of dementia, reducing cardiovascular mortality may indirectly contribute to rising AD mortality by increasing survival into later age. This twofold impact points to a complicated epidemiological link in which early declines in cardiovascular mortality may cause an apparent rise in the burden of AD, which may then stabilize or drop as risk factor management improves. The non-linear mortality patterns found in our investigation are probably a result of these conflicting processes.

One of the most salient findings of this analysis is the marked regional disparity in AD mortality. The persistently elevated burden in the Southern United States and the projected escalation in the Midwest and West underscore the influence of structural and place-based determinants of health. These spatial patterns likely reflect an interplay of region-specific distributions of modifiable risk factors (e.g., obesity, diabetes) and socioeconomic inequities, including differential access to specialized neurological and geriatric care.^{39, 43} In contrast, the steeper decline in the Northeast may signify the effectiveness of regionally tailored public health policies emphasizing equitable healthcare access and preventive infrastructure, factors associated with reduced dementia-related mortality.⁴⁴ These regional trends reinforce the necessity of geographically targeted interventions.

Age-specific trends offer vital information on the evolving epidemiology of AD. The historically sharp rises in mortality among the oldest-old (≥ 85 years), followed by a recent reduction, likely reflect improved diagnostic sensitivity and the inclusion of dementia on death certificates.⁴⁵ Projections indicating a stabilization of rates in the 75–84-year cohort and a modest rise among those aged 65–74 suggest a shifting age distribution of the AD mortality burden. This may result from both earlier diagnosis and the growing impact of midlife risk factors contributing to earlier-onset cognitive impairment.⁴⁶

4.1 Limitations and Strengths

This study has several limitations inherent to national mortality data. First, misclassification bias is a risk, as AD is often underreported as an underlying cause of death, and the transition from ICD-9 to ICD-10 may have affected trend inflections.⁴⁶ Second, while AAMR allows for population comparison, it does not fully capture disease prevalence or disability. Third, our ARIMA-based forecasts cannot account for future therapeutic breakthroughs or sudden shifts in risk factor prevalence. Fourth, we did not conduct sensitivity studies to evaluate how well our results held up under various model assumptions or specifications. This was mostly because the CDC WONDER dataset was aggregated and relied on standardized AAMR estimations, which made stratified re-analyses or other modeling techniques impractical in the absence of individual-level data. Additionally, the transition from ICD-9 to ICD-10 coding during the study period may have introduced systematic variations in cause-of-death classification. ICD-10 provides more specific coding for AD, which may have led to

an apparent increase in reported mortality independent of true epidemiological changes. This coding transition can therefore create artificial inflection points in temporal trends, potentially contributing to the observed acceleration in earlier years and complicating direct comparisons across time periods.^{46, 47} Despite these limitations, the study's strengths include comprehensive nationwide coverage via the CDC WONDER database, the use of join-point regression for data-driven identification of trend shifts, and stratified analyses that reveal disparities often obscured by national statistics.

4.2 Future implications

The projected rise in AD mortality to 2050 underscores the need for a multifaceted public health response. First, preventive measures must focus on modifying midlife risk factors, with scalable interventions targeting obesity, diabetes, and hypertension supported by growing evidence.^{19, 20} Second, healthcare systems, particularly in regions like the Midwest and West, must prepare for increased demand through expanded dementia care workforces, improved access to geriatric services, and enhanced support for unpaid caregivers.^{48, 49} Finally, standardizing diagnostic and death certification practices remains essential for accurate surveillance and reliable tracking of progress toward national dementia goals.

5.0 CONCLUSION

This analysis demonstrates that Alzheimer's disease mortality in the United States is a dynamic public health challenge marked by distinct epidemiological stages and enduring inequities. The observed trajectory, with its periods of escalation and decline, culminates in a projected resurgence through 2050, driven by a complex interplay of demographic change, risk factor prevalence, and diagnostic practices. The persistent gender disparity, similar racial trajectories, and marked regional differences highlight the critical need for targeted, equitable interventions. Addressing the anticipated rise will require coordinated efforts: primary prevention focused on modifiable risk factors, health system preparedness for integrated dementia care, and policies designed to reduce disparities across disproportionately affected populations and regions.

Abbreviations

- AAMR
age-adjusted mortality rates
- AAPC
average annual percentage change
- AD
alzheimer's disease
- APC
annual percentage change
- ARIMA
autoregressive integrated moving average
- CDC
centers for disease control and prevention
- CI
confidence intervals
- CMR
crude mortality rates
- ICD
international classification of diseases
- NH
non-Hispanic
- WONDER
wide-ranging online data for epidemiologic research

Declarations

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None

Disclosure of Interest

The authors have no relevant financial or non-financial interests to disclose.

Study Participants

The research is based on de-identified human death certificate data from the CDC WONDER database, <https://wonder.cdc.gov/mcd.html>.

Consent and Ethical Approval

The research is based on de-identified data and does not require the consent of the participants or ethical approval.

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Author Contributions:

SJ: Conceptualization, investigation, project administration, supervision, validation, visualization, writing: original draft, writing: review and editing; **MU:** Conceptualization, data curation, formal analysis, investigation, software, validation, writing: original draft; **MMAB:** Investigation, project administration, validation, writing: original draft, writing: review & editing; **MQ:** Investigation, methodology, validation, visualization, writing: original draft; **DR:** Investigation, methodology, project administration, validation, writing: original draft; **FS:** Validation, investigation, visualization, project administration, writing: original draft; **JSR:** Investigation, project administration, resources, supervision, validation, writing: review & editing; **SIA:** Investigation, project administration, resources, supervision, validation, writing: review & editing; **JHJA, MMA:** Investigation, project administration, resources, supervision, validation, writing: review & editing

References

1. Steenland K, MacNeil J, Seals R. Recent trends in Alzheimer's disease mortality in the United States, 1999–2017. *Neuroepidemiology*. 2020;54(2):153–60. [PubMed PMID: 32149762].
2. Hebert LE, Weuve J, Scherr PA, Evans DA. Alzheimer disease in the United States (2010–2050) estimated using the 2010 census. *Neurology*. 2013;80(19):1778–83. 10.1212/WNL.0b013e31828726f5. . Epub 2013 Feb 6. PMID: 23390181; PMCID: PMC3719424.
3. 2024 Alzheimer's disease facts and figures. *Alzheimers Dement*. 2024;20(5):3708–821. 10.1002/alz.13809. . Epub 2024 Apr 30. PMID: 38689398; PMCID: PMC11095490.
4. Larson EB, Kukull WA, Katzman RL. Cognitive impairment: dementia and Alzheimer's disease. *Annu Rev Public Health*. 1992;13:431 – 49. 10.1146/annurev.pu.13.050192.002243. PMID: 1599598.
5. Zhao X, Li C, Ding G, Heng Y, Li A, Wang W, Hou H, Wen J, Zhang Y. The Burden of Alzheimer's Disease Mortality in the United States, 1999–2018. *J Alzheimers Dis*. 2021;82(2):803–813. 10.3233/JAD-210225. PMID: 34092643.
6. Chen R, Charpignon ML, Raquib RV, Wang J, Meza E, Aschmann HE, DeVost MA, Mooney A, Bibbins-Domingo K, Riley AR, Kiang MV, Chen YH, Stokes AC, Glymour MM. Excess Mortality With Alzheimer Disease and Related Dementias as an Underlying or Contributing Cause During the COVID-19 Pandemic in the US. *JAMA Neurol*. 2023;80(9):919–28. 10.1001/jamaneurol.2023.2226. . PMID: 37459088; PMCID: PMC10352932.
7. Kramarow EA, Tejada-Vera B. 2024 Nov. Dementia Mortality in Adults Age 65 and Older: United States, 2018–2022. Hyattsville (MD): National Center for Health Statistics (US); 2024. Sep–. PMID: 40267244. NCHS Health E Stats [Internet].
8. Waqas SA, Ali D, Khan TM, Qureshi S, Siddiqui H, Sajid M, Imran Z, Salim H, Sohail MU, Ahmed R, Marsia S. Trends in Alzheimer's-Related Mortality Among Type 2 Diabetes Patients in the United States: 1999–2019. *Endocrinol Diabetes Metab*. 2025;8(2):e70032. 10.1002/edm2.70032. . PMID: 39899444; PMCID: PMC11789764.
9. Axenhus M, Frederiksen KS, Zhou RZ, Waldemar G, Winblad B. The impact of the COVID-19 pandemic on mortality in people with dementia without COVID-19: a systematic review and meta-analysis. *BMC Geriatr*. 2022;22(1):878. 10.1186/s12877-022-03602-6. . PMID: 36402953; PMCID: PMC9675075.
10. Mollalo A, Kramer M, Cutty M, Hoseini B. Systematic review and meta-analysis of rural-urban disparities in Alzheimer's disease dementia prevalence. *J Prev Alzheimers Dis*. 2025;12(9):100305. 10.1016/j.tpad.2025.100305. . Epub 2025 Jul 25. PMID: 40713243; PMCID: PMC12501328.
11. Chaddha J, Blaney E, Al-Salahat A, Noor A, Billion T, Chen YT, Tauseef A, Sood A, Abdul Jabbar AB. Trends and Disparities in Alzheimer's Disease Mortality in the United States: The Impact of COVID-19. *NeuroSci*. 2025;6(1):16. 10.3390/neurosci6010016. . PMID: 39982268; PMCID: PMC11843863.
12. Centers for Disease Control and Prevention, National Center for Health Statistics. Multiple cause of death 1999–2019 on CDC WONDER online database. Released 2020. Available from: <http://wonder.cdc.gov/mcd-icd10.html>
13. von Elm E, Altman DG, Egger M et al. STROBE Initiative. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *Lancet*. 2007;370(9596):1453–1457. 10.1016/S0140-6736(07)61602-X. PMID: 18064739.
14. Woolf SH, Schoomaker H. Life expectancy and mortality rates in the United States, 1959–2017. *JAMA*. 2019;322(20):1996–2016. 10.1001/jama.2019.16932. . PMID: 31769830; PMCID: PMC7146991.
15. Program JR. Version 5.0.2—May 2023; Statistical Methodology and Applications Branch, Surveillance Research Program, National Cancer Institute. Available from: <https://surveillance.cancer.gov/joinpoint/>
16. Kim HJ, Fay MP, Feuer EJ, Midthune DN. Permutation tests for joinpoint regression with applications to cancer rates. *Stat Med*. 2000;19(3):335–351. 10.1002/(sici)1097-0258(20000215)19:3<335::aid-sim336>3.0.co;2-z. Erratum in: *Stat Med*. 2001;20(4):655. PMID: 10649300.
17. Fu M, Sankaraman S, Pasaniuc B, Vossel K, Chang TS. Identifying common disease trajectories of Alzheimer's disease with electronic health records. *EBioMedicine*. 2025;118:105831. 10.1016/j.ebiom.2025.105831. . Epub 2025 Jun 30. PMID: 40592257; PMCID: PMC12266379.
18. Hao M, Chen J. Trend analysis and future predictions of global burden of alzheimer's disease and other dementias: a study based on the global burden of disease database from 1990 to 2021. *BMC Med*. 2025;23(1):378. 10.1186/s12916-025-04169-w. . PMID: 40597083; PMCID: PMC12220445.

19. Livingston G, Huntley J, Sommerlad A, Ames D, Ballard C, Banerjee S, Brayne C, Burns A, Cohen-Mansfield J, Cooper C, Costafreda SG, Dias A, Fox N, Gitlin LN, Howard R, Kales HC, Kivimäki M, Larson EB, Ogunniyi A, Orgeta V, Ritchie K, Rockwood K, Sampson EL, Samus Q, Schneider LS, Selbæk G, Teri L, Mukadam N. Dementia prevention, intervention, and care: 2020 report of the Lancet Commission. *Lancet*. 2020;396(10248):413–446. 10.1016/S0140-6736(20)30367-6. Epub 2020 Jul 30. Erratum in: *Lancet*. 2023;402(10408):1132. doi: 10.1016/S0140-6736(23)02043-3. PMID: 32738937; PMCID: PMC7392084.
20. Norton S, Matthews FE, Barnes DE, Yaffe K, Brayne C. Potential for primary prevention of Alzheimer's disease: an analysis of population-based data. *Lancet Neurol*. 2014;13(8):788 – 94. doi: 10.1016/S1474-4422(14)70136-X. Erratum in: *Lancet Neurol*. 2014;13(11):1070. PMID: 25030513.
21. Woolf SH, Masters RK, Aron LY. Effect of the covid-19 pandemic in 2020 on life expectancy across populations in the USA and other high income countries: simulations of provisional mortality data. *BMJ*. 2021;373:n1343. 10.1136/bmj.n1343. . PMID: 34162598; PMCID: PMC8220857.
22. Gilstrap L, Zhou W, Alsan M, Nanda A, Skinner JS. Trends in Mortality Rates Among Medicare Enrollees With Alzheimer Disease and Related Dementias Before and During the Early Phase of the COVID-19 Pandemic. *JAMA Neurol*. 2022;79(4):342–8. PMID: 35226041; PMCID: PMC8886452.
23. Yu DT, Li RX, Sun JR, Rong XW, Guo XG, Zhu GD. Global mortality, prevalence and disability-adjusted life years of Alzheimer's disease and other dementias in adults aged 60 years or older, and the impact of the COVID-19 pandemic: a comprehensive analysis for the global burden of disease 2021. *BMC Psychiatry*. 2025;25(1):503. 10.1186/s12888-025-06661-2. . PMID: 40389943; PMCID: PMC12090430.
24. Qureshi D, Allen NE, Kužma E, Littlejohns TJ. Metabolic syndrome and risk of incident all-cause dementia, Alzheimer's disease and vascular dementia: a systematic review and meta-analysis of longitudinal studies. *Alzheimers Res Ther*. 2025;17(1):198. 10.1186/s13195-025-01825-4. . PMID: 40849672; PMCID: PMC12374402.
25. Beam CR, Kaneshiro C, Jang JY, Reynolds CA, Pedersen NL, Gatz M. Differences Between Women and Men in Incidence Rates of Dementia and Alzheimer's Disease. *J Alzheimers Dis*. 2018;64(4):1077–83. PMID: 30010124; PMCID: PMC6226313.
26. Mielke MM. Sex and Gender Differences in Alzheimer's Disease Dementia. *Psychiatr Times*. 2018;35(11):14–7. Epub 2018 Dec 30. PMID: 30820070; PMCID: PMC6390276.
27. Austad SN, Fischer KE. Sex Differences in Lifespan. *Cell Metab*. 2016;23(6):1022–33. 10.1016/j.cmet.2016.05.019. . PMID: 27304504; PMCID: PMC4932837.
28. O'Neal MA. Women and the risk of Alzheimer's disease. *Front Glob Womens Health*. 2024;4:1324522. 10.3389/fgwh.2023.1324522. . PMID: 38250748; PMCID: PMC10796575.
29. Rocca WA, Bower JH, Maraganore DM, Ahlskog JE, Grossardt BR, de Andrade M, Melton LJ 3rd. Increased risk of cognitive impairment or dementia in women who underwent oophorectomy before menopause. *Neurology*. 2007;69(11):1074–83. 10.1212/01.wnl.0000276984.19542.e6. . Epub 2007 Aug 29. PMID: 17761551.
30. Ali N, Sohail R, Jaffer SR, Siddique S, Kaya B, Atowoju I, Imran A, Wright W, Pamulapati S, Choudhry F, Akbar A, Khawaja UA. The Role of Estrogen Therapy as a Protective Factor for Alzheimer's Disease and Dementia in Postmenopausal Women: A Comprehensive Review of the Literature. *Cureus*. 2023;15(8):e43053. 10.7759/cureus.43053. . PMID: 37680393; PMCID: PMC10480684.
31. Fratiglioni L, Paillard-Borg S, Winblad B. An active and socially integrated lifestyle in late life might protect against dementia. *Lancet Neurol*. 2004;3(6):343 – 53. 10.1016/S1474-4422(04)00767-7. PMID: 15157849.
32. Danza P, Koo TH, Haddix M, Fisher R, Traub E, OYong K, Balter S. SARS-CoV-2 Infection and Hospitalization Among Adults Aged ≥ 18 Years, by Vaccination Status, Before and, During. SARS-CoV-2 B.1.1.529 (Omicron) Variant Predominance - Los Angeles County, California, November 7, 2021–January 8, 2022. *MMWR Morb Mortal Wkly Rep*. 2022;71(5):177–181. 10.15585/mmwr.mm7105e1. PMID: 35113851; PMCID: PMC8812833.
33. Steenland K, Goldstein FC, Levey A, Wharton W. A Meta-Analysis of Alzheimer's Disease Incidence and Prevalence Comparing African-Americans and Caucasians. *J Alzheimers Dis*. 2016;50(1):71–6. 10.3233/JAD-150778. . PMID: 26639973; PMCID: PMC4739787.
34. Matthews KA, Xu W, Gaglioti AH, Holt JB, Croft JB, Mack D, McGuire LC. Racial and ethnic estimates of Alzheimer's disease and related dementias in the United States (2015–2060) in adults aged ≥ 65 years. *Alzheimers Dement*. 2019;15(1):17–24. Epub 2018 Sep 19. PMID: 30243772; PMCID: PMC6333531.
35. Weuve J, Proust-Lima C, Power MC, Gross AL, Hofer SM, Thiébaud R, Chêne G, Glymour MM, Dufouil C, MELODEM Initiative. Guidelines for reporting methodological challenges and evaluating potential bias in dementia research. *Alzheimers Dement*. 2015;11(9):1098–109. PMID: 26397878; PMCID: PMC4655106.
36. Weiner MF. Perspective on race and ethnicity in Alzheimer's disease research. *Alzheimers Dement*. 2008;4(4):233–8. 10.1016/j.jalz.2007.10.016. . Epub 2007 Dec 21. PMID: 18631972; PMCID: PMC2570194.
37. Barnes LL, Bennett DA. Alzheimer's disease in African Americans: risk factors and challenges for the future. *Health Aff (Millwood)*. 2014;33(4):580–6. 10.1377/hlthaff.2013.1353. . PMID: 24711318; PMCID: PMC4084964.
38. Mayeda ER, Glymour MM, Quesenberry CP, Whitmer RA. Inequalities in dementia incidence between six racial and ethnic groups over 14 years. *Alzheimers Dement*. 2016;12(3):216–24. 10.1016/j.jalz.2015.12.007. . Epub 2016 Feb 11. PMID: 26874595; PMCID: PMC4969071.
39. Tini G, Scagliola R, Monacelli F, La Malfa G, Porto I, Brunelli C, Rosa GM. Alzheimer's Disease and Cardiovascular Disease: A Particular Association. *Cardiol Res Pract*. 2020;2020:2617970. 10.1155/2020/2617970. . PMID: 32454996; PMCID: PMC7222603.
40. Wen J, Hu J, Zou G. Trends and differences in cardiovascular disease and alzheimer's disease-related mortality among older adults in the United States, 1999 to 2023: A CDC WONDER database analysis. *Am Heart J Plus*. 2025;59:100618. 10.1016/j.ahjo.2025.100618. Published 2025 Sep 17.
41. Akhtar M, Farooqi HA, Nabi R, et al. Trends in mortality due to ischemic heart diseases among patients with Alzheimer's disease in the United States from 1999 to 2020. *Int J Cardiol Cardiovasc Risk Prev*. 2025;25:200390. 10.1016/j.ijcrp.2025.200390. Published 2025 Mar 7.

42. Santos CY, Snyder PJ, Wu WC, Zhang M, Echeverria A, Alber J. Pathophysiologic relationship between Alzheimer's disease, cerebrovascular disease, and cardiovascular risk: A review and synthesis. *Alzheimers Dement (Amst)*. 2017;7:69–87. 10.1016/j.dadm.2017.01.005. Published 2017 Feb 9.

43. Khan AH, Ijaz E, Ubaid B, Eddaki I, Edhi M, Shah MN, Perry G. Analysis of Alzheimer's Disease-Related Mortality Rates Among the Elderly Populations Across the United States: An Analysis of Demographic and Regional Disparities from 1999 to 2020. *Curr Alzheimer Res*. 2024;21(6):384–394. 10.2174/0115672050338833240924113200. PMID: 39444182.

44. Dhillon A, Fazal J. Overview and Regional Context of Alzheimer's Disease in the Middle East and North Africa Region. *Cureus*. 2025;17(4):e83164. 10.7759/cureus.83164. . PMID: 40443613; PMCID: PMC12120654.

45. Safiri S, Ghaffari Jolfayi A, Fazlollahi A, Morsali S, Sarkesh A, Daei Sorkhabi A, Golabi B, Aletaha R, Motlagh Asghari K, Hamidi S, Mousavi SE, Jamalkhani S, Karamzad N, Shamekh A, Mohammadinasab R, Sullman MJM, Şahin F, Kolahi AA. Alzheimer's disease: a comprehensive review of epidemiology, risk factors, symptoms diagnosis, management, caregiving, advanced treatments and associated challenges. *Front Med (Lausanne)*. 2024;11:1474043. 10.3389/fmed.2024.1474043. . PMID: 39736972; PMCID: PMC11682909.

46. Sato K, Shioda K, Suda S. Accuracy of Death Certificates in Attributing Mortality to Alzheimer's Disease and Other Dementias in Japanese Psychiatric Hospitals. *Neuropsychiatr Dis Treat*. 2025;21:1325–37. PMID: 40636801; PMCID: PMC12239922.

47. Anderson RN, Miniño AM, Hoyert DL, Rosenberg HM. Comparability of cause of death between ICD-9 and ICD-10: preliminary estimates. *Natl Vital Stat Rep*. 2001;49(2):1–32.

48. Wiese LK, Pratt BA, Heinze K, Besser L, Ifill AA, Williams CL. Community-Based Strategies to Reduce Alzheimer's Disease and Related Dementia Incidence Among Rural, Racially/Ethnically Diverse Older Adults. *Curr Geriatr Rep*. 2023;12(4):205–19. 10.1007/s13670-023-00400-9. . Epub 2023 Oct 20. PMID: 38223294; PMCID: PMC10783445.

49. Bereczki E, Mangialasche F, Barbera M, Padilla P, Hara Y, Fillit H, Solomon A, Kivipelto M. Risk reduction and precision prevention across the Alzheimer's disease continuum: a systematic review of clinical trials combining multidomain lifestyle interventions and pharmacological or nutraceutical approaches. *J Prev Alzheimers Dis*. 2025;12(10):100367. Epub 2025 Oct 27. PMID: 41145344.

Table

Table. Joinpoint Regression Analysis: Annual Percent Change (APC) by Subgroup and Trend Period

Subgroup	Trend 1		Trend 2		Trend 3		Trend 4		Trend 5		Trend 6		Trend 7		1
	Year	APC (95% CI)	Year	APC (95% CI)	Year	APC (95% CI)	Year	APC (95% CI)	Year	APC (95% CI)	Year	APC (95% CI)	Year	APC (95% CI)	
Overall	1979– 1985	54.1 (44.0– 64.9)	1985– 1997	5.3 (4.3– 6.3)	1997– 2000	30.5 (18.4– 43.9)	2000– 2008	3.6 (2.7– 4.6)	2008– 2013	–1.6 (–3.4– 0.19)	2013– 2016	10.1 (4.4– 16.1)	2016– 2023	–1.1 (–1.9– 0.3)	2023– 2026
Sex															
<i>Female</i>	1979– 1985	57.1 (44.7– 70.7)	1985– 1997	6.4 (5.3– 7.5)	1997– 2000	30.6 (17.6– 45.0)	2000– 2005	6.0 (3.5– 8.5)	2005– 2013	–0.02 (–0.8– 0.8)	2013– 2016	9.7 (7.3– 16.3)	2016– 2023	–0.7 (–1.6– 0.1)	2023– 2026
<i>Male</i>	1979– 1985	50.8 (43.9– 58.1)	1985– 1997	3.5 (2.7– 4.2)	1997– 2000	25.8 (15.6– 36.8)	2000– 2008	3.5 (2.6– 4.3)	2008– 2013	–1.5 (–3.1– 0.01)	2013– 2016	9.0 (4.2– 14.0)	2016– 2023	–1.4 (–2.1– 0.7)	2023– 2026
Race															
<i>Black</i>	1979– 1987	39.6 (29.8– 50.1)	1987– 1997	6.8 (4.7– 9.0)	1997– 2000	33.3 (14.6– 55.0)	2000– 2005	9.1 (5.7– 12.6)	2005– 2013	–0.2 (–1.3– 0.9)	2013– 2016	11.9 (4.2– 20.1)	2016– 2023	–0.8 (–1.9– 0.19)	2023– 2026
<i>White</i>	1979– 1985	54.0 (44.8– 63.7)	1985– 1997	5.2 (4.3– 6.1)	1997– 2000	31.2 (19.9– 43.4)	2000– 2008	3.6 (2.7– 4.4)	2008– 2013	–1.5 (–3.3– 0.18)	2013– 2016	10.0 (4.5– 15.8)	2016– 2023	–1.0 (–1.8– 0.2)	2023– 2026
Census Region															
<i>Northeast</i>	1979– 1985	48.0 (40.1– 56.3)	1985– 1997	4.8 (3.9– 5.7)	1997– 2000	31.7 (20.0– 44.5)	2000– 2008	2.2 (1.3– 3.1)	2008– 2013	–1.9 (–3.8– 0.09)	2013– 2017	5.6 (2.6– 8.6)	2017– 2026	–1.8 (–2.4– 1.3)	2026– 2029
<i>Midwest</i>	1979– 1986	43.3 (36.4– 50.5)	1986– 1997	4.7 (3.6– 5.8)	1997– 2000	30.0 (17.8– 43.6)	2000– 2008	3.8 (2.8– 4.7)	2008– 2013	–1.3 (–3.3– 0.5)	2013– 2017	7.0 (4.0– 10.2)	2017– 2023	–1.2 (–2.4– 0.07)	2023– 2026
<i>South</i>	1979– 1985	59.9 (44.5– 76.9)	1985– 1997	6.3 (5.0– 7.7)	1997– 2000	26.8 (11.5– 44.3)	2000– 2005	6.4 (3.4– 9.5)	2005– 2013	–0.9 (–2.0– 0.1)	2013– 2016	13.0 (5.5– 20.9)	2016– 2026	–2.5 (–3.1– 2.0)	2026– 2029
<i>West</i>	1979– 1985	50.1 (36.2– 65.4)	1985– 1997	3.5 (2.0– 5.0)	1997– 2000	36.8 (18.2– 58.2)	2000– 2020	2.5 (2.3– 2.8)	2020– 2023	–4.1 (–10.2– 2.3)	2023– 2050	0.1 (0.004– 0.2)	—	—	—
Age Group															
<i>65–74 Years</i>	1979– 1984	37.3 (30.4– 44.7)	1984– 1997	–0.03 (–0.8– 0.7)	1997– 2000	24.0 (9.8– 40.0)	2000– 2013	–0.2 (–0.7– 0.3)	2013– 2020	5.3 (4.0– 6.6)	2020– 2023	–2.1 (–7.9– 4.0)	2023– 2050	1.38 (1.30– 1.47)	—
<i>75–84 Years</i>	1979– 1985	57.7 (44.2– 72.4)	1985– 1997	3.2 (1.9– 4.5)	1997– 2000	28.3 (12.0– 47.0)	2000– 2020	1.9 (1.6– 2.2)	2020– 2023	–4.6 (–11.5– 2.8)	2023– 2050	0.08 (–0.02– 0.19)	—	—	—
<i>≥80 Years</i>	1979– 1986	56.9 (42.1– 73.1)	1986– 1997	7.8 (6.2– 9.4)	1997– 2000	32.5 (17.4– 49.5)	2000– 2005	6.3 (3.6– 9.16)	2005– 2013	0.2 (–0.6– 1.1)	2013– 2017	7.6 (4.5– 10.8)	2017– 2027	–2.2 (–2.7– 1.7)	2027– 2030

APC = Annual Percent Change; CI = Confidence Interval. Values in parentheses represent 95% confidence intervals. — denotes no additional trend period for that subgroup. Analysis performed using Joinpoint Regression Program (National Cancer Institute).

Figures

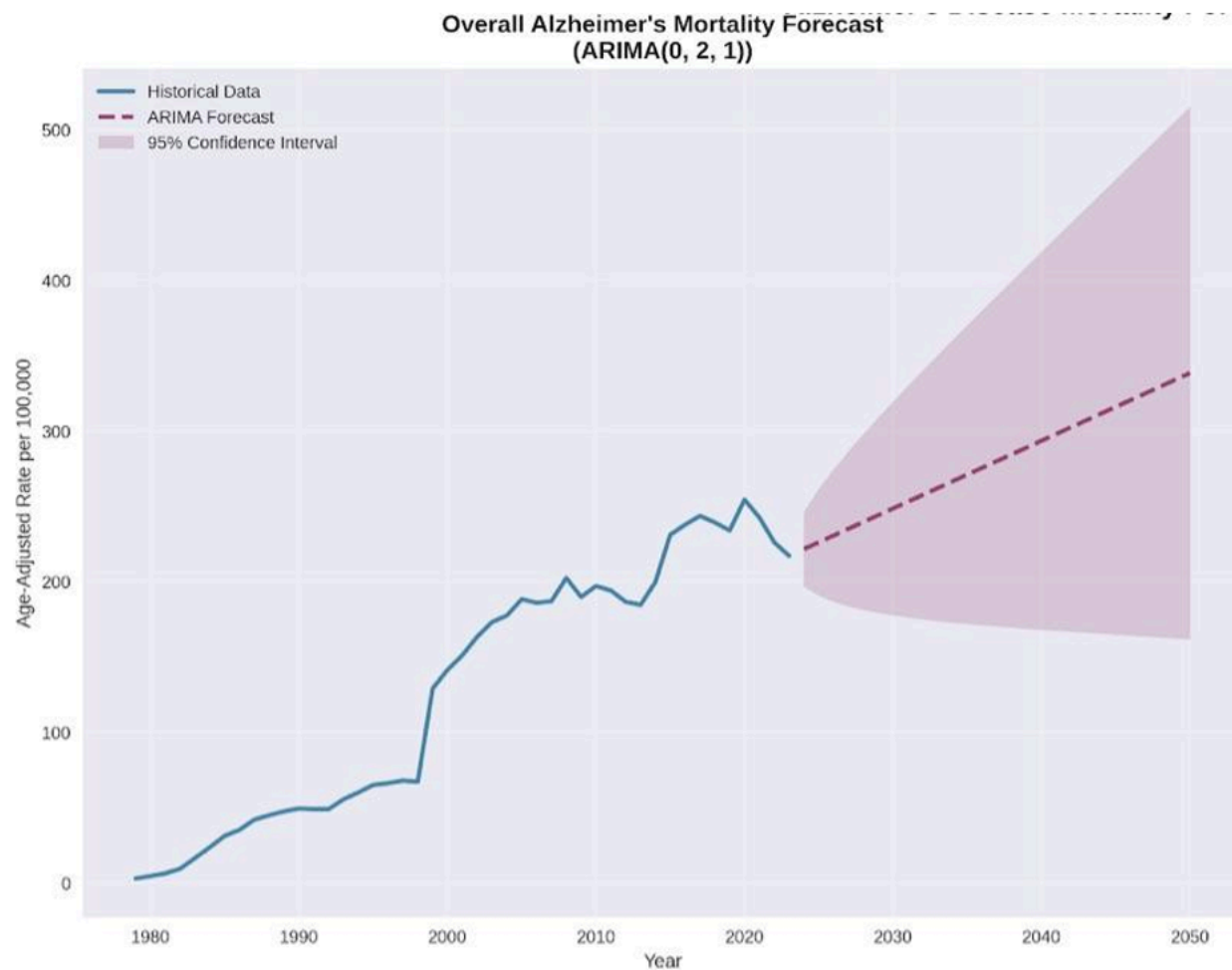


Figure 1

Annual age-adjusted mortality rate (AAMR) for Alzheimer's Disease in U.S. adults aged ≥ 65 years, 1979–2050, showing observed data (1979–2023) and forecast projections (2024–2050) across all racial groups. Shaded areas represent 95% confidence intervals.

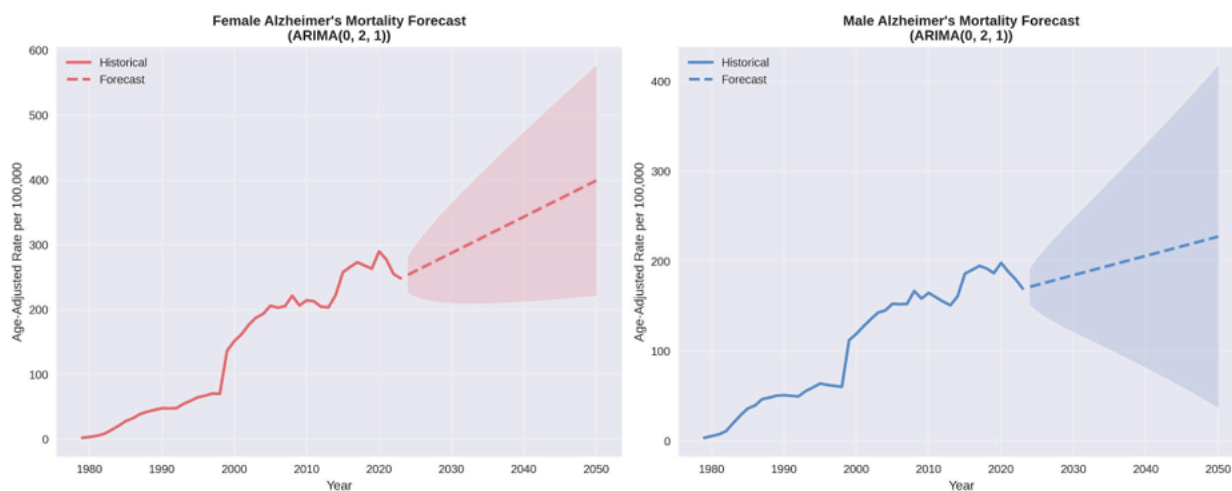


Figure 2

Sex stratified age-adjusted mortality rate (AAMR) for Alzheimer's Disease in U.S. adults aged ≥ 65 years, 1979–2050, showing observed data (1979–2023) and forecast projections (2025–2050) across all racial groups. Shaded areas represent 95% confidence intervals.

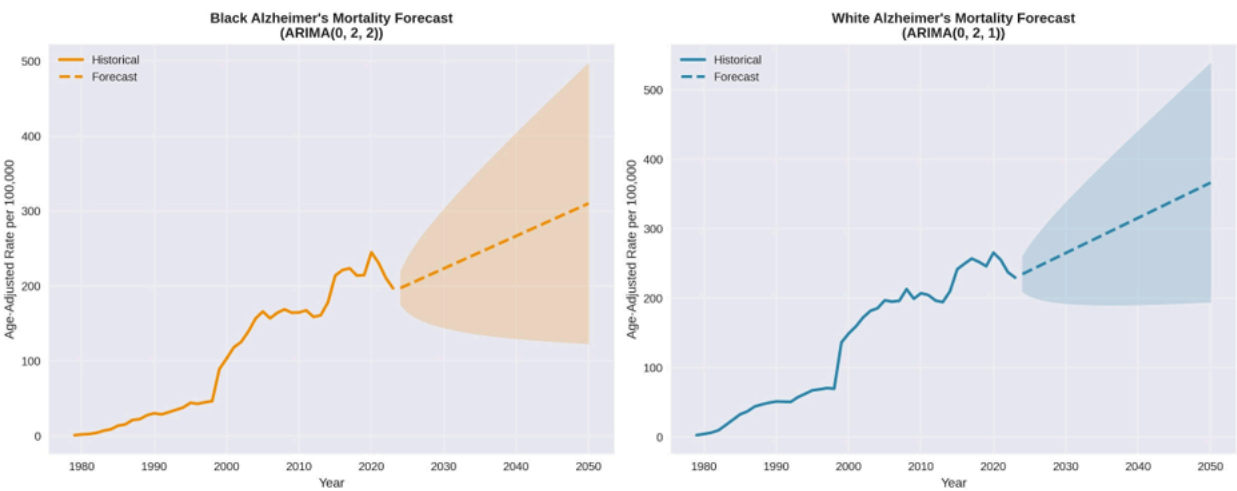


Figure 3

Race stratified age-adjusted mortality rate (AAMR) for Alzheimer's Disease in U.S. adults aged ≥ 65 years, 1979–2050, showing observed data (1979–2023) and forecast projections (2025–2050) across all racial groups. Shaded areas represent 95% confidence intervals.

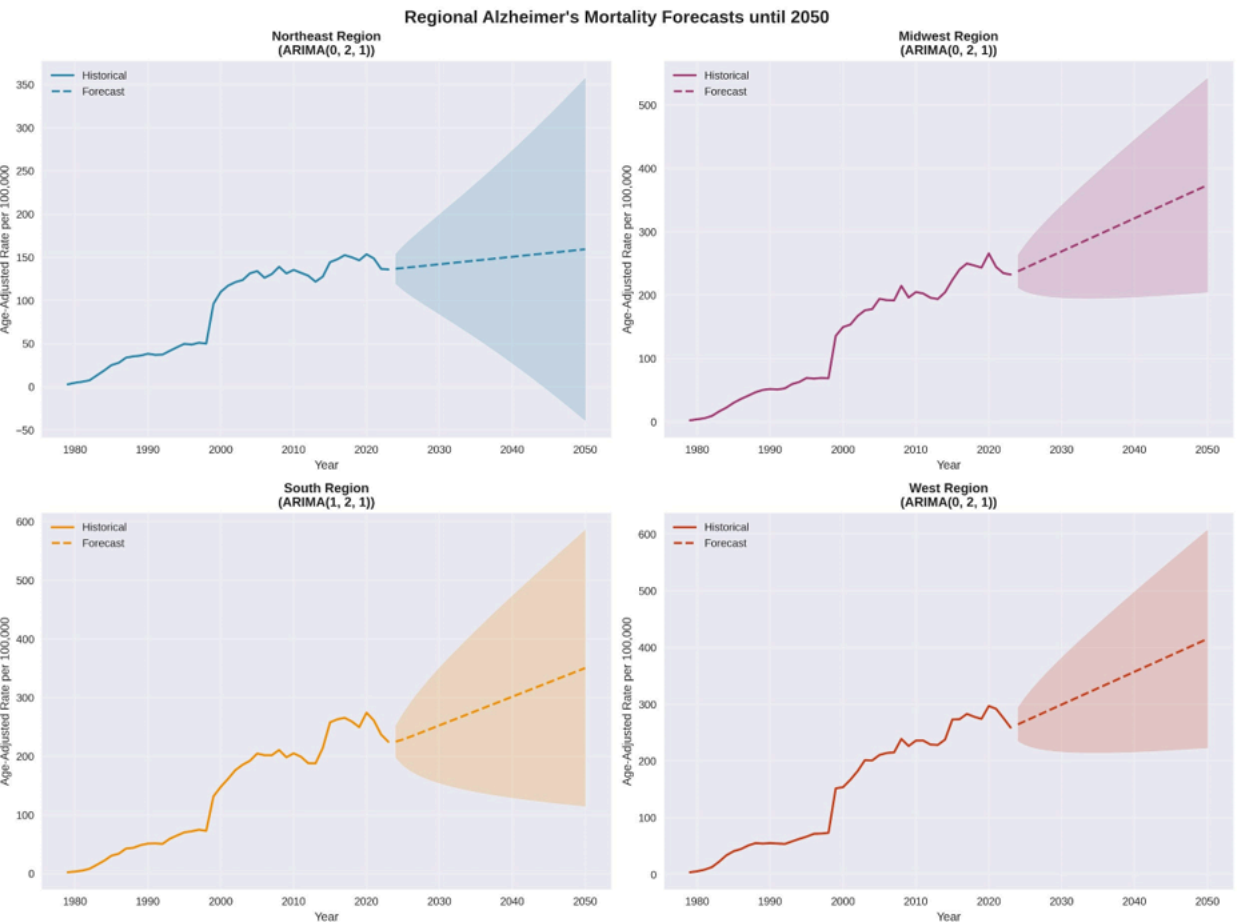


Figure 4

Census-region stratified age-adjusted mortality rate (AAMR) for Alzheimer's Disease in U.S. adults aged ≥65 years, 1979–2050, showing observed data (1979–2023) and forecast projections (2025–2050) across all racial groups. Shaded areas represent 95% confidence intervals.

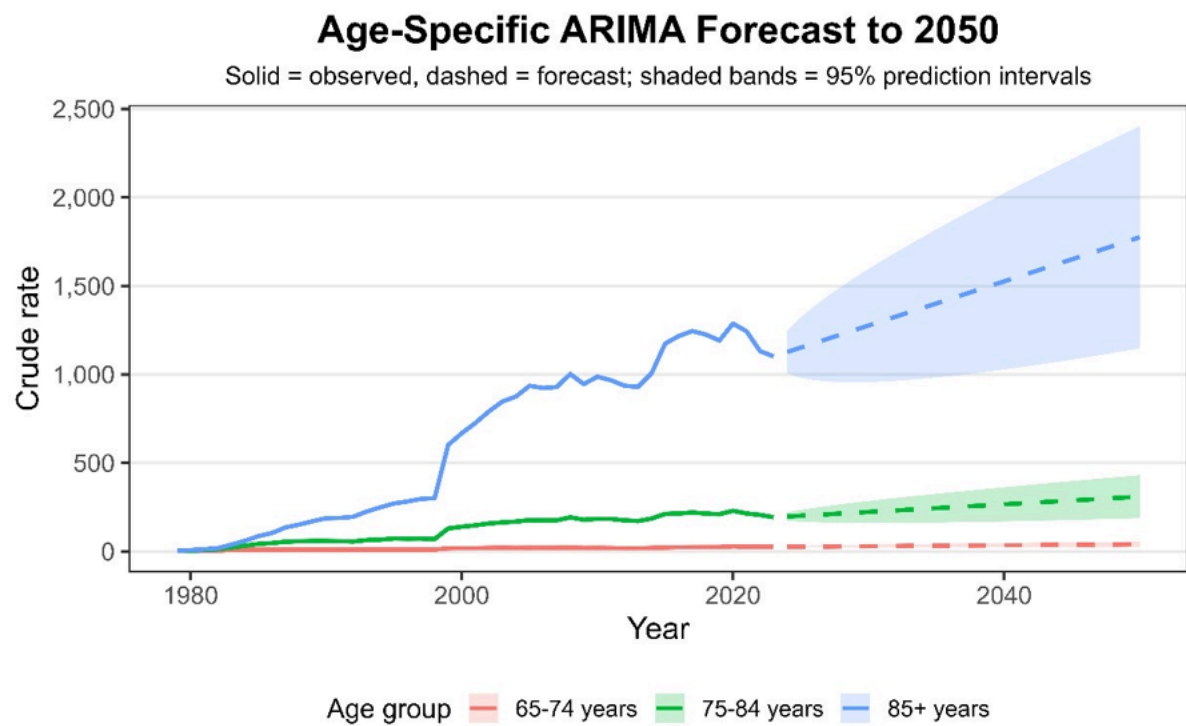


Figure 5

Age stratified age-adjusted mortality rate (AAMR) for Alzheimer's Disease in U.S. adults aged ≥65 years, 1979–2050, showing observed data (1979–2023) and forecast projections (2025–2050) across all racial groups. Shaded areas represent 95% confidence intervals

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