

Lin, Zhuoer et al.

**Working Paper**

## Long-Term Trends in Racial and Ethnic Reporting and Representation in US Alzheimer's Clinical Trials

GLO Discussion Paper, No. 1728

**Provided in Cooperation with:**

Global Labor Organization (GLO)

*Suggested Citation:* Lin, Zhuoer et al. (2026) : Long-Term Trends in Racial and Ethnic Reporting and Representation in US Alzheimer's Clinical Trials, GLO Discussion Paper, No. 1728, Global Labor Organization (GLO), Essen

This Version is available at:

<https://hdl.handle.net/10419/338966>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

# Long-Term Trends in Racial and Ethnic Reporting and Representation in US Alzheimer's Clinical Trials

Zhuoer Lin, University of Illinois Chicago

Ruo Chen Sun, University of Pennsylvania

Joseph S. Ross, Yale University

Kien Lau, Yale University

Sophia Stumpf, Yale University

Xi Chen, Yale University, GLO, NBER

## Abstract

Alzheimer's disease (AD) disproportionately burdens racial and ethnic minority populations, yet the extent to which US clinical trials reflect this burden remains poorly understood. We conduct a systematic review of all 88 completed US-based Phase III AD drug trials between 1997 and 2023, using a multi-source approach that integrates the Trialstrove clinical trial database with PubMed, ClinicalTrials.gov, pharmaceutical reports, and conference abstracts. We document three main findings. First, nearly half of published trials (49.3%) reported no data on patient race or ethnicity. Among trials that did report, practices were highly inconsistent in terminology, categorization, and analytical depth. Second, White patients constituted a median of 91.3% of enrollment, while Black patients represented 4.5%–7.2%, Hispanic patients 5.2%, and Asian / Pacific Islander and Native American patients less than 1% - shares that are grossly disproportionate to AD prevalence rates, which are approximately twice as high among non-Hispanic Black older adults and 1.5 times as high among Hispanic older adults relative to non-Hispanic Whites. Third, only 3 trials (4.2%) conducted any subgroup analyses by race or ethnicity, and none reported treatment safety or efficacy stratified by demographic group. Critically, regression models find no evidence of improvement in reporting or representation from 1997 to 2023. These patterns limit the generalizability of existing AD treatment evidence and raise fundamental concerns about health equity. Our findings support strengthening mandatory reporting standards, broadening eligibility criteria, and diversifying trial site selection to ensure emerging AD treatments are evaluated equitably across the populations most affected.

**JEL Classification:** I14, I18, J15, J14, L65, I11

**Keywords:** Alzheimer's disease; dementia; clinical trials; racial and ethnic disparities; health equity; underrepresentation; diversity in clinical research

\* **Corresponding to:** Xi Chen, PhD, [xi.chen@yale.edu](mailto:xi.chen@yale.edu); Department of Health Policy and Management, Yale School of Public Health, 60 College St, New Haven, CT 06520, United States of America.

## Introduction

Alzheimer's disease (AD) affects more than 7 million Americans and disproportionately impacts racial and ethnic populations underrepresented in clinical research in the US.<sup>1</sup> Non-Hispanic Black and Hispanic older adults are nearly twice and 1.5 times more likely, respectively, to have AD than non-Hispanic White older adults,<sup>1-5</sup> yet face substantial barriers to participation in clinical trials.<sup>6-9</sup> As the US population ages and becomes more diverse, these disparities are expected to widen, further intensifying the burden of AD and pointing to the urgency of addressing inequities in disease burden and research representation.<sup>1-5</sup>

These growing disparities highlight the need to assess whether emerging treatments are safe and effective across diverse groups.<sup>10,11</sup> Clinical trials, particularly Phase III trials, provide the foundation for clinical guidelines and regulatory decisions and are critical for establishing the safety and efficacy of new AD treatments.<sup>6,12,13</sup> However, Phase III trials have often fallen short of enrolling racial and ethnic underrepresented populations, including non-Hispanic Black, Hispanic, and Native American individuals, and frequently fail to reflect the racial and ethnic diversity of the US population.<sup>9,11,14-16</sup> Such underrepresentation limits the generalizability of trial findings and may exacerbate disparities in care, as well-documented differences in genetic, behavioral, and clinical factors of AD across racial and ethnic groups can influence therapeutic safety and efficacy.<sup>17-21</sup> For example, prior research has demonstrated racial and ethnic differences in APOE prevalence, burden of vascular and cardiometabolic conditions, health behaviors, healthcare access and utilization, and clinical presentation of cognitive symptoms, all of which may affect AD risk and treatment response.<sup>1,22-24</sup> Despite these concerns, reporting and inclusion by race and ethnicity remain limited and inconsistent.<sup>6</sup>

Previous reviews of AD trials often did not distinguish between trial phases, combined US and non-US trials, or relied primarily on selected bibliographic databases or trial registries, limiting their applicability and policy relevance to the US context.<sup>6,19</sup> Moreover, the extent to which US-based AD trials have achieved meaningful racial and ethnic representation remains unclear, particularly given rapid demographic shifts in which racial and ethnic underrepresented groups constitute the fastest-growing segments of the older adults population.<sup>11,25</sup> Focusing on US-based Phase III trials is therefore critical to ensuring that trial findings are directly relevant to the populations most affected by AD.<sup>9,11,17,25,26</sup>

Using comprehensive trial databases, we characterized the trends to date in how patient race and ethnicity have been reported, analyzed, and represented in US-based Phase III AD trials from 1997 to 2023. We assessed the extent to which racial and ethnic differences were considered in trial design and analysis and evaluated changes in reporting and representation over time.

## **Methods**

This systematic review was determined non-human subjects research and we followed the PRISMA reporting guidelines.

### ***Data Sources and Trial Identification***

We conducted a systematic review of US-based Phase III AD clinical trials of drug treatment using a multi-source approach. AD trials were identified primarily through the Trialtrove clinical trial database, which provides comprehensive tracking of clinical trials from initiation through completion. Trialtrove aggregates information from a wide variety of sources, including

pharmaceutical companies, regulatory agencies, trial registries, conference proceedings, press releases, and peer-reviewed publications.<sup>27-29</sup> The database has been validated in prior research,<sup>28,29</sup> and offers detailed information on trial design, enrollment characteristics, study timelines, and reported outcomes, enabling precise identification, selection, and analysis of clinical trials.<sup>27-29</sup>

In this study, Trialtrove was queried to identify all Phase III AD clinical trials as of April 21, 2023. To ensure completeness and accuracy, identified trials were cross-referenced with PubMed, trial registries, and other public sources. This approach enabled inclusion of both published and unpublished trials and supported comprehensive identification regardless of registration and publication status.

### ***Eligibility Criteria and Study Selection***

Trials were eligible for inclusion if they met the following criteria: (1) designated as Phase III drug trials; (2) targeted Alzheimer's disease; (3) considered as completed; and (4) recruited patients exclusively in the US. Trials were excluded if they were ongoing, planned, terminated, or suspended without publicly available data; were not Phase III drug trials; or included non-US populations.

The initial search identified 484 Phase III AD trials. After excluding trials that were open or planned (67 trials), lacked US populations (178 trials), or recruited patients outside the US (136 trials), 103 US-based Phase III trials remained for further review.

Two reviewers (K.L., S.S.) independently screened the 103 trials by examining associated publications, registries, or public sources. We excluded 15 trials that were incomplete with no publicly available records (10 terminated, 1 suspended), not Phase III (2 trials), or not fully US-

based (2 trials) after the review. The final analytic sample included 88 completed US-based Phase III AD trials. The sample selection process is presented in the Supplementary eFigure 1 and the list of 88 trials is provided in Supplementary eReferences (see Supplementary eFigure 2 for the distribution of trials over publication years).

### ***Data Extraction and Quality Assurance.***

We followed a two-stage process to extract data on patient race and ethnicity reporting and representation. In the first stage, the two reviewers (K.L., S.S.) independently extracted all reported racial and ethnic data from available sources. For each trial with published reports, the data source and publication date were documented. Publication dates in our sample ranged from 1997 to 2023. In the second stage, the reviewers cross-checked their extracted data and resolved discrepancies through consensus. A third reviewer (Z.L.) then performed a final quality check. Data collection was completed in May 2024.

### ***Outcome Measures***

The primary outcomes were measures of patient racial and ethnic reporting and representation in US-based Phase III AD trials, including whether race and ethnicity were reported, the number of racial and ethnic groups reported, the terminology used, and the proportion of patients from each racial and ethnic group.

Secondary outcomes included whether trials reported sample characteristics, subgroup analyses or differences in safety or efficacy by race and ethnicity, and whether trial reports discussed the racial and ethnic representation of enrolled patients.

Terminology used to describe racial and ethnic groups varied widely and was often inconsistent with existing reporting guidelines.<sup>30-34</sup> Because Hispanic ethnicity were frequently unspecified, racial and ethnic categories were analyzed separately for White (ethnicity unspecified) and White (non-Hispanic) patients, as well as for Black (ethnicity unspecified) and Black (non-Hispanic) patients. Additional categories included Hispanic, Asian or Pacific Islander, and Native American patients, as documented in trial reports.

### ***Statistical Analysis***

Trials were considered published if trial data appeared in peer-reviewed journals, ClinicalTrials.gov, pharmaceutical reports, or conference abstracts. Our analyses focused on all published trials, with additional emphasis on trials reported in peer-reviewed publications. When multiple reports were available for a single trial, the report containing the most complete information was selected.

Descriptive statistics were used to summarize trial characteristics, reporting practices, and patient composition. Time trends in racial and ethnic reporting were assessed by estimating changes over time in the proportion of trials reporting race and ethnicity and the number of racial and ethnic groups reported. Time trends in representation were evaluated by examining changes in the percentage of enrolled patients across racial and ethnic categories over time. Linear regression models with robust standard errors were used to estimate temporal trends, with statistical significance assessed at 5% level. Analyses were conducted using R (version-4.5.0) and STATA (version-17.0).

## **Results**

**Table 1** presents the characteristics of US-based Phase III AD clinical trials. Of the 88 Phase III AD clinical trials reported from 1997-2023, 71 trials (80.7%) had published data available, while 17 (19.5%) had no publications. Among trials with available data, 52 (59.1%) were published in peer-reviewed journals, the remaining trials reported results through ClinicalTrials.gov, pharmaceutical company reports, or conference abstracts.

### ***Racial and Ethnic Reporting in AD Trials***

Among the 71 published trials, nearly half (49.3%) did not report any data on patient race or ethnicity. Only 35.2% trials reported White patients (ethnicity unspecified), and 15.5% reported White (non-Hispanic) patients. Reporting of other racial and ethnic groups was limited. Specifically, only 15.5% of trials reported data on Asian/Pacific Islander patients, 14.1% on Black (ethnicity unspecified) patients, 14.1% on Black (non-Hispanic) patients, 18.3% on Hispanic patients, and 2.8% on Native American patients (**Table 1**).

Reporting proportions were modestly higher among trials published in peer-reviewed journals; however, substantial underreporting persisted. The median number of patient racial and ethnic groups reported was 1 (IQR: 0-3) across all published trials, and 1 (IQR: 0-3.5) among peer-reviewed trials, with most trials reporting only the number/proportion of White patients (**Table 1**).

Trials differed in whether they reported race, ethnicity, or both; whether Hispanic ethnicity was clearly distinguished from race; and how racial and ethnic categories were defined (Supplementary eTable 1).

No trials reported sample characteristics (e.g., demographic or clinical characteristics) stratified by race or ethnicity. Only 3 trials (4.2%) conducted any subgroup analyses by race or

ethnicity, and none reported detailed treatment efficacy or safety outcomes stratified by racial or ethnic group or provided sufficient information to assess differential treatment effects (**Table 1**).

### ***Racial and Ethnic Representation in AD Trials***

When racial and ethnic composition was reported, White patients constituted the majority of enrolled populations. The median proportion of White patients was 91.3% (IQR: 87.3%-93.6%) among trials reporting White race, and 84.1% (IQR: 80.1%-93.4%) among trials reporting non-Hispanic White ethnicity.

In contrast, patients from racial and ethnic underrepresented groups accounted for a small proportion of trial enrollment. Median enrollment populations were 0.9% (Interquartile Range [IQR]: 0.6-1.6) for Asian or Pacific Islander, 4.5% (IQR: 3.6-6.6) for Black (unspecified ethnicity), 7.2% (IQR: 3.7-9.1) for Black (non-Hispanic), 5.2% (IQR: 3.1-6.6) for Hispanic, and 0.4% (IQR: 0-0.8) for Native American patients. No trials acknowledged underrepresentation in enrollment, discussed its implications for generalizability, or proposed strategies to improve representation (**Table 1**).

### ***Trends in Racial and Ethnic Reporting and Representation***

**Figure 1** illustrates trends in racial and ethnic reporting. Over time, the proportion of trials reporting any patient race or ethnicity data did not improve, though the number of racial and ethnic groups reported slightly increased. Among all published trials, there was a nonsignificant decline in the proportion reporting racial and ethnic data (slope: -1.0%; 95% CI: -3.4%, 1.4%), while reporting remained stable among trials published in peer-reviewed journals (slope: 0.02%; 95% CI: -3.7%, 3.7%). The number of racial and ethnic groups reported showed an increasing

trend among peer-reviewed trials, although this trend was not statistically significant (slope: 0.12; 95% CI: -0.01, 0.26).

**Figure 2** presents trends in racial and ethnic groups representation among trial patients (see Supplementary eFigure 3 for more detailed breakdowns). White patients consistently constituted nearly 90% of trial enrollment over time, with a slight but nonsignificant increasing trend. In contrast, enrollment of racial and ethnic underrepresented groups remained persistently low, with no evidence of improvement over time. Among peer-reviewed trials, Hispanic representation showed a modest and statistically significant decline (slope: -1.3%; 95% CI: -2.4%, -0.19%).

## **Discussion**

This systematic review of US-based Phase III AD clinical trials reported between 1997 and 2023 reveals persistent and substantial gaps in both reporting of patient race and ethnicity and representation. Despite decades of recognition that AD disproportionately affects certain racial and ethnic groups, including non-Hispanic Black and Hispanic populations,<sup>1,2</sup> nearly half of trials failed to report any information on patient race or ethnicity, with little evidence of improvement over time. Among trials that did report these data, enrollment of racial and ethnic underrepresented populations remained consistently low, and few trials conducted subgroup analyses by patient race or ethnicity. As a result, the ability to assess treatment safety or efficacy across diverse populations remains constrained.<sup>6,11,35</sup> These patterns raise important concerns about the generalizability of trial findings and the extent to which current evidence can support equitable treatment decisions for populations most affected by AD.<sup>6,17</sup>

Inadequate reporting of race and ethnicity represents a fundamental limitation of current clinical evidence to inform AD treatment. Even when demographic information was reported, we found that practices were often inconsistent, with wide variation in terminology, categorization, and distinctions between race and ethnicity. Reporting frequently focused on White patients, with limited attention to other racial and ethnic groups and little clarity regarding how categories were defined or used in analyses. These inconsistencies limit transparency and hinder meaningful comparisons across trials. More importantly, incomplete reporting constrains the ability to assess the generalizability and evaluate whether treatment safety and efficacy may differ across populations, despite well-documented differences in genetic risk profiles, comorbidity burden, and social determinants of health across racial and ethnic groups.<sup>1,17,20,21,36</sup> The persistence of these reporting gaps highlights the importance of further strengthening and consistently implementing race and ethnicity reporting standards, including recent initiatives by federal agencies and academic journals.<sup>30-34</sup>

Meanwhile, our findings reveal a persistent mismatch between AD disease burden and trial enrollment. In the US, non-Hispanic Black older adults experience nearly twice the prevalence of AD compared with non-Hispanic White older adults, and Hispanic older adults face approximately 50% higher prevalence than non-Hispanic White older adults.<sup>1</sup> Notably, in 2020, non-Hispanic Black individuals accounted for 17.5% of all people living with AD, while Hispanic individuals accounted for 11.7%, proportion projected to increase to 24.5% for Black and 26.8% for Hispanic individuals respectively by 2060.<sup>37</sup> Yet Phase III AD trials have continued to enroll disproportionately few patients from these groups. From 1997-2023, we showed that median enrollment remained approximately 4% to 7% for Black patients, about 5% Hispanic patients, and less than 1% for Native American patients, while White patients

consistently comprised nearly 90% of trial populations. This marked imbalance has important implications for both equity and scientific validity. When trial populations do not reflect those most affected by AD, the resulting evidence may inadequately capture variation in treatment response, adverse events, and real-world effectiveness.<sup>6</sup> This concern is particularly salient for AD, given well-established differences in disease progression, comorbid conditions, and access to diagnosis and care across populations.<sup>1,11</sup>

The limited progress observed in reporting and representation likely reflects broader structural and trial-level barriers.<sup>6–11,14,19,35,38–46</sup> Restrictive eligibility criteria, including exclusions related to comorbidities or cognitive screening thresholds, may disproportionately exclude individuals from populations with higher disease burden.<sup>9,19,47</sup> Trial sites are often concentrated in locations that are less accessible to individuals living in disadvantaged or underserved communities, further limiting participation by racial and ethnic underrepresented groups. In addition, investigators may face practical constraints, including limited time, funding, expertise, and access to culturally appropriate resources, which may challenge effective engagement with underrepresented communities.<sup>48</sup> Recruitment strategies also often lack partnerships with community organizations and fail to address limited awareness of AD and research opportunities, language barriers, cultural relevance, stigma, logistical challenges, and longstanding mistrust of research institutions.<sup>6–11,14,19,35,38–45,49</sup> These factors, together, help explain why improvements in enrollment and reporting have remained limited despite increased attention to diversity in clinical research.

Addressing these challenges will require coordinated multilevel efforts.<sup>6,10,11,14,19,35</sup> First, standardized race and ethnicity reporting, with consistent definitions and mandatory registry fields, provides a necessary foundation for improving transparency, comparability, and

accountability.<sup>17,19,21</sup> This should follow established guidance from federal agencies and journals, including separate collection of race and ethnicity, consistent use of predefined categories, explicit distinction of Hispanic ethnicity from race, allowance for multiple racial identifies, and clear reporting of missing or unknown responses.<sup>30-34</sup> Consistent application of these standards across trial registries and publications would improve comparability and interpretability across AD trials. Second, beyond reporting, meaningful progress in representation will depend on intentional trial design choices, including more inclusive eligibility criteria, broader and more diverse site selection, and recruitment strategies that actively engage racial and ethnic populations disproportionately affected by AD.<sup>7,19</sup> Financial supports such as transportation assistance or patient compensation may help mitigate socioeconomic barriers that disproportionately limit participation among underrepresented populations.<sup>19,26,41</sup> In addition, partnerships with local advocacy groups and healthcare providers, use of bilingual and culturally concordant research staff, and tailored outreach materials for underserved communities may further reduce barriers, strengthen trust, and improve accessibility.<sup>7,18,20,21,41,43</sup> These approaches should be adopted more widely to ensure inclusive and generalizable AD research.<sup>6,10,11,14,19,35</sup>

### ***Strengths***

This study has several notable strengths. First, by leveraging multiple complementary data sources, including Trialtrove, PubMed, ClinicalTrials.gov, conference abstracts, and pharmaceutical reports, we identified a comprehensive list of US-based AD trials conducted between 1997 and 2023. Second, our exclusive focus on US-based Phase III trials elevates both clinical and policy relevance, as these trials provide the highest level of evidence for treatment efficacy and play a central role in regulatory decision-making for the US population. Third, our

assessment of racial and ethnic reporting and representation was both thorough and comprehensive. We examined not only whether demographic data were reported, but also how they were reported and the quality of reporting. Additionally, by analyzing trends over time, we identified persistent gaps and highlighted the need for more systematic oversight and regulatory efforts.

### ***Limitations***

This study also has limitations. Although focusing on US-based trials strengths relevance for domestic US policy and practice, it excludes large multinational trials in which underrepresentation is also a significant concern. The issue of racial and ethnic underrepresentation persists even in broader global trials.<sup>11</sup> Second, trials that fail to report any racial or ethnic data may be more likely to have enrolled few patients from racial and ethnic underrepresented groups, potentially leading to underestimation of the full extent of these disparities. Finally, while we discuss several contributing factors, the underlying causes of underreporting and underrepresentation, as well as the reasons for their persistence over time, warrant further investigation. Future research, particularly using mixed methods, is needed to better understand the mechanisms and identify effective interventions.

### ***Conclusion***

This study highlights the persistent challenges in providing equitable access to clinical research and the critical need for more inclusive and representative AD trials. To ensure that the benefits of emerging AD treatments are equitably distributed, clinical trials must better reflect the diverse demographics of the US population. Policy initiatives, such as those proposed in the bipartisan

Equity in Neuroscience and Alzheimer’s Clinical Trials (ENACT) Act may play an important role in addressing these disparities by expanding outreach, strengthening recruitment infrastructure, and promoting a more representative clinical research workforce.<sup>7,50</sup> Effective and persistent efforts are needed to reduce health disparities and improve outcomes for all individuals affected by AD.

## **Acknowledgements**

**Funding/Support:** This study was funded by research grant R01AG077529 from the National Institute on Aging (NIA), grant P30AG021342 from the NIA to the Yale Claude D. Pepper Older Americans Independence Center, and grant P30AG083255 from the NIA to the UIC Center of Health in Cognitive Aging (CHECA). The GLO Discussion Paper Series serves as a preprint server to deposit latest research for early feedback.

**Potential Competing Interests:** Dr. Ross currently receives research support through Yale University from Johnson and Johnson to develop methods of clinical trial data sharing, from the Food and Drug Administration for the Yale-Mayo Clinic Center for Excellence in Regulatory Science and Innovation (CERSI) program (U01FD005938), from the NIH (R01AA032254), from the Greenwall Foundation, and from Arnold Ventures.

**Role of the Funder/Sponsor:** The funding organizations had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

**Author Contributions:** Drs. Lin and Chen had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

*Concept and design:* Lin, Sun, Ross, Chen.

*Acquisition, analysis, or interpretation of data:* All authors.

*Drafting of the manuscript:* Lin, Chen.

*Critical review of the manuscript for important intellectual content:* All authors.

*Statistical analysis:* Lin, Chen.

*Obtained funding:* Lin, Ross, Chen.

*Administrative, technical, or material support:* Lin, Chen.

*Supervision:* Lin, Chen.

## References

1. Alzheimer's Association. 2025 Alzheimer's disease facts and figures. *Alzheimers Dement*. 2025;21(4):e70235. doi:10.1002/alz.70235
2. Manly JJ, Jones RN, Langa KM, et al. Estimating the Prevalence of Dementia and Mild Cognitive Impairment in the US: The 2016 Health and Retirement Study Harmonized Cognitive Assessment Protocol Project. *JAMA Neurol*. 2022;79(12):1242-1249. doi:10.1001/jamaneurol.2022.3543
3. Langa KM, Larson EB, Crimmins EM, et al. A Comparison of the Prevalence of Dementia in the United States in 2000 and 2012. *JAMA Intern Med*. 2017;177(1):51-58. doi:10.1001/jamainternmed.2016.6807
4. Lin Z, Ye J, Allore H, Gill TM, Chen X. Early-Life Circumstances and Racial Disparities in Cognition Among Older Adults in the US. *JAMA Intern Med*. 2024;184(8):904-914. doi:10.1001/jamainternmed.2024.1132
5. Lin Z, Wang Y, Gill TM, Chen X. Exposure to School Racial Segregation and Late-Life Cognitive Outcomes. *JAMA Netw Open*. 2025;8(1):e2452713. doi:10.1001/jamanetworkopen.2024.52713
6. Wang TY, Corbie G, Allore HG, et al. Randomized Clinical Trials That Advance Health and Health Equity: JAMA Internal Medicine Call for Papers. *JAMA Intern Med*. 2024;184(9):1011-1012. doi:10.1001/jamainternmed.2024.3149
7. Aranda MP, Marquez DX, Gallagher-Thompson D, et al. A call to address structural barriers to Hispanic/Latino representation in clinical trials on Alzheimer's disease and related dementias: A micro-meso-macro perspective. *Alzheimers Dement Transl Res Clin Interv*. 2023;9(2):e12389. doi:10.1002/trc2.12389
8. Zhou Y, Elashoff D, Kremen S, Teng E, Karlawish J, Grill JD. African Americans are less likely to enroll in preclinical Alzheimer's disease clinical trials. *Alzheimers Dement Transl Res Clin Interv*. 2017;3(1):57-64. doi:10.1016/j.trci.2016.09.004
9. Manly JJ, Gilmore-Bykovskiy A, Deters KD. Inclusion of Underrepresented Groups in Preclinical Alzheimer Disease Trials—Opportunities Abound. *JAMA Netw Open*. 2021;4(7):e2114606. doi:10.1001/jamanetworkopen.2021.14606
10. Mooldijk SS, Licher S, Wolters FJ. Characterizing Demographic, Racial, and Geographic Diversity in Dementia Research: A Systematic Review. *JAMA Neurol*. 2021;78(10):1255-1261. doi:10.1001/jamaneurol.2021.2943
11. Manly JJ, Deters KD. Donanemab for Alzheimer Disease—Who Benefits and Who Is Harmed? *JAMA*. 2023;330(6):510-511. doi:10.1001/jama.2023.11704
12. Anderson TS, Ayanian JZ, Souza J, Landon BE. Representativeness of Participants Eligible to Be Enrolled in Clinical Trials of Aducanumab for Alzheimer Disease Compared With

- Medicare Beneficiaries With Alzheimer Disease and Mild Cognitive Impairment. *JAMA*. 2021;326(16):1627-1629. doi:10.1001/jama.2021.15286
13. Curfman G. Integrating Clinical Trials and Practice: A New *JAMA* Series and Call for Papers. *JAMA*. 2024;332(2):111. doi:10.1001/jama.2024.10266
  14. Miller J, Pelletiers W, Suttiratana S, et al. Harnessing policy to promote inclusive medical product evidence: development of a reference standard and structured audit of clinical trial diversity policies. *BMJ Med*. 2024;3(1):e000920. doi:10.1136/bmjmed-2024-000920
  15. Varma T, Wallach JD, Miller JE, et al. Reporting of Study Participant Demographic Characteristics and Demographic Representation in Premarketing and Postmarketing Studies of Novel Cancer Therapeutics. *JAMA Netw Open*. 2021;4(4):e217063-e217063. doi:10.1001/jamanetworkopen.2021.7063
  16. Downing NS, Shah ND, Neiman JH, Aminawung JA, Krumholz HM, Ross JS. Participation of the elderly, women, and minorities in pivotal trials supporting 2011–2013 U.S. Food and Drug Administration approvals. *Trials*. 2016;17(1):199. doi:10.1186/s13063-016-1322-4
  17. Loree JM, Anand S, Dasari A, et al. Disparity of Race Reporting and Representation in Clinical Trials Leading to Cancer Drug Approvals From 2008 to 2018. *JAMA Oncol*. 2019;5(10):e191870. doi:10.1001/jamaoncol.2019.1870
  18. Shaw AR, Perales-Puchalt J, Johnson E, et al. Representation of Racial and Ethnic Minority Populations in Dementia Prevention Trials: A Systematic Review. *J Prev Alzheimers Dis*. Published online 2021:1-6. doi:10.14283/jpad.2021.49
  19. Franzen S, Smith JE, Van Den Berg E, et al. Diversity in Alzheimer’s disease drug trials: The importance of eligibility criteria. *Alzheimers Dement*. 2022;18(4):810-823. doi:10.1002/alz.12433
  20. Vyas MV, Raval PK, Watt JA, Tang-Wai DF. Representation of ethnic groups in dementia trials: systematic review and meta-analysis. *J Neurol Sci*. 2018;394:107-111. doi:10.1016/j.jns.2018.09.012
  21. Canevelli M, Bruno G, Grande G, et al. Race reporting and disparities in clinical trials on Alzheimer’s disease: A systematic review. *Neurosci Biobehav Rev*. 2019;101:122-128. doi:10.1016/j.neubiorev.2019.03.020
  22. Llibre-Guerra JJ, Jiang M, Acosta I, et al. Social determinants of health but not global genetic ancestry predict dementia prevalence in Latin America. *Alzheimers Dement*. 2024;20(7):4828-4840. doi:10.1002/alz.14041
  23. Park SY, Setiawan VW, Crimmins EM, et al. Racial and Ethnic Differences in the Population-Attributable Fractions of Alzheimer Disease and Related Dementias. *Neurology*. 2024;102(3):e208116. doi:10.1212/WNL.0000000000208116

24. Ferdows NB, Aranda MP. Decomposing Racial and Ethnic Disparities in Risk and Protective Factors of Dementia in the U.S. *Clin Gerontol*. 2025;48(5):1186-1199. doi:10.1080/07317115.2025.2534651
25. Alzheimer's Association. 2024 Alzheimer's disease facts and figures. *Alzheimers Dement*. 2024;20(5):3708-3821. doi:10.1002/alz.13809
26. Xiao H, Vaidya R, Liu F, Chang X, Xia X, Unger JM. Sex, Racial, and Ethnic Representation in COVID-19 Clinical Trials: A Systematic Review and Meta-analysis. *JAMA Intern Med*. 2023;183(1):50. doi:10.1001/jamainternmed.2022.5600
27. Trialtrove: the go-to resource for informing clinical trial strategy, design and execution. Citeline. Accessed September 29, 2024. <https://www.citeline.com/en/products-services/clinical/trialtrove>
28. Cunningham C, Ederer F, Ma S. Killer Acquisitions. *J Polit Econ*. 2021;129(3):649-702. doi:10.1086/712506
29. Krieger J, Li D, Papanikolaou D. Missing Novelty in Drug Development. Koijen R, ed. *Rev Financ Stud*. 2022;35(2):636-679. doi:10.1093/rfs/hhab024
30. U.S. National Institutes of Health. NOT-OD-15-089: Racial and Ethnic Categories and Definitions for NIH Diversity Programs and for Other Reporting Purposes. April 8, 2015. Accessed December 28, 2025. <https://grants.nih.gov/grants/guide/notice-files/NOT-OD-15-089.html>
31. Flanagin A, Frey T, Christiansen SL, AMA Manual of Style Committee. Updated Guidance on the Reporting of Race and Ethnicity in Medical and Science Journals. *JAMA*. 2021;326(7):621-627. doi:10.1001/jama.2021.13304
32. U.S. Food and Drug Administration. Collection of Race and Ethnicity Data in Clinical Trials and Clinical Studies for FDA-Regulated Medical Products. April 11, 2024. Accessed December 28, 2025. <https://www.fda.gov/regulatory-information/search-fda-guidance-documents/collection-race-and-ethnicity-data-clinical-trials-and-clinical-studies-fda-regulated-medical>
33. U.S. National Institutes of Health. NOT-OD-25-131: Revision: NIH Policy and Guidelines on the Inclusion of Women and Minorities as Subjects in Clinical Research. July 17, 2025. Accessed December 28, 2025. <https://grants.nih.gov/grants/guide/notice-files/NOT-OD-25-131.html>
34. US Census Bureau. What Updates to OMB's Race/Ethnicity Standards Mean for the Census Bureau. [census.gov](https://www.census.gov/newsroom/blogs/random-samplings/2024/04/updates-race-ethnicity-standards.html). Accessed December 29, 2025. <https://www.census.gov/newsroom/blogs/random-samplings/2024/04/updates-race-ethnicity-standards.html>

35. Grill JD, Sperling RA, Raman R. What Should the Goals Be for Diverse Recruitment in Alzheimer Clinical Trials? *JAMA Neurol.* 2022;79(11):1097-1098. doi:10.1001/jamaneurol.2022.2274
36. Kornblith E, Bahorik A, Boscardin WJ, Xia F, Barnes DE, Yaffe K. Association of Race and Ethnicity With Incidence of Dementia Among Older Adults. *JAMA.* 2022;327(15):1488-1495. doi:10.1001/jama.2022.3550
37. Rajan KB, Weuve J, Barnes LL, McAninch EA, Wilson RS, Evans DA. Population estimate of people with clinical Alzheimer's disease and mild cognitive impairment in the United States (2020–2060). *Alzheimers Dement.* 2021;17(12):1966-1975. doi:10.1002/alz.12362
38. Young BA. Assessing Strategies for Inclusion of Marginalized Communities in Clinical Trials—What's the Plan? *JAMA Netw Open.* 2024;7(6):e2413927. doi:10.1001/jamanetworkopen.2024.13927
39. Ebrahimi H, Megally S, Plotkin E, et al. Barriers to Clinical Trial Implementation Among Community Care Centers. *JAMA Netw Open.* 2024;7(4):e248739. doi:10.1001/jamanetworkopen.2024.8739
40. Okonkwo OC, Rivera Mindt M, Ashford MT, et al. A Protocol for the Inclusion of Minoritized Persons in Alzheimer Disease Research From the ADNI3 Diversity Taskforce. *JAMA Netw Open.* 2024;7(8):e2427073. doi:10.1001/jamanetworkopen.2024.27073
41. Godbole N, Kwon SC, Beasley JM, et al. Assessing Equitable Inclusion of Underrepresented Older Adults in Alzheimer's Disease, Related Cognitive Disorders, and Aging-Related Research: A Scoping Review. Heyn PC, ed. *The Gerontologist.* 2023;63(6):1067-1077. doi:10.1093/geront/gnac060
42. Dabiri S, Raman R, Grooms J, Molina-Henry D. Examining the Role of Community Engagement in Enhancing the Participation of Racial and Ethnic Minoritized Communities in Alzheimer's Disease Clinical Trials; A Rapid Review. *J Prev Alzheimers Dis.* Published online 2024. doi:10.14283/jpad.2024.149
43. Watson JL, Ryan L, Silverberg N, Cahan V, Bernard MA. Obstacles And Opportunities In Alzheimer's Clinical Trial Recruitment. *Health Aff (Millwood).* 2014;33(4):574-579. doi:10.1377/hlthaff.2013.1314
44. Babulal GM, Quiroz YT, Albeni BC, et al. Perspectives on ethnic and racial disparities in Alzheimer's disease and related dementias: Update and areas of immediate need. *Alzheimers Dement.* 2019;15(2):292-312. doi:10.1016/j.jalz.2018.09.009
45. Ritchie M, Gillen DL, Grill JD. Recruitment across two decades of NIH-funded Alzheimer's disease clinical trials. *Alzheimers Res Ther.* 2023;15(1):28. doi:10.1186/s13195-023-01177-x
46. Mooghali M, Dhruva SS, Ross JS, Ramachandran R. Representativeness of Studies Required Under Medicare's Coverage With Evidence Development Program. *JAMA.* 2024;332(22):1943-1945. doi:10.1001/jama.2024.20493

47. Raman R, Quiroz YT, Langford O, et al. Disparities by Race and Ethnicity Among Adults Recruited for a Preclinical Alzheimer Disease Trial. *JAMA Netw Open*. 2021;4(7):e2114364. doi:10.1001/jamanetworkopen.2021.14364
48. Marchant NL, Hossain E, Chen S, et al. A multiperspective investigation of the underrepresentation of minoritized ethnic participants in dementia research and proposed strategies to improve inclusive recruitment practices. *Alzheimers Dement*. 2025;21(4):e70129. doi:10.1002/alz.70129
49. Dabiri S, Raman R, Grooms J, Molina-Henry D. Examining the Role of Community Engagement in Enhancing the Participation of Racial and Ethnic Minoritized Communities in Alzheimer's Disease Clinical Trials; A Rapid Review. *J Prev Alzheimers Dis*. 2024;11(6):1647-1672. doi:10.14283/jpad.2024.149
50. ENACT Act. Accessed December 28, 2025. <https://alzimpact.org/enact>

**Table 1.** Characteristics and Racial/Ethnic Reporting and Representation in Phase III Alzheimer’s Disease Clinical Trials in the US, 1997-2023 (N=88)

<b>Characteristics</b>	<b>No. of trials (%)</b>	
	<b>All trials (N=88)</b>	<b>Trials with peer-reviewed publications (N=52)</b>
Data source		
Peer-reviewed publications	52 (59.1)	52 (100)
ClinicalTrials.gov registries	8 (9.1)	0 (0)
Trial reports of the pharmaceutical companies	2 (2.3)	0 (0)
Conference abstracts	9 (10.2)	0 (0)
No publication	17 (19.3)	0 (0)
Year of publications among published <sup>a</sup>		
≤ 2000	5 (7.0)	5 (9.6)
2001-2005	24 (33.8)	19 (36.5)
2006-2010	29 (40.8)	20 (38.5)
2011-2015	9 (12.7)	7 (13.5)
2016-2023	4 (5.6)	1 (1.9)
Sample size <sup>a</sup> , median (IQR)	191 (85-433)	324 (134-525)
Race and ethnicity reported <sup>a</sup>		
No race and ethnicity reported	35 (49.3)	18 (34.6)
Reported Asian/Pacific Islander	11 (15.5)	10 (19.2)
Reported Black (ethnicity unspecified)	10 (14.1)	9 (17.3)
Reported Black (non-Hispanic)	10 (14.1)	10 (19.2)
Reported Hispanic	13 (18.3)	12 (23.1)
Reported Native American	2 (2.8)	1 (1.9)

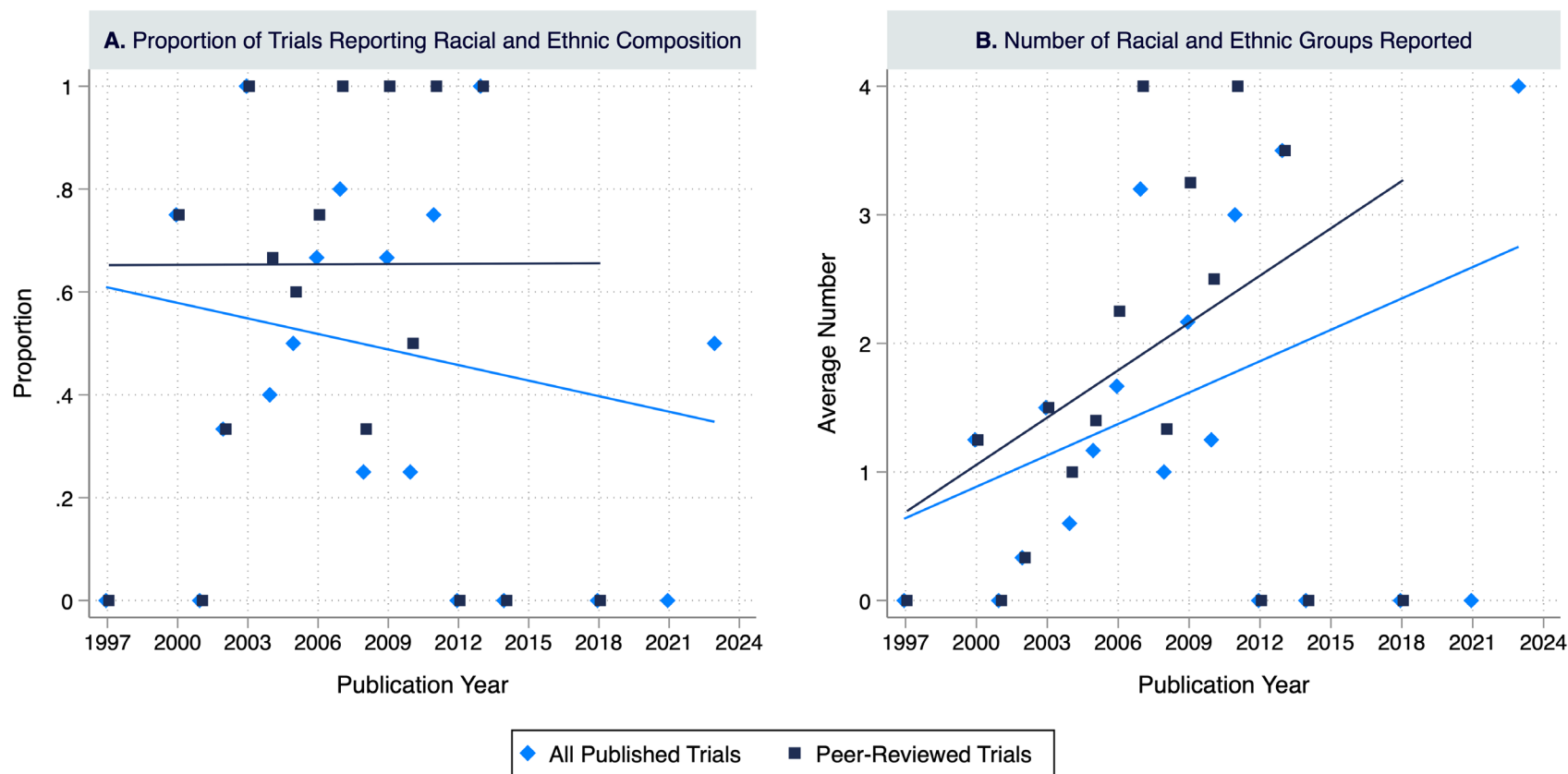
Reported White (ethnicity unspecified)	25 (35.2)	23 (44.2)
Reported White (non-Hispanic)	11 (15.5)	11 (21.2)
No. of racial and ethnic group reported <sup>a</sup> , median (IQR)	1 (0-3)	1 (0-3.5)
Percentage of Asian/Pacific Islander patients <sup>b</sup> , median (IQR)	0.9 (0.6-1.6)	0.9 (0.6-1.6)
Percentage of Black (ethnicity unspecified) patients <sup>b</sup> , median (IQR)	4.5 (3.6-6.6)	4.6 (4.1-6.6)
Percentage of Black (non-Hispanic) patients <sup>b</sup> , median (IQR)	7.2 (3.7-9.1)	7.2 (3.7-9.1)
Percentage of Hispanic patients <sup>b</sup> , median (IQR)	5.2 (3.1-6.6)	5.6 (2.5-6.6)
Percentage of Native American patients <sup>b</sup> , median (IQR)	0.4 (0-0.8)	0.8 (0.8-0.8)
Percentage of White (ethnicity unspecified) patients <sup>b</sup> , median (IQR)	91.3 (87.3-93.6)	91.3 (87.3-93.6)
Percentage of White (non-Hispanic) patients <sup>b</sup> , median (IQR)	84.1 (80.1-93.4)	84.1 (80.1-93.4)
Reporting sample characteristics by racial and ethnic groups <sup>a</sup>		
No	71 (100)	52 (100)
Yes	0 (0)	0 (0)
Reporting detailed trial outcomes (e.g., safety, efficacy) by racial and ethnic groups <sup>a</sup>		
No	71 (100)	52 (100)
Yes	0 (0)	0 (0)
Analyzing/discussing heterogeneity or differences across racial and ethnic groups <sup>a</sup>		
No	68 (95.8)	49 (94.2)
Yes	3 (4.2)	3 (5.8)
Discussing the racial and ethnic representation of enrolled trial patients <sup>a</sup>		
No	71 (100)	52 (100)
Yes	0 (0)	0 (0)

Abbreviation: IQR, Interquartile Range.

<sup>a</sup> Among trials with any published data, N=71 for column 2 (any publications), N=52 for column 3 (peer-reviewed publications)

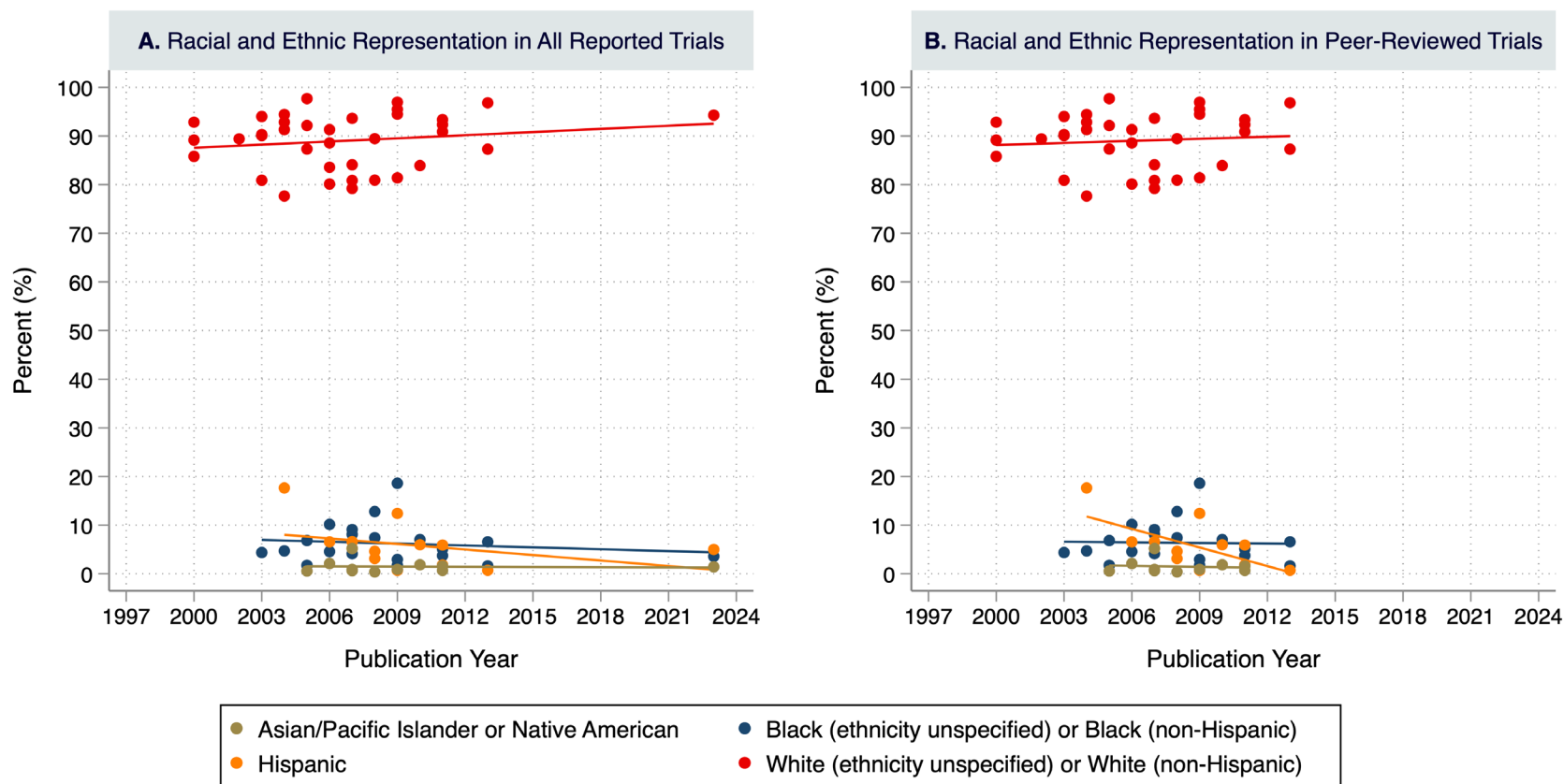
<sup>b</sup> Among trials with reported data on race and ethnicity. The sample size for each reported race and ethnicity is provided above in the table under the variable “Race and ethnicity reported”.

**Figure 1.** Trends in Racial and Ethnic Reporting Among US-based Phase III Alzheimer’s Disease Trials, 1997-2023



*Notes:* Panels A and B present the time trend of race and ethnicity reporting over years. Panel A presents the proportion of trials that reported racial and ethnic composition of the study patients. Each dotted points represent the proportion for each year, with light blue representing the proportion among all published trials, and dark blue representing the proportion among trials with peer-reviewed publications. Linear time trends were fitted respectively for all published trials (light blue line) and all peer-reviewed trials (dark blue line). Panel B presents the average number of racial and ethnic groups reported for each year among trials with published data. Estimate for each year were provided as dotted points and linear time trends were fitted respectively for all published trials (light blue color) and peer-reviewed trials (dark blue color). No statistically significant linear trends were observed.

**Figure 2.** Trends in Racial and Ethnic Representation Among US-based Phase III Alzheimer’s Disease Trials, 1997-2023



*Notes:* Panels A and B present the racial and ethnic representation among all published trials (Panel A) and peer-reviewed trials (Panel B). Each dotted point represents the percentage of patients from a specific racial and ethnic group in individual clinical trials that reported data on that group. Green dots represent the reported percentages of Asian or Pacific Islander or Native American patients; blue dots represent the reported percentages of Black (ethnicity unspecified) or Black (non-Hispanic) patients; orange dots represent the reported percentages of Hispanic patients; and red dots represent the reported percentages of White (ethnicity unspecified) or White (non-Hispanic) patients. Linear time trends were fitted for each racial and ethnic groups with consistent colors as the dotted points. No

statistically significant linear trends were observed, except for a significant decline in Hispanic representation in peer-reviewed trials. Further breakdowns of racial and ethnic groups are shown in Supplementary eFigure 3.

## **Supplementary Online Content**

**Title:** Long-Term Trends in Racial and Ethnic Reporting and Representation in US Alzheimer's Clinical Trials

**Supplementary eFigure 1.** Study Sample Selection Process

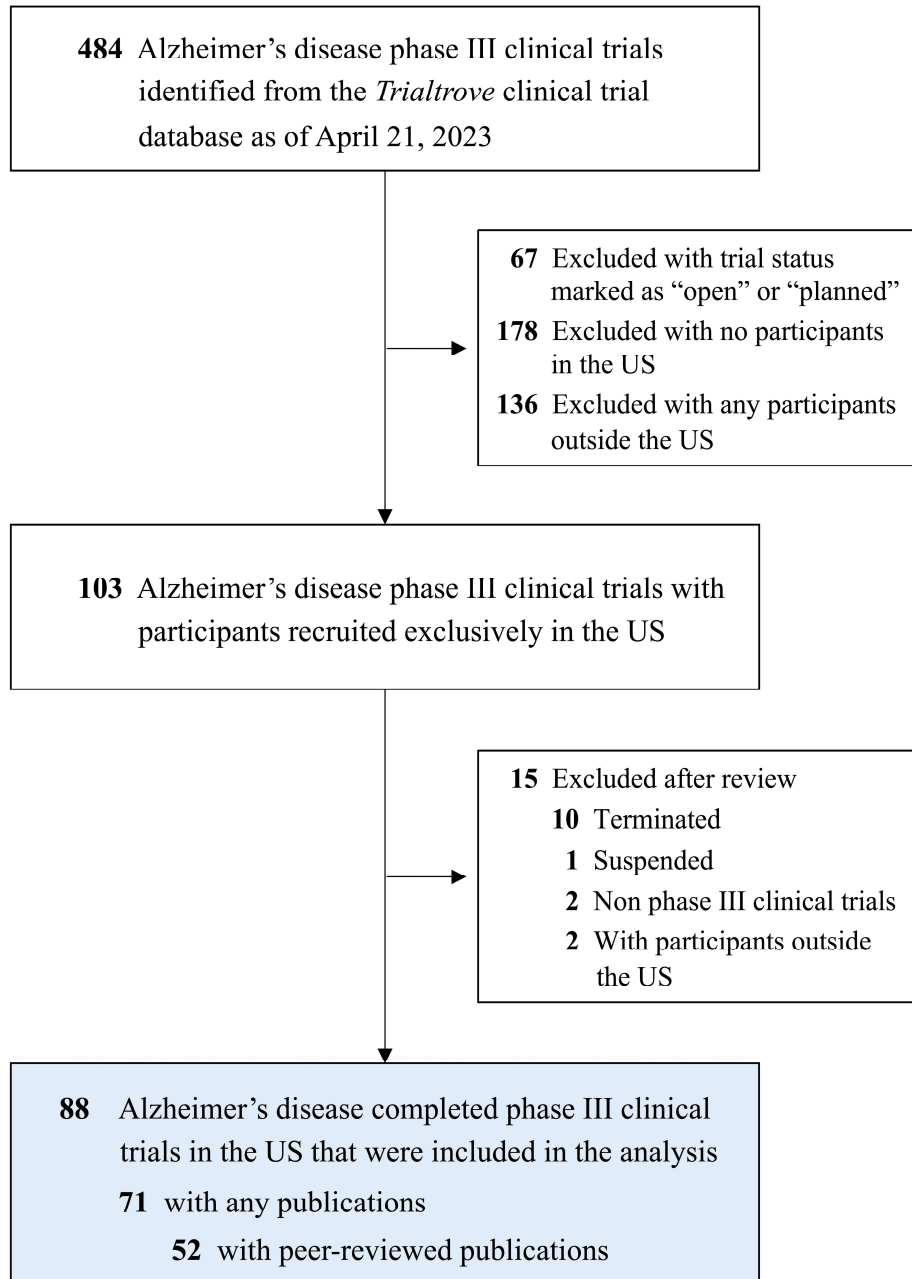
**Supplementary eFigure 2.** Number of US-based Phase III Alzheimer's Disease Trials Over Publication Years, 1997-2023

**Supplementary eFigure 3.** Trends in Representation of All Reported Racial and Ethnic Groups Among US-based Phase III Alzheimer's Disease Trials, 1997-2023

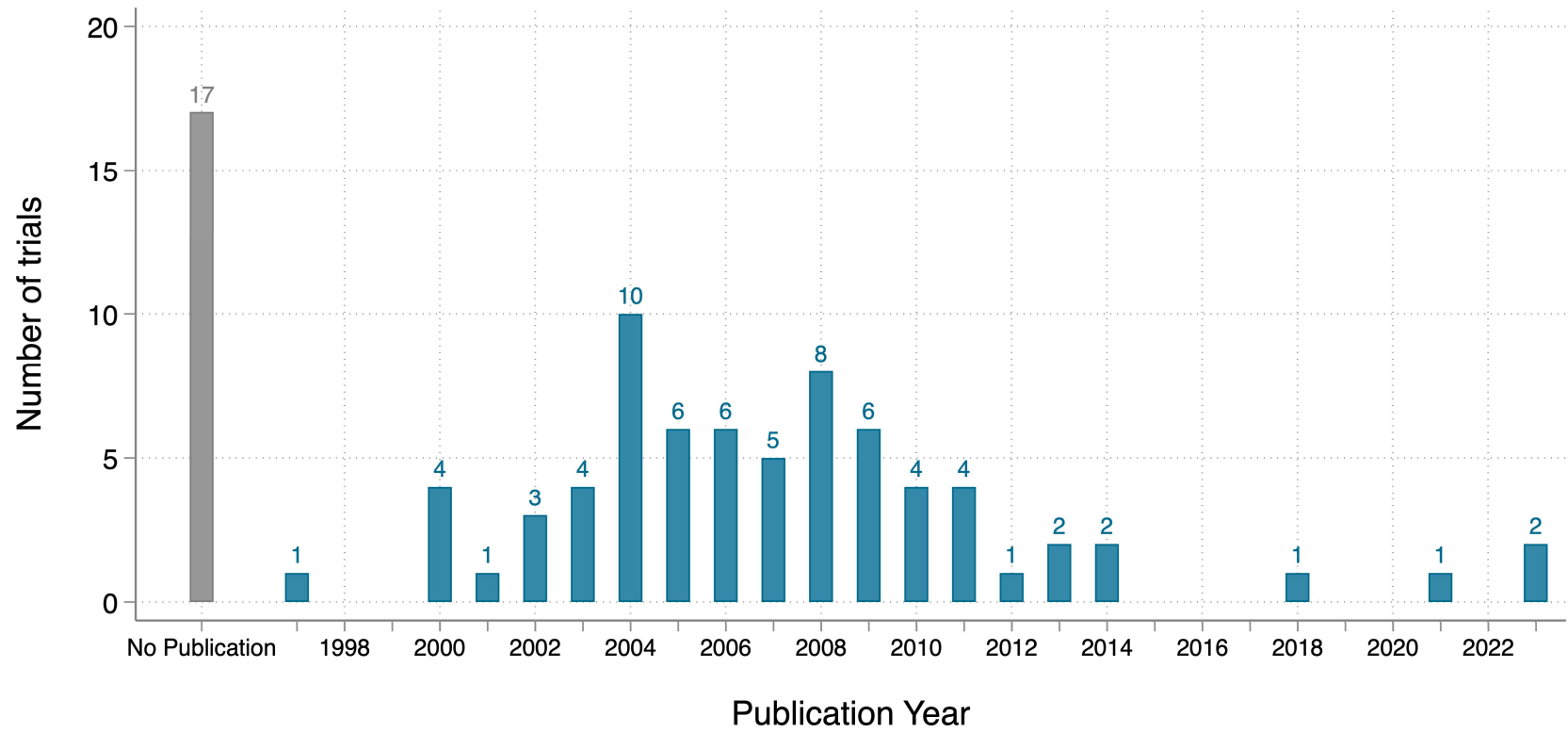
**Supplementary eTable 1.** Terminology Used for Racial and Ethnic Group Reporting Among All Published US-based Phase III Alzheimer's Disease Trials, 1997-2023

**eReferences**

**Supplementary eFigure 1. Study Sample Selection Process**



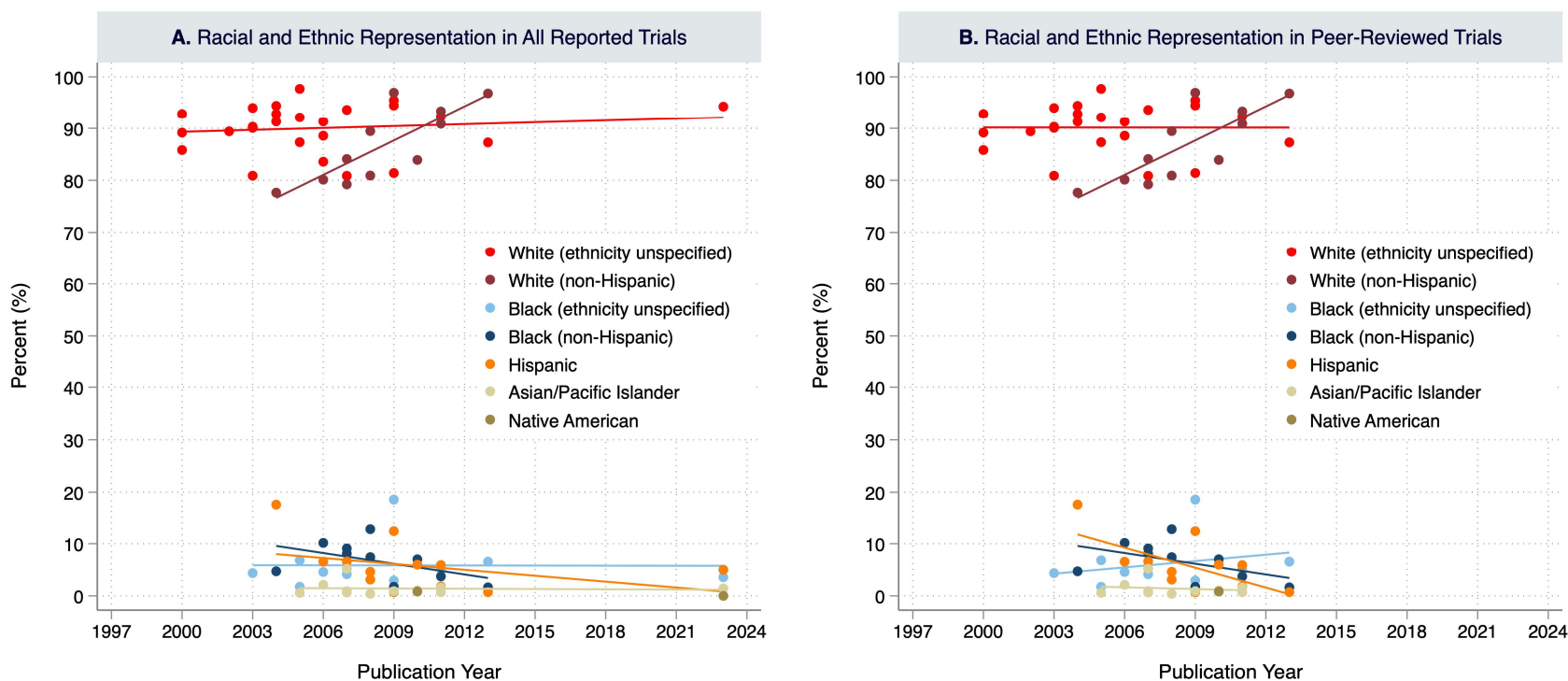
**Supplementary eFigure 2.** Number of US-based Phase III Alzheimer’s Disease Trials Over Publication Years, 1997-2023



Total # of Completed Phase III Trials in the US: 88 (Data Published: 71; Data Not Published: 17)

*Notes:* In the figure, the gray bar represents the number of trials with no publications, and the blue bars represent the number of trials published in each year.

**Supplementary eFigure 3.** Trends in Representation of All Reported Racial and Ethnic Groups Among US-based Phase III Alzheimer’s Disease Trials, 1997-2023



*Notes:* Panels A and B present the racial and ethnic representation among all published trials (Panel A) and peer-reviewed trials (Panel B). Each dotted points represent the percentage of patients of certain race and ethnicity in each clinical trial published with reported data on that race and ethnicity. Red dots represent the reported percentages of White (ethnicity unspecified) patients; dark red dots represent the reported percentages of White (non-Hispanic) patients; light blue dots represent the reported percentages of Black (ethnicity unspecified) patients; dark blue dots represent the reported percentages of Black (non-Hispanic) patients; orange dots represent the reported percentages of Hispanic patients; light green dots represent the reported percentages of Asian or Pacific Islander patients; and dark green dots represent the reported percentages of Native American patients. Linear time trends were fitted for each racial and ethnic groups with consistent colors as the dotted points. Linear trends for Native American patients were not fitted because only one clinical trial had reported data on the percentage of Native Americans.

**Supplementary eTable 1.** Terminology Used for Racial and Ethnic Group Reporting Among All Published US-based Phase III Alzheimer’s Disease Trials, 1997-2023

	No. of studies (%)	
	Trials with publications (n=71)	Trials with peer-reviewed publications (n=52)
<b>Terms used in racial and ethnic reporting</b>		
No Race/Ethnicity Reported	35 (49.3)	18 (34.6)
White	10 (14.1)	10 (19.2)
Caucasian	2 (2.8)	1 (1.9)
Minorities	1 (1.4)	1 (1.9)
White, Other	1 (1.4)	1 (1.9)
Caucasian, Hispanic/Latino	1 (1.4)	1 (1.9)
White, African American or Other	1 (1.4)	1 (1.9)
White, Black, Other	1 (1.4)	1 (1.9)
White, Hispanic, Black	1 (1.4)	1 (1.9)
Caucasian, Black, Asian	1 (1.4)	1 (1.9)
Caucasian, Black, Other	1 (1.4)	1 (1.9)
White/Caucasian, Black, Other	1 (1.4)	1 (1.9)
African American, Caucasian, Other	1 (1.4)	1 (1.9)
White, Black, Hispanic, Other	2 (2.8)	2 (2.8)
White, African-American, Hispanic, Other	1 (1.4)	1 (1.9)
White, Black, Asian/Pacific Islander, Hispanic/Latino	1 (1.4)	1 (1.9)

White, African-American, Asian/Pacific Islander, Other	1 (1.4)	1 (1.9)
White, Black/African American, Hispanic/Latino, Not Hispanic/Latino+	1 (1.4)	1 (1.9)
White, Black, Hispanic, Asian, Other	2 (2.8)	2 (3.8)
Unknown, Asian, Black, White, more than 1 race	1 (1.4)	1 (1.9)
Caucasian, African-American, Hispanic, Asian, Other	1 (1.4)	1 (1.9)
Caucasian, Hispanic, African American, Asian, Other	1 (1.4)	1 (1.9)
Caucasian (White), Non-Caucasian, Black, Asian, Other	1 (1.4)	1 (1.9)
African-American, Asian, White (non-Hispanic), White (Hispanic), Native American	1 (1.4)	1 (1.9)
American Indian or Alaska Native, Asian, Native Hawaiian or Other Pacific Islander, Black or African American, White, More than one race, Unknown or not reported, Hispanic	1 (1.4)	0 (0.0)

*Notes:* Terms are ordered by the number of racial and ethnic groups reported. All terminology shown reflects the exact wording used in the original publications.

## eReferences

1. Tariot PN, Solomon PR, Morris JC, et al. A 5-month, randomized, placebo-controlled trial of galantamine in AD. *Neurology*. 2000;54(12):2269-2276. doi:10.1212/WNL.54.12.2269
2. *A 12-Week, Open Label Trial of an Investigational Medication in the Treatment of Alzheimer's Disease*. TrialTrove (Trial Record with No Publication)
3. *A 20-Month, Placebo-Controlled Research Study Evaluating an Investigational Drug for Alzheimer's Disease*. TrialTrove (Trial Record with No Publication)
4. Reisberg B, Doody R, Stöffler A, Schmitt F, Ferris S, Möbius HJ. A 24-Week Open-Label Extension Study of Memantine in Moderate to Severe Alzheimer Disease. *Archives of Neurology*. 2006;63(1):49-54. doi:10.1001/archneur.63.1.49
5. van Dyck CH, Tariot PN, Meyers B, Malca Resnick E, for the Memantine MEM-MD-01 Study Group. A 24-week Randomized, Controlled Trial of Memantine in Patients With Moderate-to-severe Alzheimer Disease. *Alzheimer Disease & Associated Disorders*. 2007;21(2).  
[https://journals.lww.com/alzheimerjournal/fulltext/2007/04000/a\\_24\\_week\\_randomized\\_controlled\\_trial\\_of.12.aspx](https://journals.lww.com/alzheimerjournal/fulltext/2007/04000/a_24_week_randomized_controlled_trial_of.12.aspx)
6. Sano Mary, Ernesto Christopher, Thomas Ronald G., et al. A Controlled Trial of Selegiline, Alpha-Tocopherol, or Both as Treatment for Alzheimer's Disease. *New England Journal of Medicine*. 336(17):1216-1222. doi:10.1056/NEJM199704243361704
7. Conference Abstract. *A Head to Head Study of Donepezil, Rivastigmine, and Galantamine for the Treatment of Alzheimer's Disease*. Alzheimer's Association; 2004. Accessed December 29, 2025.  
<https://www.abstractsonline.com/viewer/viewAbstract.asp?CKey={3E7803E4-DCCE-4F90-B692-3551119FB711}&MKey={F38908E2-C78B-40E5-B4F4-9817BF853BD1}&AKey={50E1744A-0C52-45B2-BF85-2A798BF24E02}&SKey={BD4CCC85-1979-4B23-AE35-553338449AD1}>
8. Relkin NR, Reichman WE, Orazem J, McRae T. A Large, Community-Based, Open-Label Trial of Donepezil in the Treatment of Alzheimer's Disease. *Dementia and Geriatric Cognitive Disorders*. 2003;16(1):15-24. doi:10.1159/000069988
9. *A Long-Term Extension Study Evaluating the Safety and Tolerability of BID and QD Administration of Memantine in Patients with Mild to Moderate Dementia of the Alzheimer's Type- Phase C*. TrialTrove (Trial Record with No Publication)
10. *A Long-Term Extension Study Evaluating the Safety and Tolerability of BID and QD Administration of Memantine in Patients with Mild to Moderate Dementia of the Alzheimer's Type-Phase D*. TrialTrove (Trial Record with No Publication)
11. Forest Laboratories, Inc. *A Long-Term Extension Study Evaluating the Safety and Tolerability of Four Memantine Dosing Regimens in Patients With Moderate to Severe*

- Dementia of the Alzheimer's Type - Phase D*. Forest Laboratories, Inc.; 2006.
12. *A Long-Term Extension Study Evaluating the Safety and Tolerability of Four Memantine Dosing Regimens in Patients with Moderate to Severe Dementia of the Alzheimer's Type - Phases A and B*. TrialTrove (Trial Record with No Publication)
  13. *A Long-Term Extension Study Evaluating the Safety and Tolerability of Four Memantine Dosing Regimens in Patients with Moderate to Severe Dementia of the Alzheimer's Type-Phase C*. TrialTrove (Trial Record with No Publication)
  14. Sano M, Jacobs D, Andrews H, et al. A multi-center, randomized, double blind placebo-controlled trial of estrogens to prevent Alzheimer's disease and loss of memory in women: design and baseline characteristics. *Clinical Trials*. 2008;5(5):523-533. doi:10.1177/1740774508096313
  15. Singer C, Tractenberg RE, Kaye J, et al. A Multicenter, Placebo-controlled Trial of Melatonin for Sleep Disturbance in Alzheimer's Disease. *Sleep*. 2003;26(7):893-901. doi:10.1093/sleep/26.7.893
  16. *A Multicenter, Randomized, Double-Blind Placebo-Controlled, Flexible-Dose Study of Aripiprazole in the Treatment of Institutionalized Patients with Psychosis Associated with Dementia of the Alzheimer's Type (Extension Phase of Protocol CN138005)*. TrialTrove (Trial Record with No Publication)
  17. BioXcel Therapeutics Inc. *A Multicenter, Randomized, Double-Blind, Placebo-Controlled, Efficacy And Safety Study of PRN Dosing of BXCL501 Over A 12 Week Period In Subjects With Agitation Associated With Dementia*. clinicaltrials.gov; 2023. Accessed December 29, 2025. <https://clinicaltrials.gov/study/NCT05271552>
  18. Eli Lilly and Company. *A Phase 3, Open-Label, Parallel-Group, 2-Arm Study to Investigate Amyloid Plaque Clearance With Donanemab Compared With Aducanumab-Avwa in Patients With Early Symptomatic Alzheimer's Disease*. clinicaltrials.gov; 2024. Accessed December 29, 2025. <https://clinicaltrials.gov/study/NCT05108922>
  19. *A Phase III / Pivotal Study of Rivastigmine, TDS for Alzheimer*. TrialTrove (Trial Record with No Publication)
  20. *A Phase III Study of ABP-124 for Alzheimer's Disease*. TrialTrove (Trial Record with No Publication)
  21. Aisen PS, Davis KL, Berg JD, et al. A randomized controlled trial of prednisone in Alzheimer's disease. *Neurology*. 2000;54(3):588-588. doi:10.1212/WNL.54.3.588
  22. Dodge HH, Zitzelberger T, Oken BS, Howieson D, Kaye J. A randomized placebo-controlled trial of Ginkgo biloba for the prevention of cognitive decline. *Neurology*. 2008;70(19\_part\_2):1809-1817. doi:10.1212/01.wnl.0000303814.13509.db
  23. Forest Laboratories. *A Randomized, Double-Blind, Placebo-Controlled Evaluation of the*

*Safety and Efficacy of Memantine in Non-Institutionalized Agitated Patients With Moderate to Severe Alzheimer's Disease.* clinicaltrials.gov; 2012. Accessed December 29, 2025. <https://clinicaltrials.gov/study/NCT00097916>

24. *A Randomized, Double-Blind, Placebo-Controlled Evaluation of the Safety and Efficacy of Memantine In Patients with Mild to Moderate Dementia of the Alzheimer's Type, with A Long-Term, Open-Label Extension Study - Phase A.* TrialTrove (Trial Record with No Publication)
25. *A Randomized, Double-Blind, Placebo-Controlled Evaluation of the Safety and Efficacy of Memantine in Patients with Mild to Moderate Dementia of the Alzheimer's Type, with A Long-Term, Open-Label Extension Study - Phase B.* TrialTrove (Trial Record with No Publication)
26. Streim JE, Porsteinsson AP, Breder CD, et al. A Randomized, Double-Blind, Placebo-Controlled Study of Aripiprazole for the Treatment of Psychosis in Nursing Home Patients with Alzheimer Disease. *The American Journal of Geriatric Psychiatry.* 2008;16(7):537-550. doi:10.1097/JGP.0b013e318165db77
27. Tariot PN, Cummings JL, Katz IR, et al. A Randomized, Double-Blind, Placebo-Controlled Study of the Efficacy and Safety of Donepezil in Patients with Alzheimer's Disease in the Nursing Home Setting. *Journal of the American Geriatrics Society.* 2001;49(12):1590-1599. doi:10.1111/j.1532-5415.2001.49266.x
28. Rappaport SA, Marcus RN, Manos G, McQuade RD, Oren DA. A Randomized, Double-Blind, Placebo-Controlled Tolerability Study of Intramuscular Aripiprazole in Acutely Agitated Patients With Alzheimer's, Vascular, or Mixed Dementia. *Journal of the American Medical Directors Association.* 2009;10(1):21-27. doi:10.1016/j.jamda.2008.06.006
29. Frakey LL, Salloway S, Buelow M, Malloy P. A Randomized, Double-Blind, Placebo-Controlled Trial of Modafinil for the Treatment of Apathy in Individuals With Mild-to-Moderate Alzheimer's Disease. *J Clin Psychiatry.* 2012;73(06):796-801. doi:10.4088/JCP.10m06708
30. Zhu CW, Grossman H, Neugroschl J, et al. A randomized, double-blind, placebo-controlled trial of resveratrol with glucose and malate (RGM) to slow the progression of Alzheimer's disease: A pilot study. *Alzheimer's & Dementia: Translational Research & Clinical Interventions.* 2018;4(1):609-616. doi:10.1016/j.trci.2018.09.009
31. Sano M, Bell KL, Galasko D, et al. A randomized, double-blind, placebo-controlled trial of simvastatin to treat Alzheimer disease. *Neurology.* 2011;77(6):556-563. doi:10.1212/WNL.0b013e318228bf11
32. Lon S, Schneider, Steven T, DeKosky, Martin R, Farlow, Pierre N, Tariot, Robert Hoerr, Meinhard Kieser. A Randomized, Double-Blind, Placebo-Controlled Trial of Two Doses of Ginkgo Biloba Extract in Dementia of the Alzheimers Type. *Current Alzheimer Research.* 2005;2(5):541-551. doi:10.2174/156720505774932287

33. Thal LJ, Ferris SH, Kirby L, et al. A Randomized, Double-Blind, Study of Rofecoxib in Patients with Mild Cognitive Impairment. *Neuropsychopharmacology*. 2005;30(6):1204-1215. doi:10.1038/sj.npp.1300690
34. Forest Laboratories. *A Randomized, Double-Blind, Placebo-Controlled Evaluation of the Safety and Efficacy of Neramexane Monotherapy in Patients With Moderate to Severe Dementia of the Alzheimer's Type*. clinicaltrials.gov; 2012. Accessed December 29, 2025. <https://clinicaltrials.gov/study/NCT00090116>
35. *A Randomized, Parallel-Group Pilot Study to Evaluate the Brain Effects and Efficacy of Exelon Compared to Aricept in Patients with Alzheimer's Disease with an Optional 12 Month Adjunctive Namenda Extension*. TrialTrove (Trial Record with No Publication)
36. *A Randomized, Parallel-Group Study to Evaluate the Efficacy of Trileptal Compared to Risperdal in Patients with Alzheimer's Dementia*. TrialTrove (Trial Record with No Publication)
37. Farlow MR, Grossberg GT, Sadowsky CH, Meng X, Somogyi M. aA 24-Week, Randomized, Controlled Trial of Rivastigmine Patch 13.3 mg/24 h Versus 4.6 mg/24 h in Severe Alzheimer's Dementia. *CNS Neurosci Ther*. 2013;19(10):745-752. doi:10.1111/cns.12158
38. ADAPT Research Group. Alzheimer's Disease Anti-Inflammatory Prevention Trial: Design, methods, and baseline results. *Alzheimer's & Dementia*. 2009;5(2):93-104. doi:10.1016/j.jalz.2008.09.004
39. *An Evaluation of the Long-Term Safety and Efficacy of Neramexane in Patients with Moderate to Severe Dementia of the Alzheimer's Type*. TrialTrove (Trial Record with No Publication)
40. Conference Abstract. *An Open-Label Evaluation of the Safety of Memantine in Patients with Moderate-to-Severe Dementia of the Alzheimer's Type*. Annual American Academy of Neurology Meeting; 2010.
41. Rao V, Spiro JR, Rosenberg PB, Lee HB, Rosenblatt A, Lyketsos CG. An open-label study of escitalopram (Lexapro®) for the treatment of 'Depression of Alzheimer's disease' (dAD). *International Journal of Geriatric Psychiatry*. 2006;21(3):273-274. doi:10.1002/gps.1459
42. Small G. *Anti-Inflammation in AD: PET Imaging Supplement*. clinicaltrials.gov; 2020. Accessed December 29, 2025. <https://clinicaltrials.gov/study/NCT00065169>
43. Yurko-Mauro K, McCarthy D, Rom D, et al. Beneficial effects of docosahexaenoic acid on cognition in age-related cognitive decline. *Alzheimer's & Dementia*. 2010;6(6):456-464. doi:10.1016/j.jalz.2010.01.013
44. BioVie. BioVie Announces Completion of Last Patient Treatment Visit in Phase 3 Trial of NE3107 in Mild to Moderate Alzheimer's Disease - BioSpace. Accessed December 29, 2025. <https://www.biospace.com/biovie-announces-completion-of-last-patient-treatment->

visit-in-phase-3-trial-of-ne3107-in-mild-to-moderate-alzheimer-s-disease

45. Tariot PN, Schneider LS, Cummings J, et al. Chronic Divalproex Sodium to Attenuate Agitation and Clinical Progression of Alzheimer Disease. *Archives of General Psychiatry*. 2011;68(8):853-861. doi:10.1001/archgenpsychiatry.2011.72
46. Small GW, Siddarth P, Silverman DHS, et al. Cognitive and Cerebral Metabolic Effects of Celecoxib Versus Placebo in People With Age-Related Memory Loss: Randomized Controlled Study. *The American Journal of Geriatric Psychiatry*. 2008;16(12):999-1009. doi:10.1097/JGP.0b013e31818cd3a4
47. Pollock Bruce G., Mulsant Benoit H., Rosen Jules, et al. Comparison of Citalopram, Perphenazine, and Placebo for the Acute Treatment of Psychosis and Behavioral Disturbances in Hospitalized, Demented Patients. *American Journal of Psychiatry*. 2002;159:460-465. doi:10.1176/appi.ajp.159.3.460
48. Mulsant BH, Gharabawi GM, Bossie CA, et al. Correlates of Anticholinergic Activity in Patients With Dementia and Psychosis Treated With Risperidone or Olanzapine. *J Clin Psychiatry*. 2004;65(12):1708-1714. doi:10.4088/JCP.v65n1217
49. Tariot PN, Raman R, Jakimovich L, et al. Divalproex Sodium in Nursing Home Residents With Possible or Probable Alzheimer Disease Complicated by Agitation: A Randomized, Controlled Trial. *The American Journal of Geriatric Psychiatry*. 2005;13(11):942-949. doi:10.1097/00019442-200511000-00004
50. Quinn JF, Raman R, Thomas RG, et al. Docosahexaenoic Acid Supplementation and Cognitive Decline in Alzheimer Disease: A Randomized Trial. *JAMA*. 2010;304(17):1903-1911. doi:10.1001/jama.2010.1510
51. *Double-Blind, Placebo-Controlled Evaluation of the Safety and Efficacy of Neramexane in Patients with Moderate to Severe Dementia of the Alzheimer's Disease*. TrialTrove (Trial Record with No Publication)
52. Green RC, Schneider LS, Amato DA, et al. Effect of Tarenflurbil on Cognitive Decline and Activities of Daily Living in Patients With Mild Alzheimer Disease: A Randomized Controlled Trial. *JAMA*. 2009;302(23):2557-2564. doi:10.1001/jama.2009.1866
53. M. Gaudig, U. Richarz, J. Han, B. Van Baelen, B. Schauble. Effects of Galantamine in Alzheimers Disease: Double-blind Withdrawal Studies Evaluating Sustained Versus Interrupted Treatment. *Current Alzheimer Research*. 2011;8(7):771-780. doi:10.2174/156720511797633205
54. Seltzer B, Zolnoui P, Nunez M, et al. Efficacy of Donepezil in Early-Stage Alzheimer Disease: A Randomized Placebo-Controlled Trial. *Archives of Neurology*. 2004;61(12):1852-1856. doi:10.1001/archneur.61.12.1852
55. Salloway S, Ferris S, Kluger A, et al. Efficacy of donepezil in mild cognitive impairment. *Neurology*. 2004;63(4):651-657. doi:10.1212/01.WNL.0000134664.80320.92

56. Mulnard RA, Cotman CW, Kawas C, et al. Estrogen Replacement Therapy for Treatment of Mild to Moderate Alzheimer Disease: A Randomized Controlled Trial. *JAMA*. 2000;283(8):1007-1015. doi:10.1001/jama.283.8.1007
57. Alzheimer's Association. *Galantamine in the Treatment of Moderate to Advanced Alzheimer's Disease: Clinical and Pharmacoeconomic Outcomes in the Assisted Living Environment*. Alzheimer's Association Accessed December 29, 2025. <http://www.abstractsonline.com/viewer/viewAbstract.asp?CKey={8A34B71C-6048-46DE-AA34-94962AC33502}&MKey={F38908E2-C78B-40E5-B4F4-9817BF853BD1}&AKey={50E1744A-0C52-45B2-BF85-2A798BF24E02}&SKey={BD4CCC85-1979-4B23-AE35-553338449AD1}>
58. Snitz BE, O'Meara ES, Carlson MC, et al. Ginkgo biloba for Preventing Cognitive Decline in Older Adults: A Randomized Trial. *JAMA*. 2009;302(24):2663-2670. doi:10.1001/jama.2009.1913
59. Carlson MC, Tschanz JT, Norton MC, Welsh-Bohmer K, Martin BK, Breitner JCS. H2 Histamine Receptor Blockade in the Treatment of Alzheimer Disease: A Randomized, Double-Blind, Placebo-Controlled Trial of Nizatidine. *Alzheimer Disease & Associated Disorders*. 2002;16(1). [https://journals.lww.com/alzheimerjournal/fulltext/2002/01000/h2\\_histamine\\_receptor\\_blockade\\_in\\_the\\_treatment\\_of.4.aspx](https://journals.lww.com/alzheimerjournal/fulltext/2002/01000/h2_histamine_receptor_blockade_in_the_treatment_of.4.aspx)
60. Aisen PS, Schneider LS, Sano M, et al. High-Dose B Vitamin Supplementation and Cognitive Decline in Alzheimer Disease: A Randomized Controlled Trial. *JAMA*. 2008;300(15):1774-1783. doi:10.1001/jama.300.15.1774
61. Thal LJ, Grundman M, Berg J, et al. Idebenone treatment fails to slow cognitive decline in Alzheimer's disease. *Neurology*. 2003;61(11):1498-1502. doi:10.1212/01.WNL.0000096376.03678.C1
62. Edwards K, Koumaras B, Chen M, Gunay I, Mirski D, Rivastigmine Nursing Home Study Team. Long-Term Effects of Rivastigmine Treatment on the Need for Psychotropic Medications in Nursing Home Patients with Alzheimer's Disease. *Clinical Drug Investigation*. 2005;25(8):507-515. doi:10.2165/00044011-200525080-00003
63. Aupperle P, Tariot P, Safirstein B, Graham SM, Lee G, Tocco M. Long-term safety and efficacy of memantine treatment in moderate to severe Alzheimer's disease: Results from a three-year trial. *Journal of the American Medical Directors Association*. 2007;8(3):B9. doi:10.1016/j.jamda.2007.01.050
64. Haley AP. *Mechanisms of Insulin Facilitation of Memory*. clinicaltrials.gov; 2014. Accessed December 29, 2025. <https://clinicaltrials.gov/study/NCT01145482>
65. Reisberg Barry, Doody Rachelle, Stöffler Albrecht, Schmitt Frederick, Ferris Steven, Möbius Hans Jörg. Memantine in Moderate-to-Severe Alzheimer's Disease. *New England Journal of Medicine*. 348(14):1333-1341. doi:10.1056/NEJMoa013128

66. Peskind ER, Potkin SG, Pomara N, et al. Memantine Treatment in Mild to Moderate Alzheimer Disease: A 24-Week Randomized, Controlled Trial. *The American Journal of Geriatric Psychiatry*. 2006;14(8):704-715. doi:10.1097/01.JGP.0000224350.82719.83
67. Anton P, Porsteinsson, George T, Grossberg, Jacobo Mintzer, Jason T. Olin. Memantine Treatment in Patients with Mild to Moderate Alzheimers Disease Already Receiving a Cholinesterase Inhibitor: A Randomized, Double-Blind, Placebo-Controlled Trial. *Current Alzheimer Research*. 2008;5(1):83-89. doi:10.2174/156720508783884576
68. Tariot PN, Farlow MR, Grossberg GT, et al. Memantine Treatment in Patients With Moderate to Severe Alzheimer Disease Already Receiving Donepezil A Randomized Controlled Trial. *JAMA*. 2004;291(3):317-324. doi:10.1001/jama.291.3.317
69. Scharre DW, Shiovitz T, Zhu Y, Amatniek J. One-week dose titration of extended release galantamine in patients with Alzheimer's disease. *Alzheimer's & Dementia*. 2008;4(1):30-37. doi:10.1016/j.jalz.2007.10.013
70. *Open Label Study Assessing the Safety and Efficacy of Combined Donepezil Plus Quetiapine in the Treatment of Agitated Demented Nursing Home Patients*. TrialTrove (Trial Record with No Publication)
71. Ott BR, Blake LM, Kagan E, Resnick M, for the Memantine MEM-MD-11AB Study Group. Open label, multicenter, 28-week extension study of the safety and tolerability of memantine in patients with mild to moderate Alzheimer's disease. *Journal of Neurology*. 2007;254(3):351-358. doi:10.1007/s00415-006-0374-x
72. Doody RS, Geldmacher DS, Gordon B, Perdomo CA, Pratt RD, for the Donepezil Study Group. Open-Label, Multicenter, Phase 3 Extension Study of the Safety and Efficacy of Donepezil in Patients With Alzheimer Disease. *Archives of Neurology*. 2001;58(3):427-433. doi:10.1001/archneur.58.3.427
73. Shua-Haim JR, Yap C, Kretov A, Lee P. P2-408: Results of next day crossover study of donepezil (Aricept) to rivastigmine patch (Exelon Patch) in Alzheimer's disease patients: A two-month clinical experience. *Alzheimer's & Dementia*. 2008;4(4S\_Part\_15):T493-T493. doi:10.1016/j.jalz.2008.05.1487
74. Shua-Haim JR, Yap C, Kretov A, Lee P, Patel S. P2-410: Results of next day crossover study of galantamine ER (Razadyne ER) to rivastigmine patch (Exelon Patch) in Alzheimer's disease patients: A two-month clinical experience. *Alzheimer's & Dementia*. 2008;4(4S\_Part\_15):T493-T494. doi:10.1016/j.jalz.2008.05.1489
75. Shankle WR, Hara J. P3-297: Longitudinal measure of IVIG treatment effect in patients with Alzheimer's and Lewy Body disease. *Alzheimer's & Dementia*. 2009;5(4S\_Part\_14):P430-P430. doi:10.1016/j.jalz.2009.04.968
76. Perhach J, Graham S. P4-454: A long-term, open-label extension study evaluating the safety of extended-release memantine (28 mg) in patients with moderate to severe Alzheimer's disease. *Alzheimer's & Dementia*. 2011;7(4S\_Part\_25):e70-e70.

doi:10.1016/j.jalz.2011.09.149

77. *Phase III Study of Citicoline for Alzheimer's Disease*. TrialTrove (Trial Record with No Publication)
78. Johnson & Johnson Pharmaceutical Research & Development, L.L.C. *Placebo-Controlled Evaluation of Galantamine in the Treatment of Alzheimer's Disease: A Cardiac Safety Study*. clinicaltrials.gov; 2011. Accessed December 29, 2025. <https://clinicaltrials.gov/study/NCT00309725>
79. Zhong KX, Tariot PN, Mintzer J, Minkwitz MC, Devine NA. Quetiapine to Treat Agitation in Dementia: A Randomized, Double-Blind, Placebo-Controlled Study. *Current Alzheimer Research*. 2007;4(1):81-93. doi:10.2174/156720507779939805
80. Aisen PS, Schmeidler J, Pasinetti GM. Randomized pilot study of nimesulide treatment in Alzheimer's disease. *Neurology*. 2002;58(7):1050-1054. doi:10.1212/WNL.58.7.1050
81. Cummings Jeffrey L., Schneider Lon, Tariot Pierre N., Kershaw Paul R., Yuan Weiyong. Reduction of Behavioral Disturbances and Caregiver Distress by Galantamine in Patients With Alzheimer's Disease. *American Journal of Psychiatry*. 2004;161:532-538. doi:10.1176/appi.ajp.161.3.532
82. The Alzheimer's Disease Anti-inflammatory Prevention Trial Research Group. Results of a follow-up study to the randomized Alzheimer's Disease Anti-inflammatory Prevention Trial (ADAPT). *Alzheimer's & Dementia*. 2013;9(6):714-723. doi:10.1016/j.jalz.2012.11.012
83. Mintzer J, Greenspan A, Caers I, et al. Risperidone in the Treatment of Psychosis of Alzheimer Disease: Results From a Prospective Clinical Trial. *The American Journal of Geriatric Psychiatry*. 2006;14(3):280-291. doi:10.1097/01.JGP.0000194643.63245.8c
84. Reines SA, Block GA, Morris JC, et al. Rofecoxib: No effect on Alzheimer's disease in a 1-year, randomized, blinded, controlled study. *Neurology*. 2004;62(1):66-71. doi:10.1212/WNL.62.1.66
85. Conference Abstract. *Safety, Tolerability, and Caregiver's Impressions of Combination Therapy with Galantamine and Memantine for the Treatment of Alzheimer's Disease*. Alzheimer's Association; 2004. Accessed December 29, 2025. <https://www.abstractsonline.com/viewer/viewAbstract.asp?CKey={B7A0303E-9EBF-40EE-AAD0-58297117B183}&MKey={F38908E2-C78B-40E5-B4F4-9817BF853BD1}&AKey={50E1744A-0C52-45B2-BF85-2A798BF24E02}&SKey={BD4CCC85-1979-4B23-AE35-553338449AD1}27>
86. Cherrier MM, Anderson K, Shofer J, Millard S, Matsumoto AM. Testosterone Treatment of Men With Mild Cognitive Impairment and Low Testosterone Levels. *Am J Alzheimers Dis Other Demen*. 2015;30(4):421-430. doi:10.1177/1533317514556874
87. Yesavage JA. *The Effect of Memantine on Brain Structure and Chemistry in Alzheimer's Disease Patients: A Randomized, Placebo-Controlled, 52-Week Clinical Trial*.

clinicaltrials.gov; 2017. Accessed December 29, 2025.  
<https://clinicaltrials.gov/study/NCT00255086>

88. Teri L, Logsdon RG, Peskind E, et al. Treatment of agitation in AD. *Neurology*. 2000;55(9):1271-1278. doi:10.1212/WNL.55.9.1271