Where Adults with Alzheimer’s Die

Insights from the CDC-WONDER Database

Ali Salman

## Preamble:

* **Rationale**: Alzheimer’s disease is a leading cause of death among older adults in the United States, with substantial implications for end-of-life care delivery. Despite growing recognition of the importance of supportive and palliative services for individuals with dementia, limited research has examined where these patients die, particularly across sociodemographic and geographic subgroups. Understanding disparities in place of death—whether in hospitals, at home, or in hospice or nursing facilities—is critical to informing health system strategies and improving the quality of dying for individuals with Alzheimer’s. This study addresses a critical knowledge gap by analyzing recent mortality data to explore how age, sex, race, ethnicity, and urbanization are associated with the location of death in this vulnerable population. The findings aim to support more equitable, person-centered, and policy-relevant approaches to end-of-life care for people living with Alzheimer’s disease.
* **Reference Papers:**
  + [Ali et al., 2025](https://doi.org/10.1161/circheartfailure.124.012447)
* **Study Objective**: To assess sociodemographic patterns in place of death among U.S. adults aged 55 years and older with Alzheimer’s disease (ICD-10: G30), focusing on how age group, sex, race, Hispanic origin, and urbanization level influence the likelihood of dying at home, in a hospital (inpatient or outpatient), or in a hospice/nursing facility.
* **Data Source**: CDC WONDER Multiple Cause of Death database (1999 to 2023), using publicly available death certificate records. This dataset includes individual-level demographic characteristics, cause of death codes, and place of death, enabling detailed examination of mortality trends and patterns.
* **Patient Selection**: Included all decedents aged ≥55 years with Alzheimer’s disease (ICD-10: G30) listed as an underlying or contributing cause of death in the multiple cause-of-death fields. Age groups under 55 were excluded to align with the typical epidemiology of Alzheimer’s and to reduce sparse data issues.
* **Outcome of Interest:** Place of death, categorized into four mutually exclusive settings:
  1. Hospice or Nursing Facility (reference category)
  2. Decedent’s home
  3. Medical Facility - Inpatient
  4. Medical Facility - Outpatient or ER
  + The following categories were excluded due to small counts or ambiguous classification: “Dead on Arrival,” “Status unknown,” “Other,” and “Place of death unknown.”
* **Statistical Analysis**:
  + **Descriptive Analysis:** Summarized demographic characteristics across place of death using frequency distributions and compared using Pearson’s chi-square tests.
  + **Multinomial Logistic Regression:**
    - **Dependent Variable**: Place of death (4 categories; reference = Hospice or Nursing Facility).
    - **Independent Variables**: Five-year age group (55–69, 70–84, 85+), sex (Female = reference), race (White = reference), Hispanic origin (Non-Hispanic = reference), and urbanization level (Large Metro = reference).
    - **Model Reporting:** Relative odds (exponentiated coefficients) were reported with 95% confidence intervals. Statistical significance was assessed at a threshold of P<0.05.
  + **Reporting:** Results expressed as odds ratios (ORs) with 95% confidence intervals (CIs). Statistical significance set at P<0.05.
* **Software:** All statistical analyses were performed using the R Statistical Language (Version 4.5.0; R Foundation for Statistical Computing, Vienna, Austria). Joinpoint Regression was performed using the NCI Joinpoint Regression Program (Version 5.4.0).

## Baseline table:

| **Characteristic** | **Overall** N = 2,721,714 | **Hospice or Nursing Facility** N = 1712633 (63%) | **Decedent's home** N = 684831 (25%) | **Medical Facility - Inpatient** N = 278170 (10%) | **Medical Facility - Outpatient or ER** N = 46080 (1.7%) | **p-value***1* |
| --- | --- | --- | --- | --- | --- | --- |
| Age (years), n (%) |  |  |  |  |  | <0.001 |
| 85+ | 1,707,986 (63) | 1,121,849 (66) | 408,420 (60) | 153,759 (55) | 23,958 (52) |  |
| 70-84 | 942,558 (35) | 551,808 (32) | 254,400 (37) | 115,877 (42) | 20,473 (44) |  |
| 55-69 | 71,170 (2.6) | 38,976 (2.3) | 22,011 (3.2) | 8,534 (3.1) | 1,649 (3.6) |  |
| Sex, n (%) |  |  |  |  |  | <0.001 |
| Female | 1,858,831 (68) | 1,207,218 (70) | 460,782 (67) | 160,830 (58) | 30,001 (65) |  |
| Male | 862,883 (32) | 505,415 (30) | 224,049 (33) | 117,340 (42) | 16,079 (35) |  |
| Race, n (%) |  |  |  |  |  | <0.001 |
| White | 2,468,954 (91) | 1,598,696 (93) | 593,736 (87) | 240,563 (86) | 35,959 (78) |  |
| Asian or Pacific Islander | 47,597 (1.7) | 19,795 (1.2) | 19,152 (2.8) | 7,371 (2.6) | 1,279 (2.8) |  |
| Black | 197,903 (7.3) | 90,205 (5.3) | 69,448 (10) | 29,443 (11) | 8,807 (19) |  |
| Other | 7,260 (0.3) | 3,937 (0.2) | 2,495 (0.4) | 793 (0.3) | 35 (<0.1) |  |
| Hispanic origin, n (%) |  |  |  |  |  | <0.001 |
| Non-Hispanic | 2,582,786 (95) | 1,657,641 (97) | 623,853 (91) | 258,550 (93) | 42,742 (93) |  |
| Hispanic | 138,928 (5.1) | 54,992 (3.2) | 60,978 (8.9) | 19,620 (7.1) | 3,338 (7.2) |  |
| Urbanization, n (%) |  |  |  |  |  | <0.001 |
| Large Metro | 1,246,785 (46) | 736,701 (43) | 348,986 (51) | 137,067 (49) | 24,031 (52) |  |
| Medium/Small Metro | 926,284 (34) | 607,703 (35) | 224,557 (33) | 80,548 (29) | 13,476 (29) |  |
| Rural | 548,645 (20) | 368,229 (22) | 111,288 (16) | 60,555 (22) | 8,573 (19) |  |
| *1*Pearson's Chi-squared test | | | | | | |

## Multinomial logistic regression:

# weights: 44 (30 variable)  
initial value 3773096.770938   
iter 10 value 2700658.069191  
iter 20 value 2698919.702349  
iter 30 value 2536179.382361  
iter 40 value 2499649.167908  
final value 2499646.786189   
converged

| **Characteristic** | **OR** **(95% CI)** | **p-value** |
| --- | --- | --- |
| Decedent's home | | |
| Age (years) |  |  |
| 85+ | — |  |
| 70-84 | 1.25 (1.25 to 1.26) | <0.001 |
| 55-69 | 1.49 (1.46 to 1.51) | <0.001 |
| Sex |  |  |
| Female | — |  |
| Male | 1.13 (1.13 to 1.14) | <0.001 |
| Race |  |  |
| White | — |  |
| Asian or Pacific Islander | 2.63 (2.57 to 2.68) | <0.001 |
| Black | 2.11 (2.09 to 2.14) | <0.001 |
| Other | 1.89 (1.80 to 1.99) | <0.001 |
| Hispanic origin |  |  |
| Non-Hispanic | — |  |
| Hispanic | 3.00 (2.97 to 3.04) | <0.001 |
| Urbanization |  |  |
| Large Metro | — |  |
| Medium/Small Metro | 0.84 (0.83 to 0.84) | <0.001 |
| Rural | 0.71 (0.71 to 0.72) | <0.001 |
| Medical Facility - Inpatient | | |
| Age (years) |  |  |
| 85+ | — |  |
| 70-84 | 1.44 (1.43 to 1.45) | <0.001 |
| 55-69 | 1.42 (1.39 to 1.46) | <0.001 |
| Sex |  |  |
| Female | — |  |
| Male | 1.68 (1.66 to 1.69) | <0.001 |
| Race |  |  |
| White | — |  |
| Asian or Pacific Islander | 2.58 (2.51 to 2.65) | <0.001 |
| Black | 2.22 (2.19 to 2.25) | <0.001 |
| Other | 1.37 (1.27 to 1.48) | <0.001 |
| Hispanic origin |  |  |
| Non-Hispanic | — |  |
| Hispanic | 2.42 (2.38 to 2.47) | <0.001 |
| Urbanization |  |  |
| Large Metro | — |  |
| Medium/Small Metro | 0.75 (0.75 to 0.76) | <0.001 |
| Rural | 0.97 (0.96 to 0.98) | <0.001 |
| Medical Facility - Outpatient or ER | | |
| Age (years) |  |  |
| 85+ | — |  |
| 70-84 | 1.67 (1.64 to 1.71) | <0.001 |
| 55-69 | 1.81 (1.72 to 1.90) | <0.001 |
| Sex |  |  |
| Female | — |  |
| Male | 1.22 (1.20 to 1.24) | <0.001 |
| Race |  |  |
| White | — |  |
| Asian or Pacific Islander | 2.98 (2.81 to 3.16) | <0.001 |
| Black | 4.34 (4.24 to 4.45) | <0.001 |
| Other | 0.41 (0.29 to 0.57) | <0.001 |
| Hispanic origin |  |  |
| Non-Hispanic | — |  |
| Hispanic | 2.70 (2.60 to 2.80) | <0.001 |
| Urbanization |  |  |
| Large Metro | — |  |
| Medium/Small Metro | 0.75 (0.74 to 0.77) | <0.001 |
| Rural | 0.83 (0.81 to 0.85) | <0.001 |
| Abbreviations: CI = Confidence Interval, OR = Odds Ratio | | |