

Examining Associations Between Social Vulnerability and Alzheimer's Disease and Related Dementias in South Carolina

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BACKGROUND

- Dementia is a syndrome** marked by **severe cognitive decline** affecting daily functioning. **Alzheimer's disease causes 60–80% of cases**; risk factors include age, genetics, and family history. There is **no cure**, but available **treatments can slow progression**.²
- South Carolina burden (SC)**: There were **333,769 cases** and a **40.9 mortality rate** in 2021 (**#9 U.S.**). In 2018, **African Americans were 34% more likely** to be diagnosed than others. Medicaid expenses reached **\$652 million** in 2020, increasing by 25% in 2024. SC is projected to be the **third-largest neurology desert** by 2025.³
- Social vulnerability** refers to a community's susceptibility to the adverse impacts of **external health stressors**.¹
- The **study objective** was to improve understanding of Alzheimer's Disease and Related Dementias (**ADRD**) **risk** and its **relationship to neighborhood social vulnerability**. A **sub-aim** was to **identify pockets of outreach gaps** within the SC **Alzheimer's Association** service network.

METHODS

- County-level data (**n= 46 counties**) on **dementia diagnoses** collected by the state **registry** were requested and pulled for calendar years (**CY**) **2019** and **2021**. **County fact sheets** from **2017** were also utilized.
- Social Vulnerability Index (**SVI**) data obtained from the **ATSDR/CDC** database were matched to each corresponding year of observed ADRD cases.
- Case frequencies** were calculated, and **age-adjusted prevalence rates** were computed for adults aged **65 and older**.⁴
- Standardized morbidity ratios (**SMRs**) were calculated to compare **observed** and **expected** counts. SMRs reflect whether a county's population is **more or less likely to have ADRD** than the state reference population.
- To assess associations, **linear regression** models were fitted using the following statistical formula: $Y = B_0 + B_1X_1 + \epsilon$
 $Y = \text{SMR}; B_0 = \text{Intercept}; B_1 = \text{Slope}; X_1 = \text{SVI}$
- Outreach distribution** was evaluated using chapter reports for Fiscal Year (**FY**) **2023** (July 1, 2022–June 30, 2023).

RESULTS

- Age was revealed to be a confounding factor, so it was controlled for by computing age-adjusted rates.
- A **SMR >1** indicates **more ADRD cases than expected**, a SMR of 1 indicates **no difference**, and a SMR <1 indicates **less cases** than expected for that population. In effect, the SMR conveys **relative risk**.
- In **2017**: 29/46 (**63%**) of the counties in SC had an age-adjusted **SMR >1**. In **2019** and **2021**: 31/46 (**67.39%**).
- Highest SMR** in 2021: Lee (1.78) **Lowest**: Berkley (0.48).

Table 1a. Regression parameters, beta estimates, standard errors, 95% confidence intervals, and p-values (5% significance level) with age-adjusted SMR as the main outcome and racial & ethnic minority status SVI as the main effect.

Parameter	Estimate	Standard Error	95% CIs	P-value
Intercept	0.905	0.084	[0.736, 1.073]	<.0001
Minority Status SVI	0.515	0.144	[0.225, 0.806]	0.0009

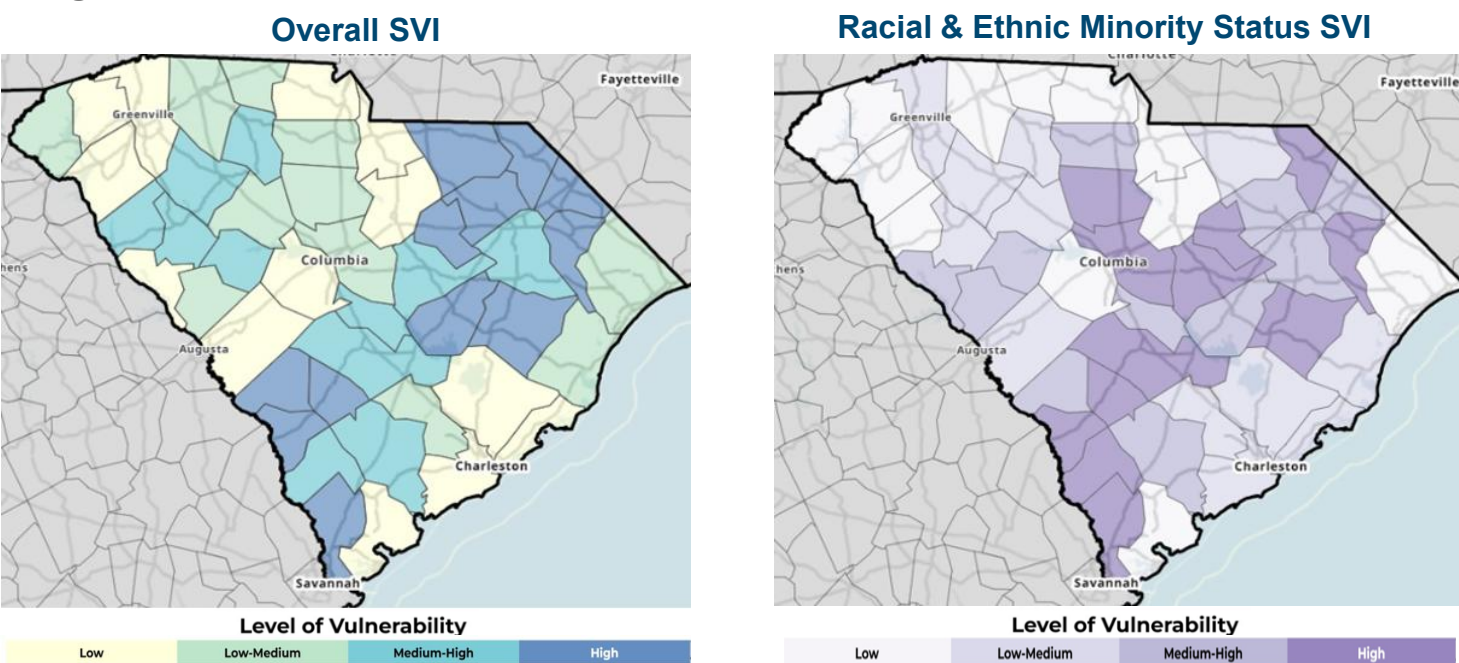
For every 1-unit increase in minority SVI, SMR increased by 0.515. When minority SVI was zero, SMR was 0.905.

Table 1b. Same as above, except looking at influence of Overall SVI on age-adjusted SMR.

Parameter	Estimate	Standard Error	95% CIs	P-value
Intercept	0.867	0.080	[0.706, 1.028]	<.0001
Overall SVI	0.590	0.138	[0.313, 0.868]	<.0001

For every 1-unit increase in overall SVI, SMR increased by 0.590. When overall SVI was zero, SMR was 0.867.

Figure 1. SVI Distribution in South Carolina, 2020.



- The percentile ranking values range from **0 to 1**, with higher values indicating greater vulnerability.¹

Figure 2. Age-adjusted SMRs showing observed-to-expected ADRD case differences across South Carolina counties, 2021.

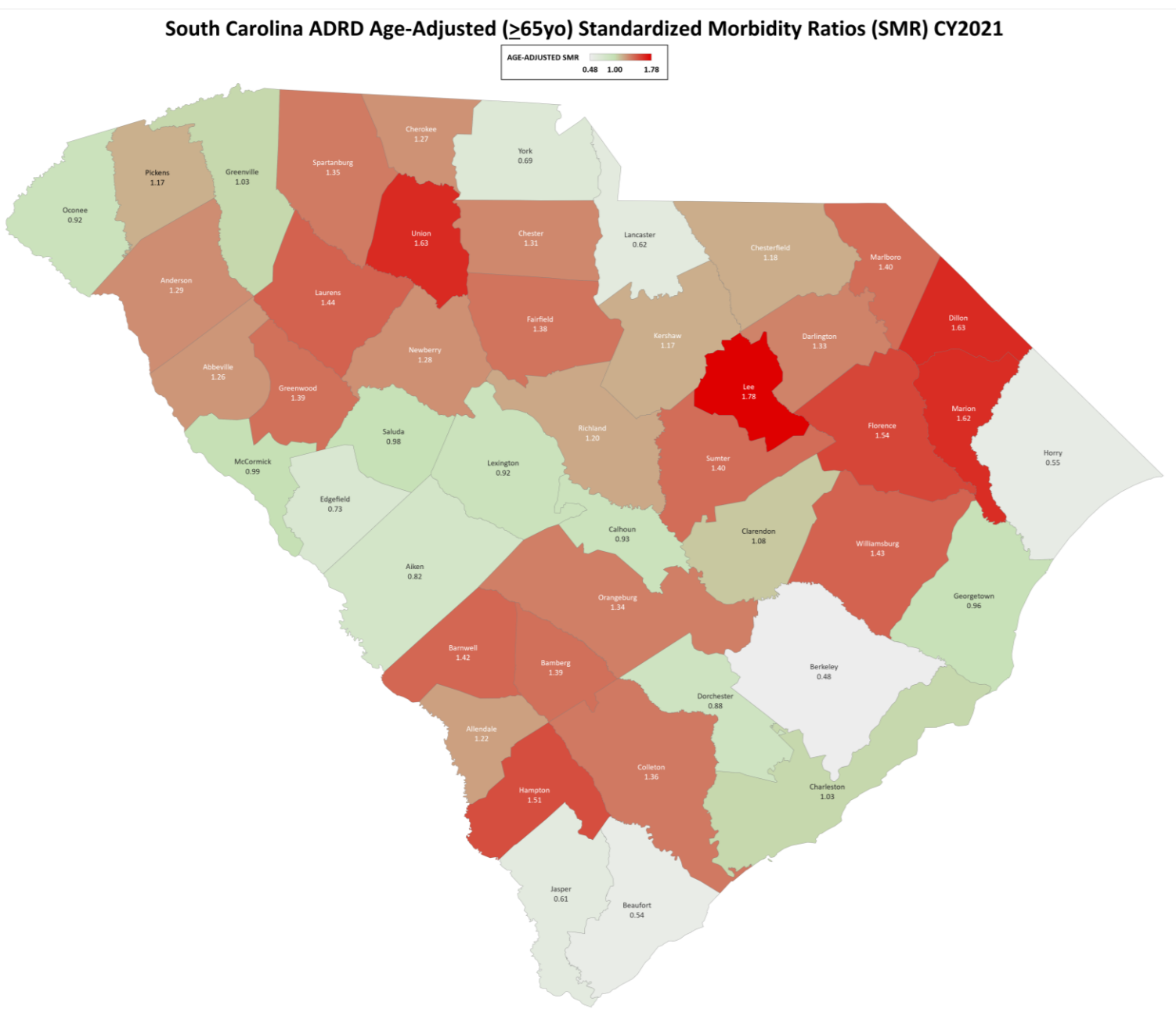
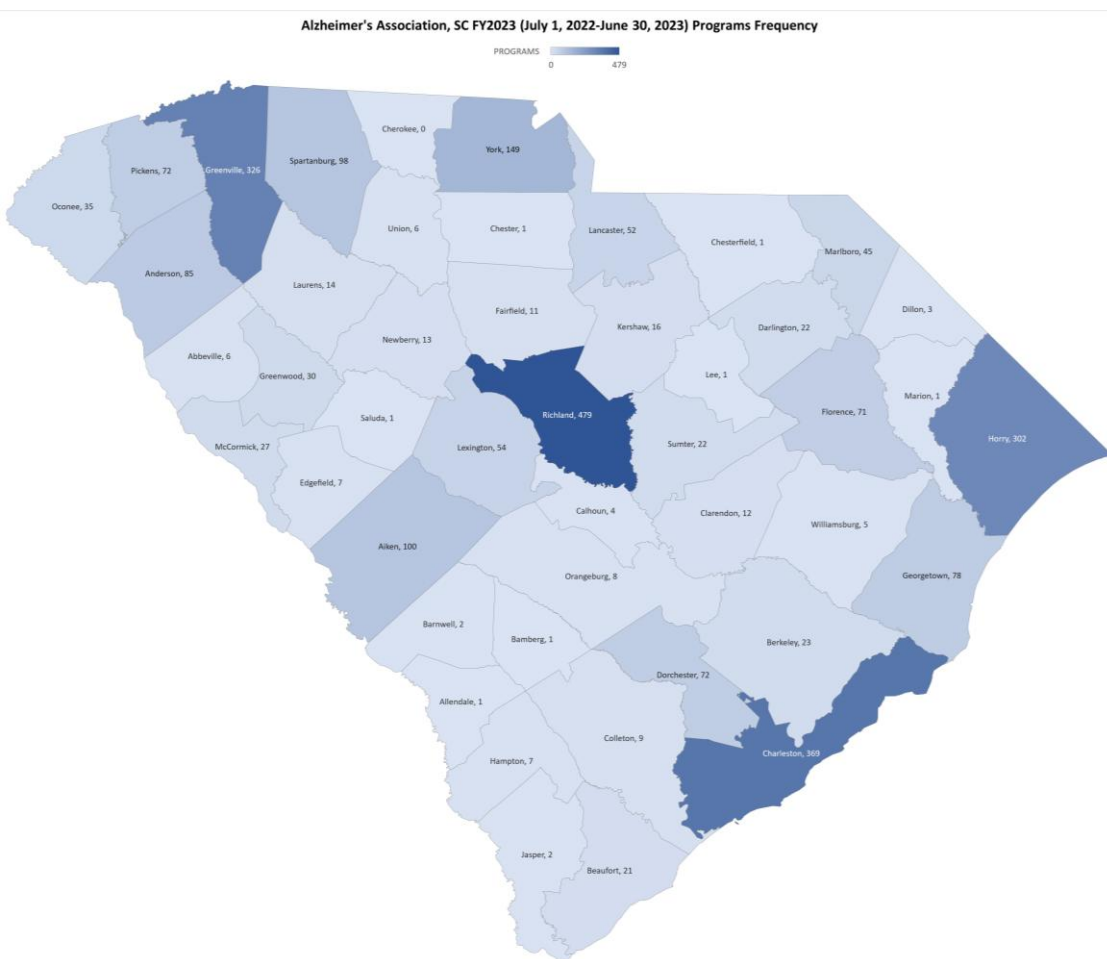


Figure 3. SC Alzheimer's Association program reach (community education workshops, early-stage social engagement, and support groups), FY2023 (right).



CONCLUSIONS

- Social vulnerability was significantly associated with ADRD risk** across both models.
- SMRs were concentrated along the I-95 corridor** and in the **northeast**, regions that are highly rural, economically disadvantaged, and racially and ethnically diverse.
- County-level SMR variation** closely aligned with neighborhood-level SVI, especially racial and ethnic minority status.
- Higher SVI corresponded with higher SMRs**, indicating disproportionate ADRD burden in structurally disadvantaged communities.
- Alzheimer's Association outreach should expand into high-SVI counties**, particularly where reach was lowest.
- The **SC Department on Aging's 2023 plan** should prioritize high-risk, rural counties with vulnerable and marginalized populations.
- Females accounted for 62% of ADRD cases**, highlighting intersectional risks spanning sex and race.

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