

# Systolic Blood Pressure Modifies Associations Between ADRD Biomarkers and Cognitive-Functional Impairment: Differential Race Effects

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## BACKGROUND

- Elevated systolic blood pressure (SBP) has been well-established as a contributor to increased risk of cognitive decline and Alzheimer's disease and related dementias (ADRD).
- Racial patterning in vascular burden and ADRD risk may shape cognitive and functional outcomes across Black and White racial groups, even when underlying pathology is similar.
- Though plasma biomarkers of neurodegeneration and Alzheimer's pathology have been increasingly used to index disease risk and severity, their associations with cognitive and functional presentation may be dependent on vascular context.
- This study examines whether SBP and race modifies the relationship between plasma biomarkers and cognitive-functional impairment among older adults.

## METHODS

### Participants

- 499 participants from the 1Florida Alzheimer's Disease Research Center

Table 1. Descriptive Statistics

| Variable                               | Mean     | SD       |
|----------------------------------------|----------|----------|
| Age (years)                            | 69.7     | 8.47     |
| Education (years)                      | 14.8     | 3.53     |
| CDR Sum of Boxes (CDR-SB)              | 1.75     | 2.50     |
| Biomarkers                             |          |          |
| Glial Fibrillary Acidic Protein (GFAP) | 191.7    | 241.7    |
| Neurofilament Light (NfL)              | 16.7     | 20.4     |
| pTau217                                | 0.59     | 0.51     |
| Systolic Blood Pressure (SBP)          | 134.4    | 18.6     |
|                                        | <b>N</b> | <b>%</b> |
| Female                                 | 277      | 55.5%    |
| White                                  | 370      | 74.1%    |
| Black                                  | 129      | 25.9%    |
| APOE Status                            |          |          |
| No e4 Alleles                          | 322      | 64.5%    |
| 1 Copy of e4 Alleles                   | 152      | 30.5%    |
| 2 Copies of e4 Alleles                 | 25       | 5%       |

### Methods

- Linear regression models tested whether SBP and race modifies associations between plasma biomarkers and cognitive-functional impairment, measured by the Clinical Dementia Rating Scale–Sum of Boxes (CDR-SB).
- Post-hoc simple slope analyses clarified significant interactions.
- Covariates: age, sex, education, APOE status

## RESULTS

Figure 1. Interaction of GFAP and SBP by Race

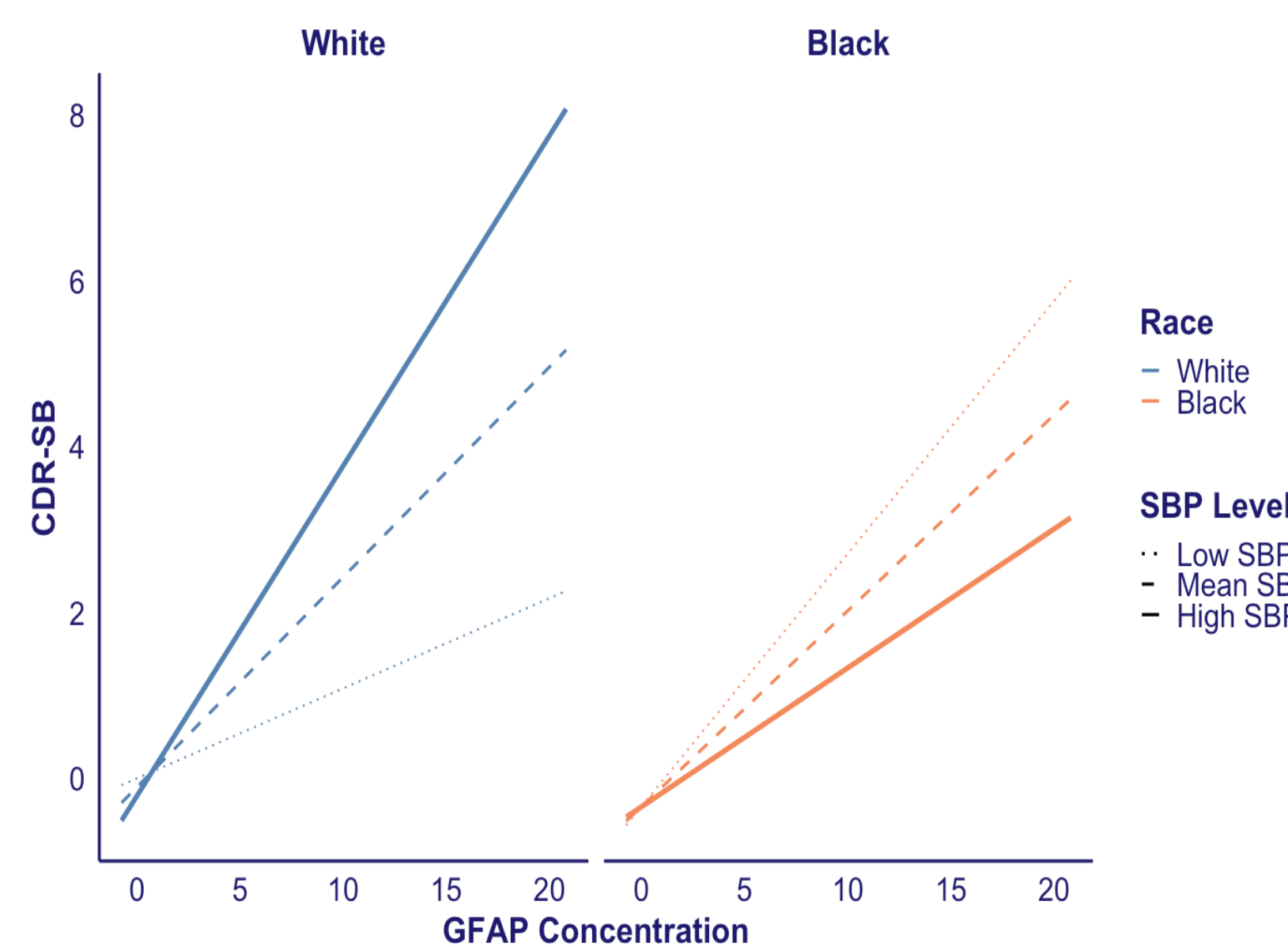


Figure 2. Interaction of NfL and SBP by Race

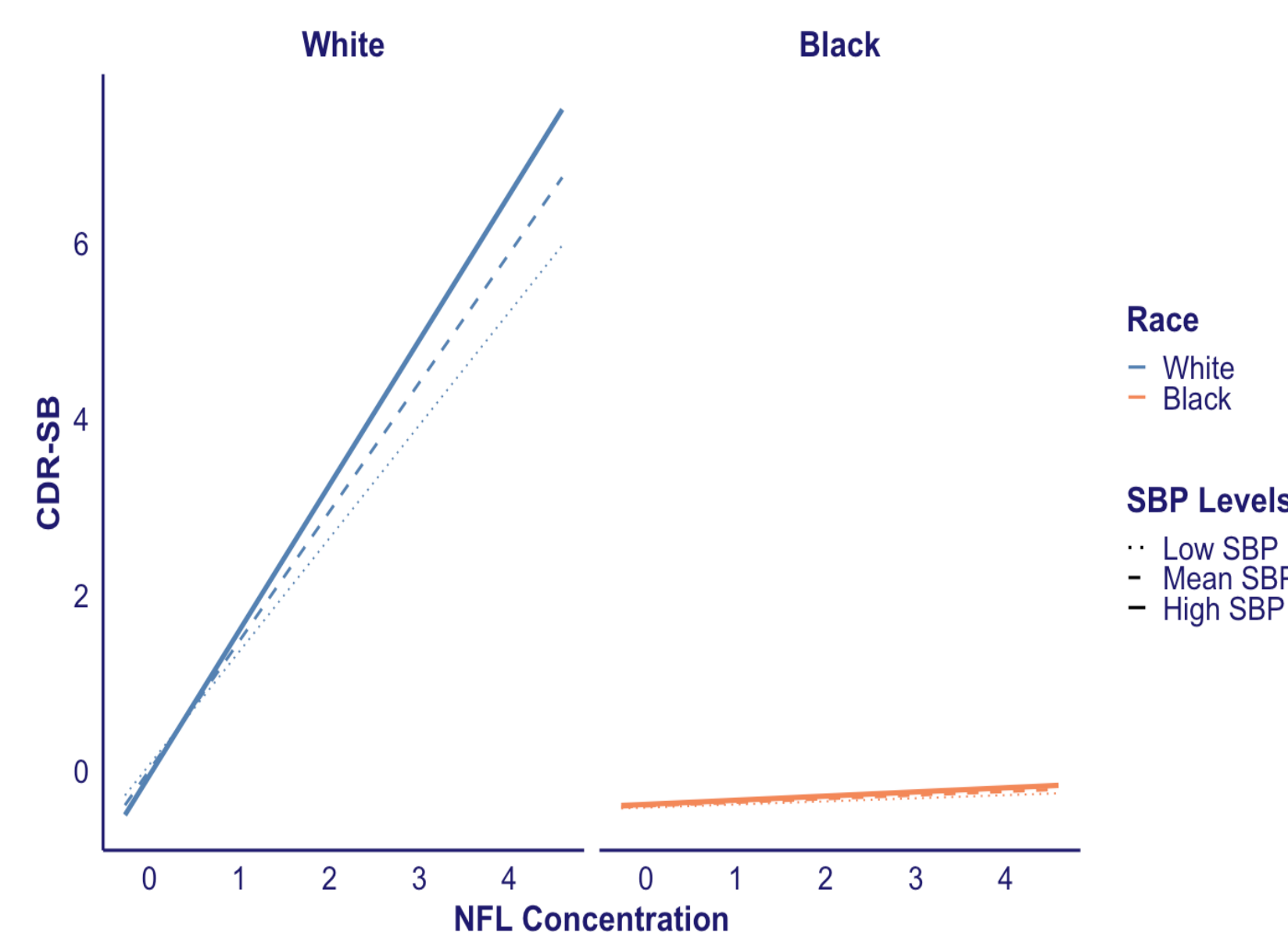
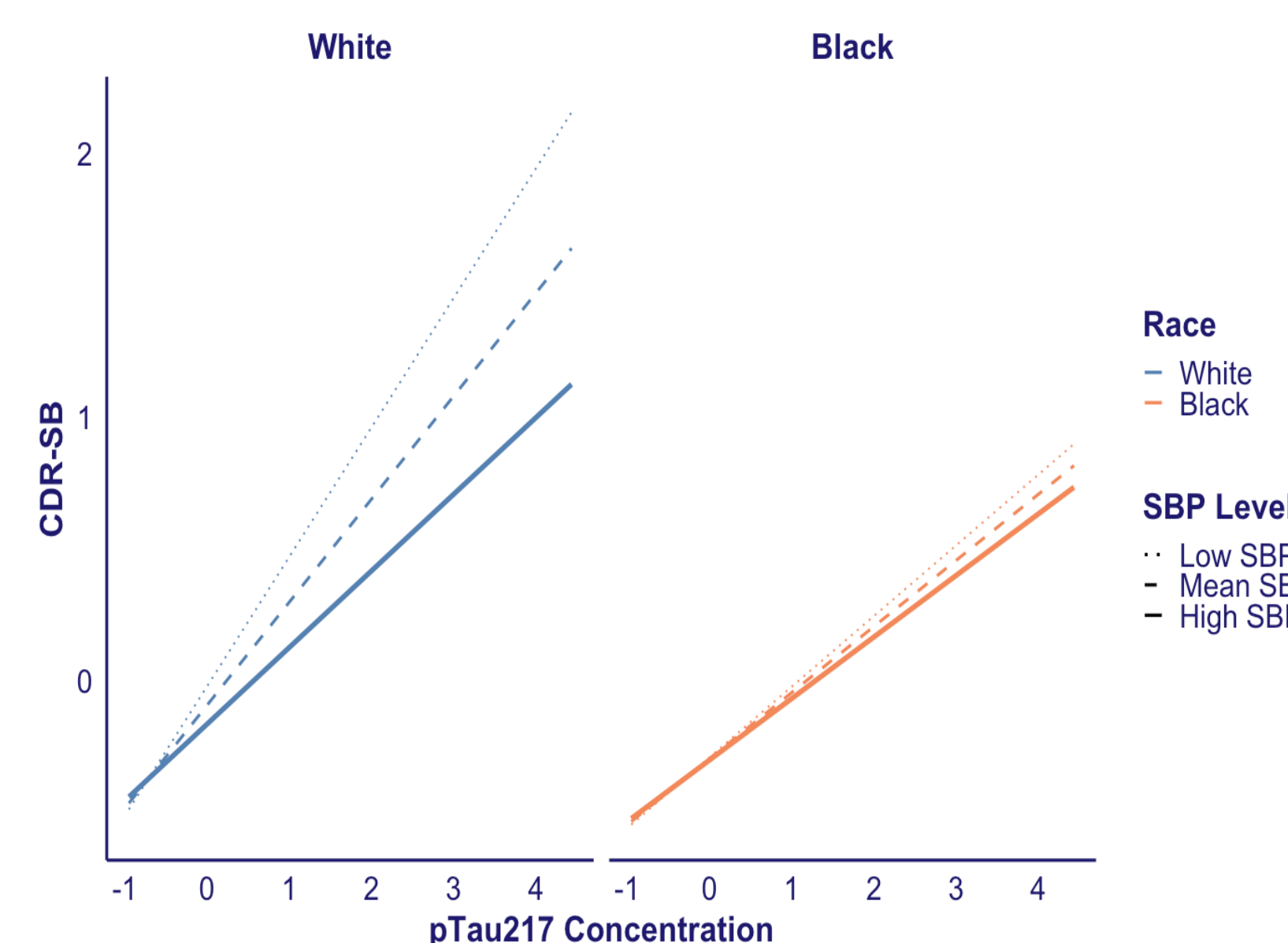


Figure 3. Interaction of pTau217 and SBP by Race



**Main effects:** GFAP ( $\beta = 0.25$ ,  $p < .001$ ), NfL ( $\beta = 1.47$ ,  $p < .001$ ), and pTau217 ( $\beta = 0.39$ ,  $p < .001$ ) were each associated with greater cognitive-functional impairment (CDR-SB). Across models, race was associated with CDR-SB, such that Black participants had lower CDR-SB ( $ps < .05$ ).

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## RESULTS (cont.)

### GFAP (astrocytic marker)

- SBP modified the GFAP-CDR-SB relationship ( $\beta = -.15$ ,  $p < .01$ ): GFAP's association with impairment strengthened as SBP levels increased (low:  $\beta = .16$ ,  $p = .05$ ; mean:  $\beta = .25$ ,  $p = .00$ ; high:  $\beta = .34$ ,  $p = .00$ ).
- Race did not moderate this interaction ( $\beta = -.22$ ,  $p = .09$ ).

### NfL (axonal injury marker)

- The NfL-impairment relationship was not modified by SBP alone ( $\beta = .19$ ,  $p = .40$ ) or jointly with race ( $\beta = -.18$ ,  $p = .59$ ).
- Only race modified the relationship, demonstrating weaker NfL-CDR-SB associations among Black participants.

### pTau217 (AD-specific marker)

- SBP modified the pTau217-CDR-SB relationship ( $\beta = -.10$ ,  $p = .01$ ): pTau217 was associated with impairment at low SBP ( $\beta = .43$ ,  $p = .00$ ) and attenuated as SBP levels increased (mean:  $\beta = .35$ ,  $p = .00$ ; high:  $\beta = .28$ ,  $p = .00$ ).
- Race did not modify this interaction ( $\beta = .08$ ,  $p = .36$ ).

## CONCLUSIONS

- Vascular health modifies neurodegeneration-related cognitive and functional impairment.
- Higher SBP strengthened the GFAP-impairment associations across racial groups, suggesting the vascular risk may amplify the effect of inflammatory processes on cognitive and functional outcomes.
- The NfL-impairment relationship was not associated with SBP, but was significantly weaker among Black participants, indicating heterogeneity in axonal injury causes or contextual factors shaping how axonal damage impacts impairment
- In contrast, pTau217 attenuated as SBP levels increased with no race differences, suggesting non-AD pathways may be competing with AD-specific tau pathology to drive cognitive and functional impairment.
- These findings highlight the need to integrate vascular health and social context in biomarker interpretation to improve precision in AD risk and treatment.

## Future Directions

- Future research should incorporate longitudinal designs, neuroimaging, and refined vascular risk assessments to clarify these pathways.