



Hippocampal volume is associated with verbal memory performance in older, but not younger, adults

Mike F Schmidt¹, Michael E Griswold, PhD², Kevin B Freeman, PhD³, Thomas H Mosley Jr, PhD⁴

1. Program in Neuroscience at The University of Mississippi Medical Center, 2. Center for Biostatistics at The University of Mississippi Medical Center, 3. Department of Psychiatry and Human Behavior at the University of Mississippi Medical Center, 4. Department of Medicine (Geriatrics) at The University of Mississippi Medical Center

* Introduction

Over the adult lifespan, both hippocampal volume and memory performance decline (Figures 1-3), accelerating in the case of dementia. The hippocampus plays a key role in memory storage and retrieval. Hippocampal volume has been measured and compared to cognition in people with numerous psychiatric disorders, but rarely in normal community-dwelling populations. We examined whether the relationship between verbal memory and hippocampal volume differed over the lifespan.

* Methods

We utilized the Genetic Epidemiology Network of Arteriopathy (GENOA) Study, whose participants are members of sibships in which at least one sibling had essential hypertension diagnosed prior to age 60. We measured hippocampal volume with Freesurfer 5.3 segmentations of 1.5T T1 SPGR images. We measured verbal memory with the Rey Auditory Verbal Learning Test. Our cohort, GENOA participants with cognitive testing, reliable MRI images, and mini mental state exam (MMSE) scores over 24, is described below (Table 1).

Table 1. Participant Characteristics

	Total n=1295	Female		Male	
		White	Black	White	Black
Age (yrs)	62.0 (8.9)	60.9 (9.2)	63.0 (8.2)	62.2 (9.3)	62.5 (8.5)
Educ (yrs)	13.3 (2.8)	13.4 (2.1)	13.2 (3.1)	13.5 (2.6)	13.2 (3.5)
SBP (mmHg)	134 (18)	133 (16)	137 (20)	131 (16)	136 (18)
L HV (cc ³)	3.93 (0.46)	3.92 (0.44)	3.76 (0.37)	4.14 (0.47)	3.99 (0.49)
R HV (cm ³)	4.00 (0.47)	3.94 (0.43)	3.85 (0.38)	4.24 (0.49)	4.09 (0.51)
TIV (cm ³)	1415 (143)	1381 (105)	1323 (103)	1565 (121)	1479 (122)

Our primary model used linear regression with generalized estimating equations to estimate slopes while accounting for sibship clustering and adjusting for age, intracranial volume, education, gender, and race; robust Huber-White variances were employed.

* Results

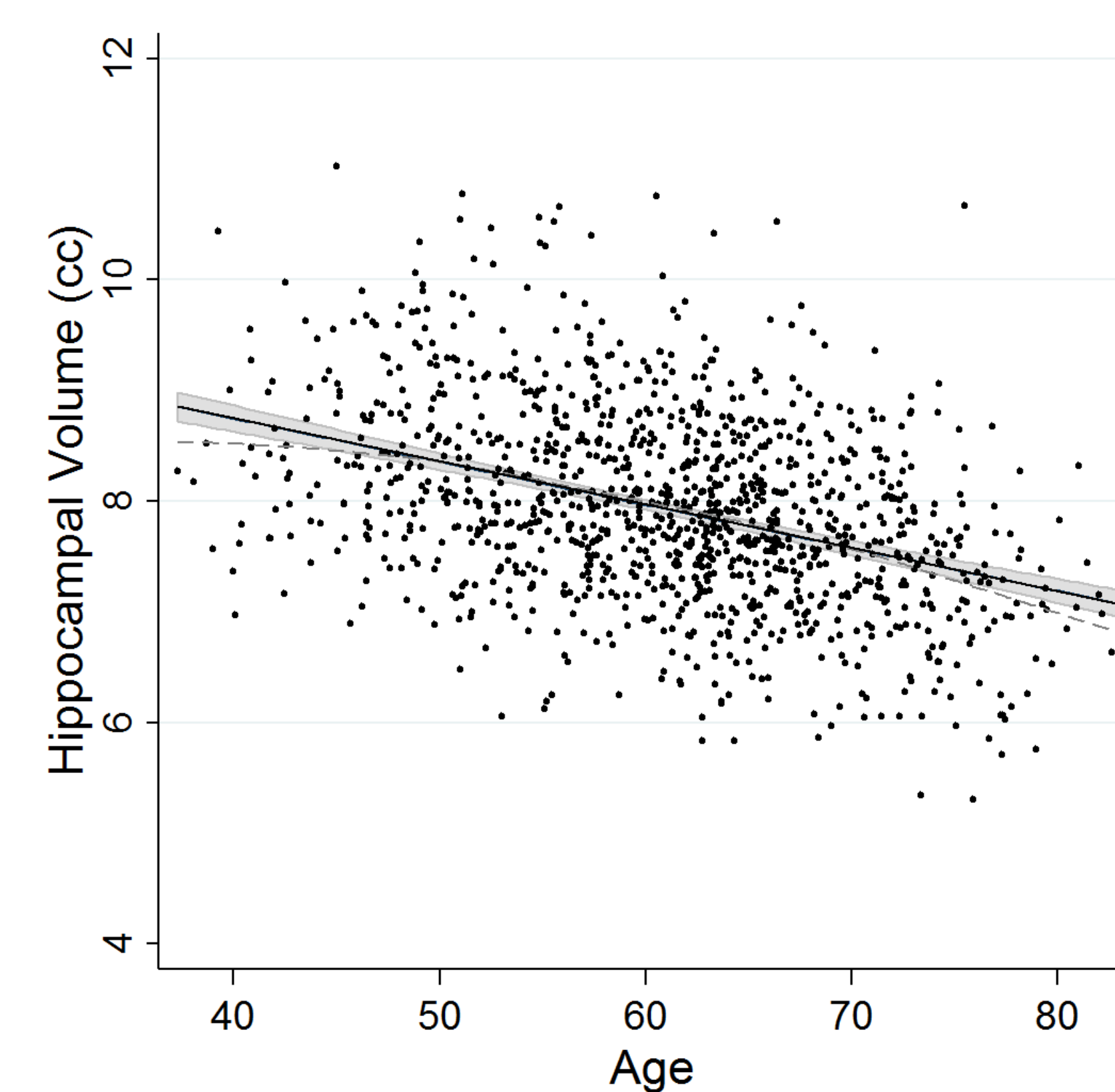


Figure 1. As expected, hippocampal volume declines throughout adulthood. (unadjusted)

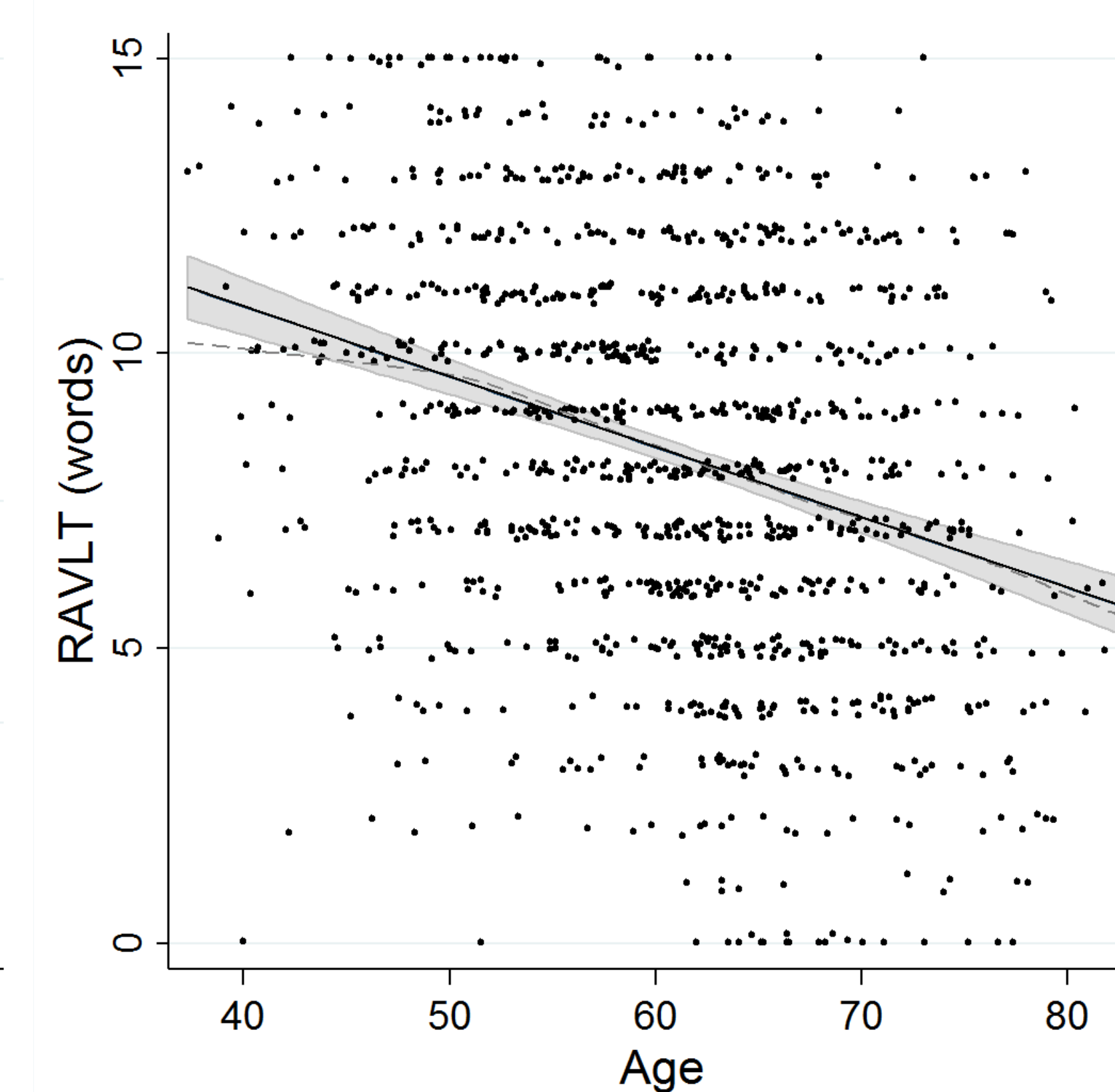


Figure 2. As expected, verbal memory declines throughout adulthood. (unadjusted)

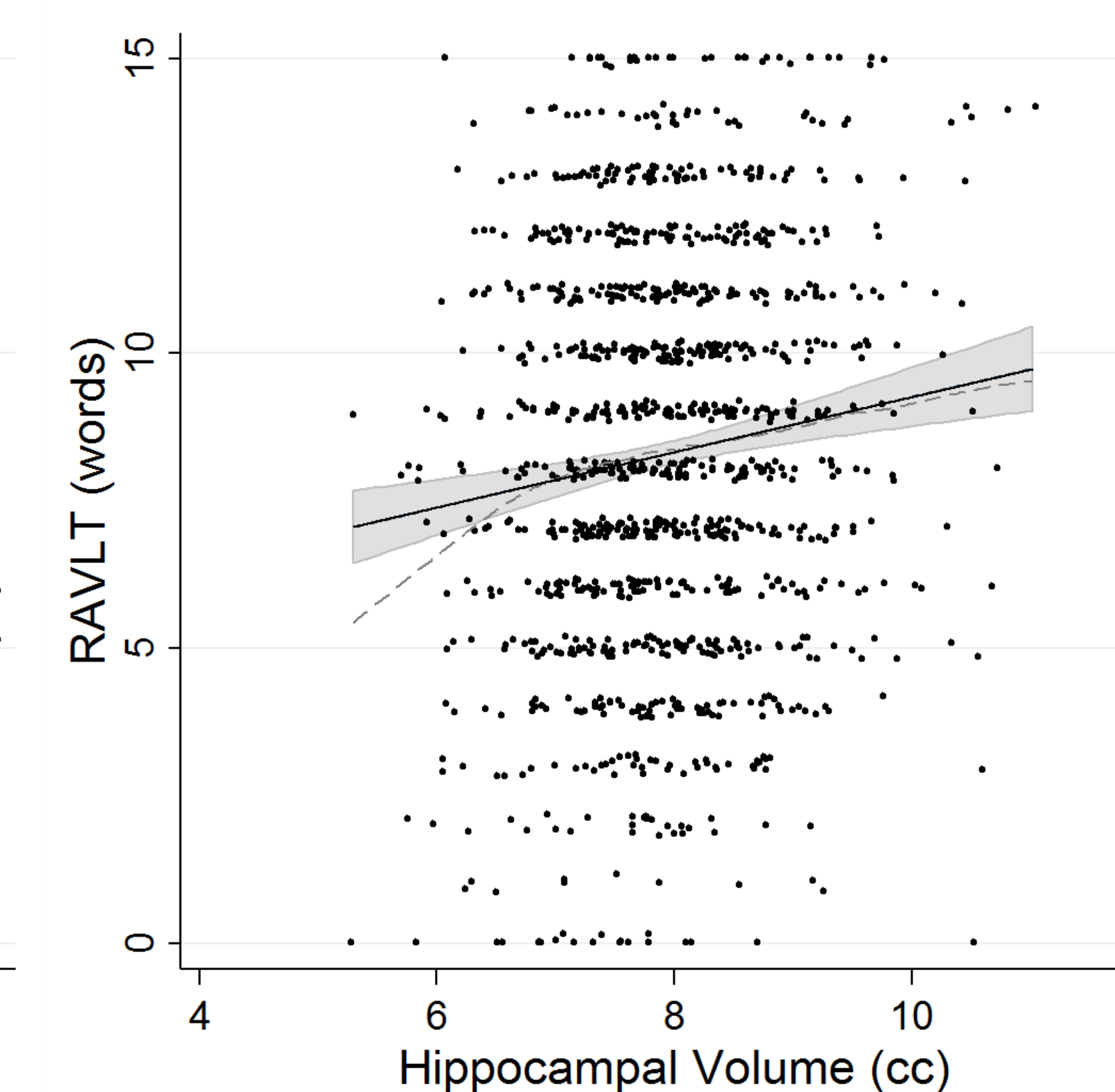
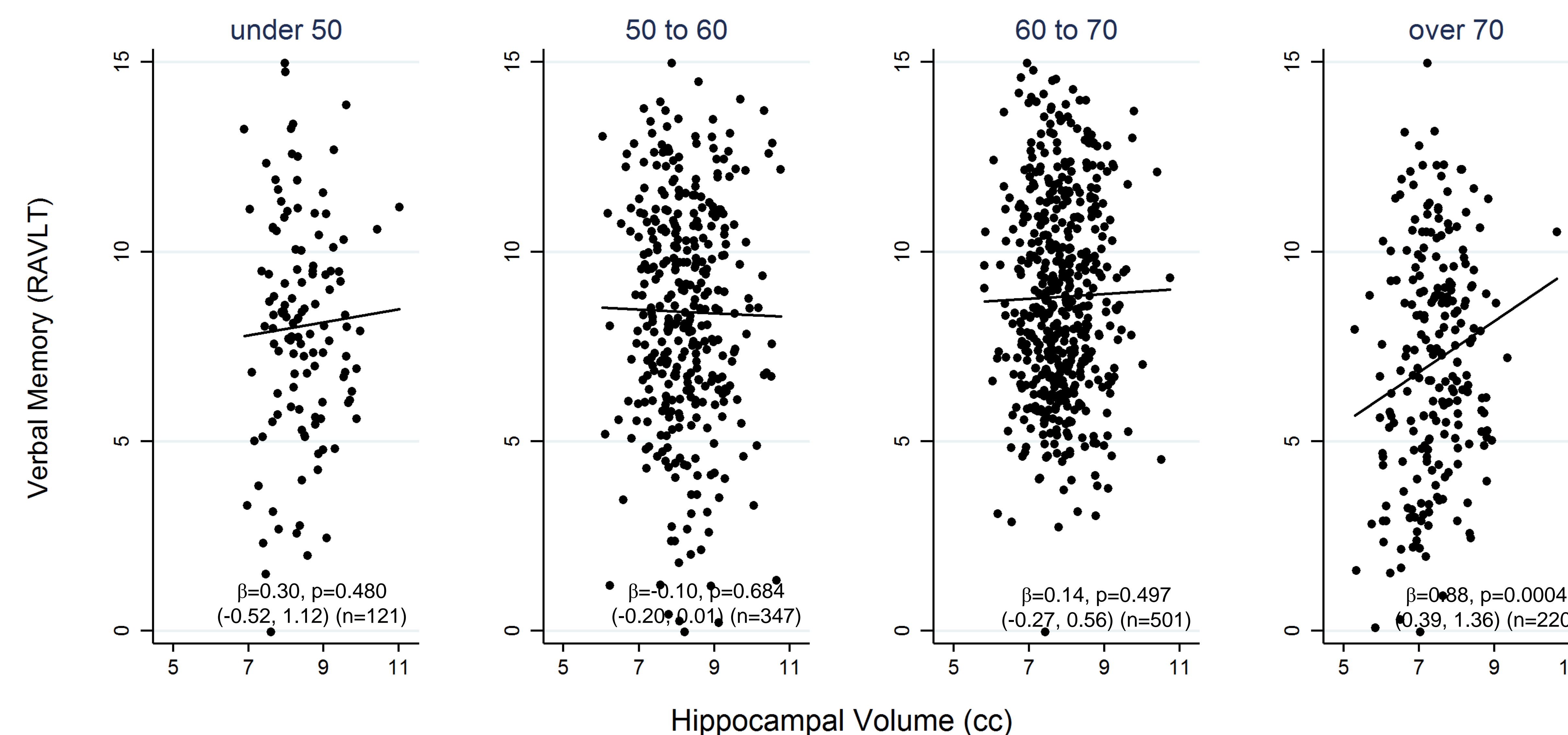


Figure 3. The larger the hippocampi, the better the verbal memory. (unadjusted)

Our primary model demonstrated a decrease of 0.32 words recalled, $p=0.015$, 95% CI:(0.06, 0.58) in the RAVLT for each cubic cm decrease in hippocampal volume. This is a small cognitive change for such a large anatomical one.

Stratifying over decade of life provided a clearer and more compelling description. There is no significant effect until participants enter their 8th decade. In those over 70, the effect size triples to 0.88 words, as shown in Figure 4.

Figure 4. The relationship between verbal memory and hippocampal volume, stratified by decade of life. The results are adjusted for age, intracranial volume, gender, race, and level of education.



* Conclusions

Our data support a relationship between hippocampal volume and memory performance in late life. But relationships between hippocampal volume and verbal memory in younger populations are weak or null. Although we attempted to exclude those with dementia, pre-clinical dementia could not be completely ruled out in the absence of pathology. Thus, the observed effect in our oldest age group may have been driven by the association of pathological (e.g., Alzheimer's disease) atrophy with memory as opposed to "normal" atrophy over age.

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* Also...

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