Feeling More Purpose in Life is Associated With Larger Hippocampal Volumes

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Research Question

Is feeling greater *Purpose in Life* associated with larger volumes of the hippocampus, a brain structure critical for learning and memory, and indicative of brain health?

Background

***Purpose in Life* is a feeling and/or belief that there is meaning to one's life, having goals, and a sense of directedness.**

Psychological Wellbeing Scale[1] *Purpose in Life* items:

I live life one day at a time and don't really think about the future.
I have a sense of direction and purpose in life.
I don't have a good sense of what it is I am trying to accomplish in life.
My daily activities often seem trivial and unimportant to me.
I enjoy making plans for the future and working to make them a reality.
Some people wander aimlessly through life, but I am not one of them.
I sometimes feel as if I've done all there is to do in life.

***Purpose* is a protective factor for:**

- All-cause mortality regardless of age[2]
- Cardiovascular events[3]
- Alzheimer's disease and cognitive decline[4]

The hippocampus is a plastic brain structure critical for learning and memory.[5]

Hippocampal volumes:

- Are susceptible to aging and chronic or severe stress.[6,7]
- Reductions in volume (atrophy) are associated with age-related cognitive decline.[8]
- Can distinguish between mild cognitive impairment and neurodegenerative diseases.[9,10]
- Serve as a marker of brain aging and neurodegeneration.[11]

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Methods

Midlife in the U.S. Refresher (MR)

- Sample size n=127, 53% Female, 36.5% BIPOC, Mean age of 48.69 years (range 26-76 years)

Midlife in the U.S. 3rd wave (M3)

- Sample size n=154, 59% Female, 27.3% BIPOC, Mean age of 64.82 years (range 48-95 years)

Purpose & Volumetric Measures

- 7 *Purpose in Life* self-report items from Psychological Well-Being questionnaire[1]
- Structural MRI data processed with FreeSurfer version 5.3.0 (MR) and 6.0.0 (M3).

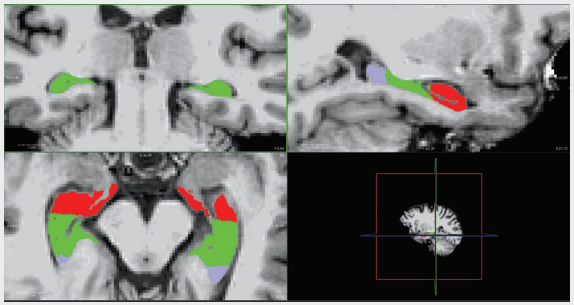
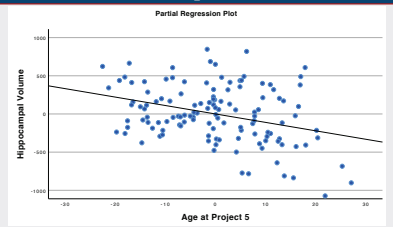


Figure 1. Image of a hippocampus from a MIDUS Refresher participant

Controls:

- Covariates: Intracranial volume (total brain + CSF), age, sex (Male/Female), race (BIPOC/White), education (High school/GED, Some college, College degree +)
- Control volume of interest: Calcarine sulcus corresponding to primary visual cortex.

As expected, hippocampal volume is negatively associated with age in both MIDUS samples: MR (β=-11.05, SE=2.86, t=-3.87, p<.001), M3 (β=-17.42, SE=2.68, t=-6.49, p<.001).



Results

Greater *purpose* is associated with larger hippocampal volumes in both MIDUS samples:
MR (β=10.22, SE=4.87, t=2.10, p=0.038)
M3 (β=8.19, SE=4.01 t=2.04, p=0.043)

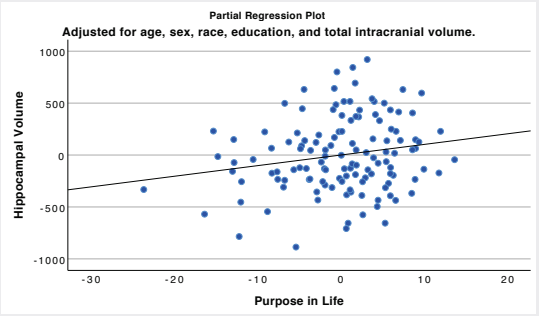


Figure 2. Association between level of *purpose* and left-right averaged hippocampal volumes when adjusting for covariates.

- No significant interactions were found between *purpose* and age (all p > 0.11) for hippocampal volume in either sample.
- No significant associations were found between *purpose* and the calcarine sulcus control region of interest volume: MR (β= 0.36, SE=5.43, t=0.06, p=0.95), M3 (β= 4.63, SE=5.02, t=0.93, p=0.36).

Discussion

- Although hippocampal volumes decrease with age, having a greater feeling of *purpose* is associated with larger hippocampal volumes across our samples' adult age ranges.
- This suggests interventions designed to increase feelings of *purpose* and meaning in life may be beneficial at all ages for maximizing hippocampal volume.
- However, the cross-sectional nature of this analysis also allows the interpretation that larger hippocampi may somehow provide the capacity for greater feelings of *purpose*.
- Alternatively, other mechanisms may underly the associations: exercise is positively associated with *purpose*[12] and has been shown to benefit hippocampal volumes.[13]

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