Greater Purpose in Life is Associated With Larger Hippocampal Volumes

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Research Question
Is greater “Purpose in Life” (PiL) associated with larger hippocampal volumes?

Background
PiL is a feeling and/or belief that there is meaning to one’s life, having goals, and a sense of directedness.

Psychological Wellbeing Scale (Ryff, 1989) PiL 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.
Some people wander aimlessly through life, but I am not one of them.
Sometimes feel as if I’ve done all there is to do in life.

PiL is a protective factor for:
- All-cause mortality regardless of age (Hill & Turiano, 2014)
- Cardiovascular events (Cohen et al., 2016)
- Alzheimer’s disease and cognitive decline (Boyle, Buchman, Barnes, et al., 2010)

The hippocampus is a plastic brain structure critical for learning and memory (Anand & Dhikav, 2012).

Hippocampal volumes:
- Are susceptible to aging and chronic, severe stress (Raz et al., 2005; Woon et al., 2010).
- Reductions (atrophy) are associated with age-related cognitive decline (Driscoll et al., 2003).
- Distinguish between mild cognitive impairment and Alzheimer’s pathology (Cavé et al., 2019; Jack et al., 1999).
- Serve as a biomarker of Alzheimer’s disease and brain aging (Nobis et al., 2019).

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Methods
Midlife in the U.S. (MIDUS) Refresher
- Sample size n=127, 53% Female, 36.5% BIPOC, Mean age of 48.69 years (range 26-76 years)

PiL & Volumetric Measures
- 7 PiL self-report items from Psychological Well-Being questionnaire (Ryff, 1989)
- Structural MRI data from MIDUS Neuroscience processed with FreeSurfer version 5.3.0

Hippocampal Volume
- Adjusted for age, sex, race, education, and total intracranial volume.

Partial Regression Plot

Hippocampal Volume

Purpose in Life

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

Figure 2. Association between level of PiL and left-right averaged hippocampal volumes when controlling for covariates

Results
Greater PiL is associated with larger hippocampal volumes ($\beta$=10.22, $SE$=4.87, $t$=2.10, $p$=0.038).

Figure 2. Association between level of PiL and left-right averaged hippocampal volumes when controlling for covariates

- No significant interactions were found between PiL and age, sex, race, or education (all $p > .19$).
- No significant associations between PiL and the control region of interest calcarine sulcus volume ($\beta=0.01$, $SE=5.43$, $t=0.06$, $p=0.95$).

Discussion
- Although hippocampal volumes decrease with age, having a greater feeling of purpose in life (PiL) is associated with larger hippocampal volumes across our sample's age range (26-76 years).
- This suggests interventions designed to increase feelings of purpose and meaning in life may be beneficial at all ages, not just older 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 PiL.
- Next, a longitudinal follow-up will test the direction of this relationship and whether greater PiL is more protective against brain aging in advanced age (+80s and 90s and beyond).

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