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RESEARCH ARTICLE

Associations between AHA's Life's Essential 8 and cognition in midlife and older adults

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Abstract

INTRODUCTION: This study evaluated the associations between Life's Essential 8 (LE8) and cognitive performance, and compared the strength of the relationships of Life's Simple 7 (LS7) and LE8 to cognition in midlife and older adults.

METHODS: Participants (N = 1539) were from the Healthy Aging in Neighborhoods of Diversity across the Life Span (HANDLS) study. Cross-sectional multivariable regression examined the associations between LE8 and cognition. Secondary analyses compared model performance between LE8 and LS7 measures on cognition from the same available sample.

RESULTS: Higher LE8 scores were associated with better global cognitive performance, working memory, and attention. The LS7 model outperformed the LE8 model on global cognitive performance, but the LE8 model outperformed the LS7 model for the working memory domain.

DISCUSSION: Better cardiovascular health (CVH) was associated with better cognitive performance among US middle-aged and older adults. However, the association between CVH and specific cognitive domains varies when using LE8 versus LS7.

KEYWORDS
aging, cardiovascular disease, cognition, Life's Essential 8, sleep

Highlights

- Cardiovascular health (CVH) is associated with cognitive performance.
- Life's Essential 8 (LE8) is a new construct to quantify CVH.
- Associations between LE8 and cognition were assessed.
- Higher LE8 was associated with better global cognitive performance.
- Higher LE8 was also associated with better working memory and attention.

1 | BACKGROUND

Cognitive decline is a growing public health concern for an aging population. More than 55 million people have dementia worldwide,[1] including roughly 10% of the US adult population ≥ 65 years of age.[2] Similarly, approximately one third of adults living in the United States ≥ 85 years of age have Alzheimer's disease (AD), and this number is expected to dramatically increase over the next 40 years.[3] Given these projections, it is crucial to identify behaviors that can encourage healthy aging earlier in life and prevent/delay the onset of cognitive decline.

Accumulating evidence suggests that cardiovascular disease is associated with a decline in cognition.[4] For example, patients with coronary artery disease have a 45% increased risk of developing cognitive impairment.[5] Additionally, people with heart failure have 1.67 higher odds for cognitive impairment than those without heart failure.[6] Risk for cardiovascular disease is ameliorable by lifestyle changes. Consequently, it is important to identify modifiable risk factors that adults can target to improve their cardiovascular health (CVH).[7]

The American Heart Association (AHA) created a 7-metric CVH construct in 2010 to estimate the likelihood of optimal CVH, and subsequently better overall quality of life. It was anticipated that this metric, Life's Simple 7 (LS7), would represent a personalized indicator of CVH that would encourage preventative approaches (e.g., maintenance or incorporation of positive health behaviors) rather than health intervention approaches designed solely to treat disease.[8] The LS7 construct includes blood pressure, glucose, cholesterol, body mass index (BMI), diet, physical activity (PA), and smoking. Prior literature has shown that optimal LS7, as indicated by a high total LS7 score, is related to better cognitive functioning,[10,11,9] particularly on tests of global cognition, processing speed, and executive function.[11,12] Additionally, optimal LS7 has been shown to be related to slower episodic memory decline within adults ≥ 60 years of age. Limited research has explored the association between LS7 and cognition in adults < 60 years of age. However, this association may be meaningful to explore at an early period of the life course, such as midlife, when CVH risk (e.g., hypertension) and poorer quality of life may initially manifest.[13]

In 2022, AHA's working group released updated metrics and renamed the construct from LS7 to Life's Essential 8 (LE8). Researchers found that sleep duration was associated with each of the LS7 components and with overall health. The AHA working group elected to add sleep duration as an eighth metric to the formal definition of CVH given this variable's ease of assessment, measurement reliability, and independent contributions to cardiometabolic and overall health outcomes.[14] In addition, the new LE8 construct includes more continuous scoring and updated categories of other individual metrics (see Table S1 in supporting information for more information on how to calculate the LE8 and LS7 composite scores). However, there is limited research on the associations between the new LE8 construct and cognitive outcomes. Therefore, the current study tested the relationship of a new LE8 construct with multiple cognitive measures in a unique, socioeconomically and racially diverse sample of midlife adults.

RESEARCH IN CONTEXT

1. **Systematic review**: The authors reviewed the available literature using traditional sources and meeting abstracts and presentations. Evidence suggests that better cardiovascular health (CVH), as indicated by a higher Life's Simple 7 (LS7) score, is associated with better cognitive performance in midlife and older adults. Research gaps remain regarding the association between the new Life's Essential 8 (LE8) score and cognition, and its comparison to LS7 in how it relates to cognition.
2. **Interpretation**: Higher LE8 scores were significantly associated with better global cognitive performance, working memory, and attention. The LS7 model outperformed the LE8 model on global cognitive performance, but the LE8 model outperformed the LS7 model for the working memory domain.
3. **Future directions**: This article highlights the need for more consistent reporting of the LE8 components and considers a multi-dimensional sleep component as an alternative to self-reported sleep duration.

The present study examines two hypotheses. First, a higher LE8 score will be associated with better cognitive performance domains and global scores. Second, LE8 (with the addition of sleep and more continuous scoring metrics sensitive to interindividual differences) will show a stronger association with cognitive performance outcomes than the LS7 composite score.

2 | METHODS

2.1 | Participants

This cross-sectional study used survey and cognitive battery data from the Wave 4 visits (2013–2017; n = 2171) of the Healthy Aging in Neighborhoods of Diversity across the Life Span (HANDLS). HANDLS participants are a fixed cohort of 3720 community-dwelling Black and White adults aged 30 to 64, recruited from 13 predetermined neighborhoods (groups of contiguous census tracts) comprising an area probability sample of Baltimore City. HANDLS was specifically designed to understand Black–White and socioeconomic disparities in health and cognitive decline by exploring protective and adverse biopsychosocial factors, a topic of relevance in the field of cognition and Alzheimer's disease and related dementias (ADRD) risk.[15] HANDLS was approved by the institutional review board at the National Institutes of Health and all participants provided written informed consent. For more information on the study sample, see Evans et al.[16]

Participants in the primary analyses (n = 1539) provided complete data for demographic covariates taken at wave 1 or wave 4, variables incorporated in the LE8 score, and the Joggle cognitive battery at

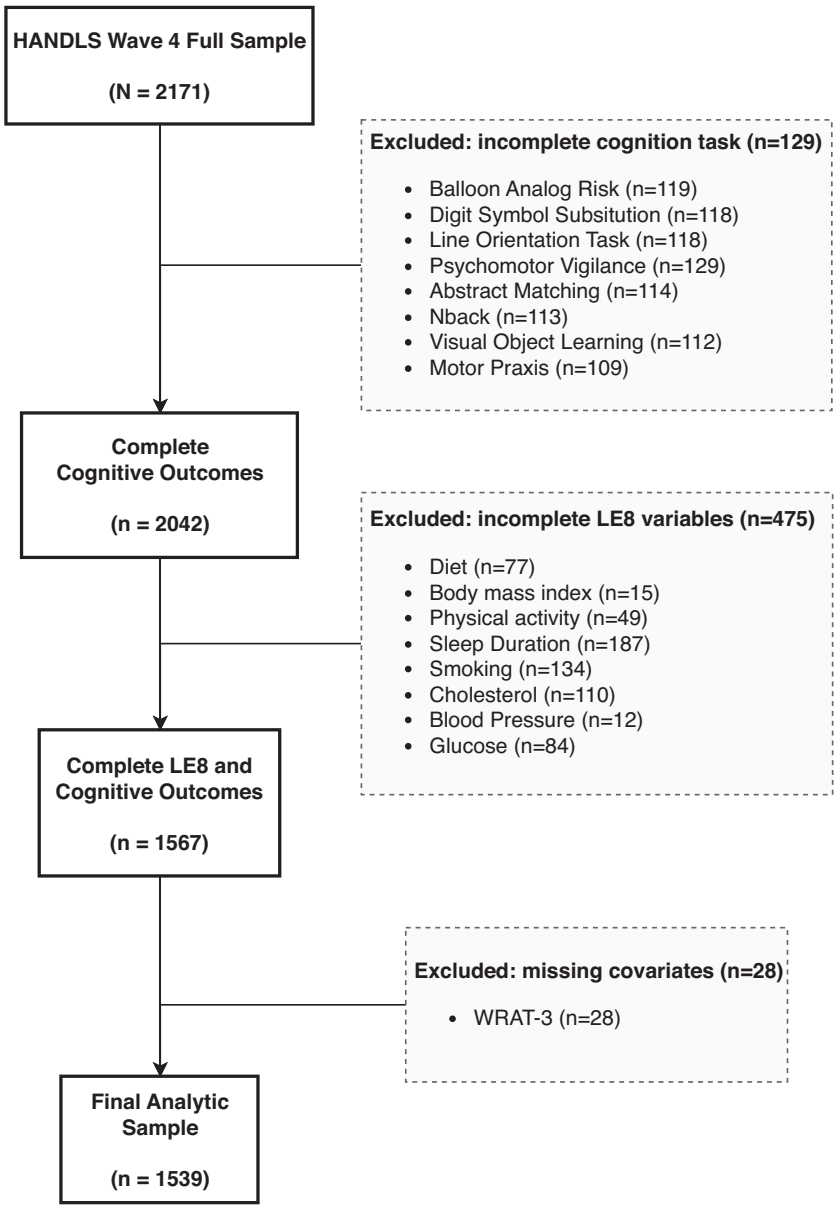

FIGURE 1 Analytic sample consort diagram (Aim 1; LE8). HANDLS, Healthy Aging in Neighborhoods of Diversity across the Life Span; LE8, Life's Essential 8; WRAT-3, Wide Range Achievement Test.

wave 4. If available, data from wave 3 were used to calculate smoking/nicotine use categories for some participants. See Figure 1 for more information on data missingness. The analytic sample to test the secondary aim consisted of participants with complete data to calculate the LE8 ($n = 1539$) and the LS7 ($n = 1513$) composite scores ($n = 1428$ overlap). Variations from the LE8 sample and the LS7 sample and their overlap are due to missingness in three metrics (diet, cholesterol, and glucose) calculated differently, and the additional LE8 sleep metric. Starting from the full wave 4 sample ($n = 2171$), LE8 diet ($n = 2066$ valid) and LS7 diet ($n = 2066$ valid) had an overlap of 2065 valid participants; LE8 cholesterol ($n = 2039$ valid) and LS7 cholesterol ($n = 2081$ valid) had an overlap of 2039 valid participants; LE8 glucose ($n = 2074$ valid) and LS7 glucose ($n = 1920$ valid) had an overlap of 1909 valid participants. Last, $n = 1919$ participants had valid data to calculate the LE8 sleep metric. See Table S1 for more information on the data used to calculate LE8 and LS7 composite scores.

2.2 | Measures/variables

2.2.1 | CVH: LS7 and LE8 (predictors)

LS7 and LE8 constructs of CVH consist of eight components: diet, PA, nicotine exposure, BMI, blood lipids, blood glucose, blood pressure, and sleep health (new for LE8). The LS7 score is the sum of the seven metrics categorized into poor (0), intermediate (1), and ideal (2), while the LE8 is calculated by averaging the eight metrics, which were updated as more continuous scores ranging from 0 to 100. See Table S1 for information on the calculation of LS7 (consistent with Beydoun et al.[17]) and LE8 for our sample, including the available survey variables used to create each of the metrics. Due to differing measurements, survey instruments, and available data used in our study versus the published calculations,[14,8] some components of LS7/LE8 are constructed differently.

2.2.2 | Cognition (outcome)

During data collection at wave 4, participants completed The Joggle Research battery (Joggle Research, Inc.) using an iPad to track performance across eight tasks: Balloon Analog Risk, Digit Symbol Substitution, Line Orientation, Psychomotor Vigilance, Abstract Matching, N-Back, Visual Object Learning, and Motor Praxis. For each task, standardized scores were estimated to create scores for five cognitive abilities (speed, working memory, attention, executive functioning, and visual orientation) and a global cognitive performance score.[18]

Computerized cognitive test batteries consisting of multiple cognitive domains have been validated in participant samples with acute total sleep deprivation.[19] The computerized Joggle Research battery has been compared to a traditional paper-and-pencil neuropsychological battery in midlife and older Black adults,[18,20] a sample with similar sociodemographics as the current study's sample. Gamaldo et al.[18] revealed that participants reported more satisfaction and less testing anxiety with the Joggle battery compared to the traditional neuropsychological battery.

Consistent with Gamaldo et al.,[18] the global cognition score was calculated by summing the standardized scores of all eight cognition tasks. A composite score for each of the five cognitive domains was calculated by summing standardized scores of different tasks, as follows: (1) speed: Motor Praxis + Psychomotor Vigilance; (2) working memory: N-Back; (3) attention: Visual Object Learning + N-Back + Digital Symbol Substitution + Psychomotor Vigilance; (4) executive function: Abstract Matching + Digit Symbol Substitution + Balloon Analog Risk; (5) visual orientation: Visual Object Learning + Line Orientation.

2.2.3 | Covariates

Sociodemographic covariates included continuous age (HANDLS wave 4), sex (wave 1), self-reported racial identity (dichotomized African American/Black or White at wave 1), and dichotomized poverty status above or below 125% of the household poverty threshold (wave 1). Other covariates included education quality measured by the Wide Range Achievement Test 3 (WRAT-3, wave 1) and dichotomized self-reported sleep apnea (wave 4). Last, continuous depressive symptoms measured from the 20-item Center for Epidemiological Studies Depression (CES-D)[21] at wave 4 were included, less the question relating to sleep, avoiding conflict with the sleep measure in LE8 or the sleep apnea covariate. All analyses were adjusted for these demographic characteristics.

A separate sensitivity analysis was performed to evaluate differences between the primary aim's analytic sample (n = 1539) and the full wave 4 participant sample (n = 2171). Logistic regression analyses were conducted to investigate whether sex, race, poverty status, sleep apnea diagnosis, reading literacy (WRAT-3 score), depressive symptoms, and age were associated with exclusion from the primary analyses (LE8 sample) due to data missingness (included n = 1539; excluded n = 632). Living below the poverty line (odds ratio [OR] = 1.54, $p < 0.0001$), having sleep apnea (OR = 1.48, $p = 0.0085$), a lower score on the WRAT-3 (OR = 0.98, $p = 0.0047$), and higher depressive symptoms (OR = 1.01, $p = 0.02$) predicted higher odds of data missingness.

2.3 | Statistical analyses

Multivariable linear regression models in R Studio (version 4.2.1) were run to test associations between the CVH constructs (LS7 or LE8) and cognition. For the primary aim, six regression analyses were performed (LE8 and covariates × 6 cognitive outcomes; N = 1539). Due to the exploratory nature of this analysis, no correction was applied for the analyses using the cognitive domains.

For the secondary aim, the participant sample was reduced to n = 1428 to include participants who had data for both LS7 and LE8 constructs to compare models and model fit to each of the six cognitive variables (12 models total, covariates included in all models). Bayesian information criterion (BIC; lower is better)[22,23] and non-nested likelihood ratio tests were used to identify differences between models.[24] According to Raftery's 1995 guidelines,[22,23] evidence associated with a difference of 0 to 2 in BIC is considered weak, 2 to 6 is positive, 6 to 10 is strong, and > 10 is very strong. Additionally, Vuong's theory of non-nested model comparisons was implemented using R.[24,25] A two-step testing procedure is used for Vuong's theory, testing whether the two models are distinguishable from one another (variance test), and if they are distinguishable, testing whether the two models' fits are equal (non-nested likelihood ratio test).

Additionally, to assess the impact of the modified metric calculations and scaling of LE8 (without sleep) and LS7, we ran analyses between LS7 and LE8 (without the sleep metric) in the identical overlapping sample (n = 1428), and compared the models using the same model fit criteria. The LE8 (without sleep metric) composite score was calculated as the unweighted average of the seven component metric scores, whereas the full LE8 composite score was calculated as the unweighted average of all eight component metric scores (including sleep).

3 | RESULTS

3.1 | Descriptive statistics

Participants (N = 1539) in the LE8 sample were 56.6 years old (standard deviation [SD] = 9.0); 59% women; 60% Black, non-Hispanic (40% White, non-Hispanic); and 37% below the poverty line (Table 1). Participants had an average LE8 score of 54.7 (SD = 13.5) and LS7 score of 7.2 (SD = 2.1, n = 1513).

3.2 | Associations of LE8 and cognition

Higher LE8 scores were significantly associated with better global cognitive performance ($\beta = 0.08$, $p < 0.001$; Table 2). Among specific cognitive domains, higher LE8 scores were significantly associated with

TABLE 1 Participant characteristics and descriptive statistics ($N = 1539$).

	Mean or %	(SD or *n*)
Sex		
Women	59%	(902)
Men	41%	(637)
Race		
Black, non-Hispanic	60%	(923)
White, non-Hispanic	40%	(616)
Poverty status (125%)		
Above	63%	(962)
Below	37%	(577)
Sleep apnea		
No	91%	(1397)
Yes	9%	(142)
Age	56.6	(9.0)
WRAT literacy	42.2	(7.8)
Depressive symptoms	11.2	(10.3)
LE8	54.7	(13.5)
LS7	7.2	(2.1)

Notes: LE8 has a range of 0–100 (mean of eight categories), where a higher score indicates better CVH. LS7 has a range of 0–14 (sum of seven categories), where a higher score indicates better CVH; LS7 M/SD was calculated on $n = 1513$ who had complete LS7 data. The CES-D is scored by summing 20 individual items (assigned a value of 0, 1, 2, or 3); higher scores indicate greater depressive symptoms. In the current analyses, depressive symptoms (range: 0–57) is calculated by the sum of 19 items in the CES-D, omitting the question on sleep (#11, restless sleep). WRAT Literacy (word reading subtest of the WRAT 3) has a range of 0–57.

Abbreviations: CES-D, Center for Epidemiological Studies Depression; CVH, cardiovascular health; LE8, Life's Essential 8; LS7, Life's Simple 7; M, mean; SD, standard deviation; WRAT, Wide Range Achievement Test.

better working memory ($\beta = 0.17$, $p < 0.001$) and attention ($\beta = 0.02$, $p < 0.001$), but not visual orientation ($\beta = 0.003$, $p = 0.15$), executive function ($\beta = 0.004$, $p = 0.22$), or speed ($\beta = 0.001$, $p = 0.82$).

3.3 | Comparison between LS7 and LE8's associations with cognition

For participants who had complete data to calculate measures for both LS7 and LE8 ($n = 1428$), model fit was compared using BIC difference (≥ 6 is considered strong evidence of a difference)[23] and Vuong's non-nested likelihood ratio test.[24,25] Covariate and cognitive performance variables were identical in both sets of models (Table 3 for model comparisons; Table S2 in supporting information for LS7 and LE8 model results using the same sample).

LS7 ($\beta = 0.102$, $p < 0.001$) and LE8 ($\beta = 0.086$, $p < 0.001$) were both significant predictors of global cognitive performance. Using Raftery's BIC difference guidelines, the LS7 model marginally outperformed the LE8 model (LS7 BIC = 7309.4, LE8 BIC = 7315.5; strong evidence of

TABLE 2 Associations between LE8 and cognition ($n = 1539$).

	Global cognitive performance			Speed			Working memory			Attention			Executive function			Visual orientation		
	B	95% CI	β	B	95% CI	β	B	95% CI	β	B	95% CI	β	B	95% CI	β	B	95% CI	β
LE8	0.02***	[0.01, 0.03]	0.08	0.00	[0.00, 0.01]	0.01	0.01***	[0.01, 0.02]	0.17	0.02***	[0.01, 0.03]	0.10	0.00	[0.00, 0.01]	0.03	0.00	[0.00, 0.01]	0.03
Intercept	1.48	[−0.18, 3.14]		1.55***	[0.77, 2.34]		−1.19***	[−1.71, −0.67]		1.11	[−0.03, 2.25]		1.08*	[0.23, 1.93]		0.04	[−0.71, 0.79]	
Male sex (ref: women)	0.23	[−0.08, 0.54]	0.03	−0.12	[−0.26, 0.03]	−0.04	0.20***	[0.10, 0.30]	0.10	−0.04	[−0.25, 0.18]	−0.01	−0.26**	[−0.42, −0.10]	−0.08	0.41***	[0.26, 0.55]	0.13
Black race (ref: White)	−1.31***	[−1.63, −0.98]	−0.18	−0.41***	[−0.56, −0.25]	−0.13	−0.14**	[−0.24, −0.03]	−0.07	−0.73***	[−0.95, −0.50]	−0.15	−0.26**	[−0.43, −0.10]	−0.08	−0.50***	[−0.65, −0.36]	−0.16
Poverty status<125% (ref:>125%)	−0.63***	[−0.96, −0.31]	−0.08	−0.27***	[−0.42, −0.11]	−0.08	−0.08	[−0.18, 0.03]	−0.04	−0.61***	[−0.83, −0.38]	−0.12	0.00	[−0.16, −0.17]	0.00	−0.29***	[−0.44, −0.14]	−0.09
Sleep apnea (ref: no sleep apnea)	0.28	[−0.26, 0.81]	0.02	0.15	[−0.10, 0.41]	0.03	0.01	[−0.16, 0.17]	0.00	0.10	[−0.26, 0.47]	0.01	0.06	[−0.22, 0.33]	0.01	0.06	[−0.18, 0.31]	0.01
Age	−0.11***	[−0.13, −0.09]	−0.28	−0.04***	[−0.05, −0.03]	−0.24	0.00	[−0.01, 00]	−0.01	−0.07***	[−0.08, −0.06]	−0.26	−0.04***	[−0.05, −0.03]	−0.22	−0.03***	[−0.04, −0.02]	−0.17
WRAT literacy	0.13***	[0.11, 0.15]	0.27	0.03***	[0.02, 0.04]	0.17	0.01***	[0.01, 0.02]	0.12	0.07***	[0.06, 0.09]	0.24	0.03***	[0.02, 0.04]	0.16	0.05***	[0.04, 0.05]	0.23
Depressive symptoms	−0.06***	[−0.08, −0.05]	−0.18	−0.02***	[−0.03, −0.01]	−0.13	0.00	[−0.01, 0.00]	−0.02	−0.04***	[−0.05, −0.03]	−0.17	−0.01***	[−0.02, −0.01]	−0.09	−0.03***	[−0.03, −0.02]	−0.17

Note: The column name represents the cognitive outcome. B = unstandardized beta, β = standardized beta, CI = confidence interval.
Abbreviations: LE8, Life's Essential 8; WRAT, Wide Range Achievement Test.
*$p < 0.05$.
**$p < 0.01$.
***$p < 0.001$.

TABLE 3 LS7/LE8 and cognition model comparisons ($n = 1428$).

	LS7 BIC	LE8 BIC	BIC difference	95% confidence interval of BIC difference	Raftery guidelines: evidence associated with a difference[a]	Vuong test: non-nested likelihood ratio test[b]
Global cognitive performance	7309.357	7315.540	−6.183	[−17.332, 4.965]	"Strong" evidence of difference	models are distinguishable ($p < 0.001$), but model fits are equal for the focal population (p's > 0.05).
Speed	5218.880	5222.296	−3.416	[−8.945, 2.114]	"Positive" evidence of difference	Models are distinguishable ($p = 0.028$), but model fits are equal for the focal population (p's > 0.05).
Working memory	4018.724	4003.567	15.157	[−1.117, 31.433]	"Very strong" evidence of difference	Models are distinguishable ($p < 0.001$); LE8 model fits better than LS7 model ($p = 0.034$)
Attention	6255.013	6259.795	−4.782	[−16.178, 6.614]	"Positive" evidence of difference	Models are distinguishable ($p < 0.001$), but model fits are equal for the focal population (p's > 0.05).
Executive function	5369.202	5371.402	−2.2	[−8.035, 3.635]	"Positive" evidence of difference	Models are indistinguishable ($p = 0.102$); cannot use test
Visual orientation	5043.942	5045.209	−1.267	[−5.857, 3.322]	"Weak" evidence of difference	Models are indistinguishable ($p = 0.175$); cannot use test

Note: Participant $n = 1428$ (LS7 and LE8 complete participant data overlap). Covariates were included in all models.
Abbreviations: BIC, Bayesian information criterion; LE8, Life's Essential 8; LS7, Life's Simple 7.
[a]Evidence associated with a difference of 0–2 in BIC is considered weak, 2–6 is positive, 6–10 is strong, > 10 is very strong (1995 Raftery).
[b]If the models are indistinguishable, Vuong's Closeness Test can test partially non-nested models for model fit (1989 Vuong).

a difference). However, Vuong's non-nested likelihood ratio test indicated that we were not able to reject the null hypothesis that the model fits are equal for the focal population ($p > 0.05$).

Similar to the primary analyses, LS7 and LE8 (from the overlapping sample) were both associated with working memory and attention cognitive domains. The LE8 model outperformed the LS7 model in the working memory domain, using both Raftery's and Vuong's guidelines (Raftery: LS7 working memory BIC = 4018.7, LE8 working memory BIC = 4003.6, very strong evidence of a difference; Vuong: LE8 model fits better than the LS7 model, $p = 0.034$). There was no meaningful difference in BIC in the attention domain (Raftery: LS7 attention BIC = 6255.0, LE8 attention BIC = 6259.8; positive evidence of a difference; Vuong: models fits are equal for the focal population).

Finally, there were no meaningful model fit differences in the LS7/LE8 models that were not associated with cognition domains ($p > 0.05$: speed, executive function, visual orientation).

3.4 | Comparison between LS7 and LE8's (without sleep metric) associations with cognition

There were only slight changes to LE8 BIC in each model with the removal of the sleep metric, which is also reflected in changes to the difference in BIC between LE8 and LS7 (see Table 4). Additionally, in the Global Cognitive Performance model comparison using Raftery's guidelines, there was only "positive" evidence of BIC difference between LE8 (without sleep) and LS7, compared to "strong" evidence of BIC difference between LE8 (with sleep) and LS7. There were no other differences in the Raftery guidelines and Vuong test on model performance between Table 3 (LE8 with sleep) and Table 4 (LE8 without sleep).

4 | DISCUSSION

As indicated by a higher LE8 score, better CVH is associated with better cognitive performance among the HANDLS sample of US middle-aged and older adults. A higher LE8 composite score was significantly associated with better global cognitive performance, working memory, and attention, but not visual orientation, executive function, or processing speed. Secondary analyses showed inconsistent model performance for the associations between cognitive performance and the older LS7 measure versus the newer LE8 measure, which adds a sleep category, revises metric scaling, and calculates the composite score differently. Interestingly, in direct model comparisons, LS7 outperformed the LE8 (with and without sleep) on global cognitive performance using Raftery's BIC difference guidelines. However, the LE8 (with and without sleep) outperformed the LS7 model for the working memory domain using both Raftery's and Vuong's guidelines. Thus, we speculate that the updated scaling of the metrics in LE8 was more influential in the comparison between LE8/LS7 and cognition models than the addition of the sleep duration metric. Overall, our findings suggest that both LS7 and LE8 may be significant tools for evaluating interventions to lower the risk of cognitive decline.

The current study's findings support the biopsychosocial cardiovascular disease framework[26] and empirical evidence supporting the interconnections among cardiovascular risk and disease (e.g., hypertension, diabetes, obesity) to cognition.[27–29] In fact, numerous studies

TABLE 4 LS7/LE8 (without sleep metric) and cognition model comparisons (n = 1428).

	LS7 BIC	LE8 BIC	BIC difference	95% confidence interval of BIC difference	Raftery guidelines: evidence associated with a difference[a]	Vuong test: non-nested likelihood ratio test[b]
Global Cognitive Performance	7309.357	7314.513	−5.156	[−15.505, 5.193]	"Positive" evidence of difference	Models are distinguishable ($p < 0.001$), but model fits are equal for the focal population (p's > 0.05).
Speed	5218.880	5222.112	−3.232	[−8.352, 1.887]	"Positive" evidence of difference	Models are distinguishable ($p = 0.032$), but model fits are equal for the focal population (p's > 0.05).
Working memory	4018.724	4002.629	16.095	[0.781,31.410]	"Very strong" evidence of difference	Models are distinguishable ($p < 0.001$); LE8 model fits better than LS7 model ($p = 0.0197$)
Attention	6255.013	6258.714	−3.701	[14.437, 7.036]	"Positive" evidence of difference	Models are distinguishable ($p < 0.001$), but model fits are equal for the focal population (p's > 0.05).
Executive function	5369.202	5371.304	−2.102	[−7.423, 3.219]	"Positive" evidence of difference	Models are indistinguishable ($p = 0.092$); cannot use test
Visual orientation	5043.942	5045.136	−1.194	[−5.476, 3.087]	"Weak" evidence of difference	Models are indistinguishable ($p = 0.173$); cannot use test

Note: Participant $n = 1428$ (LS7 and LE8 complete participant data overlap). The LE8 (without sleep metric) composite score was calculated as the unweighted average of the seven component metric scores, whereas the full LE8 composite score (Table 3) was calculated as the unweighted average of all eight component metric scores (including sleep). Covariates were included in all models.

Abbreviations: BIC, Bayesian information criterion; LE8, Life's Essential 8; LS7, Life's Simple 7.

[a]Evidence associated with a difference of 0-2 in BIC is considered weak, 2-6 is positive, 6-10 is strong, > 10 is very strong (1995 Raftery).

[b]If the models are indistinguishable, Vuong's Closeness Test can test partially non-nested models for model fit (1989 Vuong).

have suggested a link between CVH and cognition using LS7.[30,9] Recent studies using LE8 have primarily explored associations between metabolic dysfunction-associated fatty liver disease, incidence of cardiovascular outcomes, and clinically significant weight loss among other health outcomes.[31–34] Only one study examined LE8's association with cognition. Zhou et al.[35] examined the association among LE8 scores and risk of dementia, cognition, and neuroimaging outcomes in middle-aged to older adults (ages 37–73) in a sample of participants from the UK Biobank without prevalent cardiovascular disease or dementia at baseline. Their findings indicated that individuals with intermediate LE8 profiles (LE8 scores ranging from 50 to 79) had higher fluid intelligence (verbal–numerical reasoning) and numeric memory (maximum digits remembered) than those with poor LE8 profiles. The same association persisted comparing those with optimal LE8 profiles to those with poor LE8 profiles. Although the direction of these findings is consistent with our results, the same cognitive domains were not examined and the LE8 score was categorized to create poor, intermediate, and optimal profiles. Moreover, the directionality of our findings are consistent with a body of literature demonstrating a positive association between higher LS7 and varying cognitive domains.[12] Specifically, Speh et al.[12] identified that having an optimal LS7 score was associated with better baseline performance for perceptual speed, verbal fluency, and global cognition. In sum, our study findings highlight not only the utility of LE8 as a continuous metric but a call for more researchers to incorporate LE8 in their studies examining associations between CVH and various domains of cognition (e.g., memory, attention).

To our knowledge, there are no comparative studies using LS7 and LE8 pertaining to cognition. There are studies that have compared the predictive value between LS7 and LE8 to predict the likelihood of major adverse cardiac events (MACEs) and evaluate CVH in samples ranging from early childhood to middle adulthood.[36–38] As our study findings indicated, all previous studies also identified concordance in directionality between the two constructs. However, unlike our study, LE8 outperformed LS7. For example, using multivariable Cox proportional hazards analysis, Gao et al.[36] demonstrated that LE8 was a significant influencing factor of MACEs risk. Furthermore, their results from area under the curve (AUC) analyses illustrated the AUC was higher for LE8 than LS7. Additionally, studies by Perng et al.[37] and Shetty et al.[38] identified that LE8 yielded a moderate percentage of discrepancy between the proportion of participants in each category (poor, intermediate, ideal) based on LS7 and LE8 metrics. That is, the categorization of the participants based on LS7 and LE8 differed depending on the cutoff points for each score.

Our findings in the comparison of LS7 versus LE8 for cognition are inconsistent with some prior findings, potentially due to different survey tools and questionnaires used in the calculation of LS7/LE8 measures. For example, for the calculation of the PA metric, we used self-reported duration categories of moderate and vigorous activities (e.g., 1–2 hours) from the Baecke Questionnaire for PA [39] as an estimation, rather than a measure of self-reported continuous minutes of moderate-to-vigorous PA. These types of measurement differences between individuals' self-evaluation may lead to an inconsistency of the data accuracy across participants. Additionally, we had

limited information about electric cigarette use and secondhand smoke exposure as recommended by LE8 criteria for the nicotine exposure category. See Table S1 for LE8/LS7 calculations.

Aside from the availability of data from our study to create similar individual metrics, there were several major differences in the published classification of LE8 compared to LS7. These differences, and our results from the comparison between LS7 and LE8's (without sleep) associations with cognition, may suggest that the discrepancies in the LS7/LE8 models are not necessarily attributed to the inclusion of sleep duration in the LE8 but could be influenced by classification of some of the original LS7 components. For more detailed information on the differences between LS7 and LE8, see Supplementary Text in supporting information. Overall, the differences in the current study between LS7 and LE8 in measurement and their relationship with cognition warrant further analyses in a different sample to determine whether the findings are consistently observable. This may prompt conversations on which metric is particularly clinically sensitive to estimate risk on particular cognitive ability. Differences between LS7 and LE8 may have clinical implications for longitudinal assessments of health, as longitudinal studies that shift from LS7 to LE8 may show differences due to the meaningful consensus updates. We recommend that researchers recalculate the LE8 CVH construct on prior samples that use LS7.

This study addresses the gap in knowledge about the association between LE8 and cognition, particularly computerized cognitive performance. The strengths include its large diverse sample. Specifically, Black adults and adults from low socioeconomic status (SES) backgrounds are at disproportionate risk for cardiovascular disease[40] and/or cognitive impairment, particularly ADRD.[41] Few studies have explored the intersection of cognition and CVH using a sample, similar to the current study, that consists of a large number of Black adults and adults from lower SES backgrounds.[42,9] Thus, the diverse demographic characteristics of the current study's sample and exploration of the association between LE8 and cognition align with scientific recommendations for a more inclusive representation of these groups to better understand mechanisms linked to health risk. Similarly, the middle age of the study sample is a strength. Midlife is a critical period to identify factors associated with cognitive health and decline.[27,43,44] Exploration of cognitive health at midlife may identify early and meaningful sources of cognitive health as individuals approach older adulthood.

Although the study has several strengths, there are limitations. First, the study sample is limited to adults residing in Baltimore, Maryland, who may have unique sociocontextual experiences (e.g., access to health providers, high-quality housing, nutrition-rich food options) that could influence the association between LE8 and cognition. Thus, the study findings may not be generalizable to participants from other geographic settings. Additionally, only 71% ($n = 1539$) of the full HANDLS wave 4 sample ($n = 2171$) were included in our primary analyses due to having sufficient data; therefore, the participants included in our study may represent a biased sample. Second, the study's cross-sectional data limit the ability to detect whether LE8 relates to changes in cognition. Future studies should explore this relationship using longitudinal data, and explore the predictive power of each LE8 component and the connection between LE8 and biomarkers of systemic inflammation associated with cognitive health.[45–48] Third, the calibration of measures is not a one-to-one match to the components of LE8 or LS7. That is, this study extracted measures from a larger study (i.e., HANDLS) to create the aggregate measures to calculate LE8 scores. Many of these survey measures differed from the metric measurements recommended in Lloyd-Jones et al.,[14] such as PA duration and nicotine exposure. Last, future work should measure behavior metrics objectively, such as PA and sleep duration, as self-reported measures are prone to bias.

Our findings indicate that higher LE8 and LS7 composite scores are associated with better cognitive performance among US middle-aged and older adults; however, one score didn't systematically outperform the other. The addition of the new sleep duration metric made only minor variations to the LE8/LS7 and cognition model comparisons, in contrast to the change in scaling of metrics and calculation of the new composite score. Although the addition of a sleep component to LS7 is crucial given the associations between cardiometabolic risks and poor sleep health,[49–51] current research indicates the importance of other sleep elements, such as quality and timing, rather than only nighttime sleep duration.[52,53] Thus, incorporating a multi-dimensional sleep category may be appropriate for future updates to AHA's LE8 when using the composite score to enhance the scientific understanding of the associations between CVH and cognition.

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CONFLICT OF INTEREST STATEMENT

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CONSENT STATEMENT

All human subjects provided written informed consent.

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REFERENCES

1. Organization WH. Fact sheets of dementia. Accessed 8/16/2023 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9081392/#b2-arm-22027
2. Manly JJ, Jones RN, Langa KM, et al. Estimating the prevalence of dementia and mild cognitive impairment in the US: the 2016 health and retirement study harmonized cognitive assessment protocol project. *JAMA Neurol*. 2022;79(12):1242-1249.
3. Hebert LE, Weuve J, Scherr PA, Evans DA. Alzheimer disease in the United States (2010-2050) estimated using the 2010 census. *Neurology*. 2013;80(19):1778-1783.
4. Johansen MC, Langton-Frost N, Gottesman RF. The role of cardiovascular disease in cognitive impairment. *Curr Geriatr Rep*. 2020;9:1-9.
5. Deckers K, Schievink SHJ, Rodriquez MMF, et al. Coronary heart disease and risk for cognitive impairment or dementia: systematic review and meta-analysis. *PLoS One*. 2017;12(9):e0184244.
6. Cannon JA, Moffitt P, Perez-Moreno AC, et al. Cognitive impairment and heart failure: systematic review and meta-analysis. *J Card Fail*. 2017;23(6):464-475.
7. Benjamin EJ, Muntner P, Alonso A, et al. Heart disease and stroke statistics-2019 update: a report from the American Heart Association. *Circulation*. 2019;139(10):e56-e528.
8. Lloyd-Jones DM, Hong Y, Labarthe D, et al. Defining and setting national goals for cardiovascular health promotion and disease reduction: the American Heart Association's strategic impact goal through 2020 and beyond. *Circulation*. 2010;121(4):586-613.
9. Thacker EL, Gillett SR, Wadley VG, et al. The American Heart Association Life's Simple 7 and incident cognitive impairment: the Reasons for Geographic and Racial Differences in Stroke (REGARDS) study. *J Am Heart Assoc*. 2014;3(3):e000635.
10. Gonzalez HM, Tarraf W, Gouskova N, et al. Life's Simple 7's cardiovascular health metrics are associated with Hispanic/Latino neurocognitive function: HCHS/SOL results. *J Alzheimers Dis*. 2016;53(3):955-965.
11. Wei J, Wang L, Kulshreshtha A, Xu H. Adherence to Life's Simple 7 and cognitive function among older adults: the National Health And Nutrition Examination Survey 2011 to 2014. *J Am Heart Assoc*. 2022;11(6):e022959.
12. Speh A, Wang R, Winblad B, et al. The relationship between cardiovascular health and rate of cognitive decline in young-old and old-old adults: a Population-Based Study. *J Alzheimers Dis*. 2021;84(4):1523-1537.
13. Pool LR, Ning H, Huffman MD, Reis JP, Lloyd-Jones DM, Allen NB. Association of Cardiovascular Health through early adulthood and health-related quality of life in middle age: the Coronary Artery Risk Development in Young Adults (CARDIA) study. *Prev Med*. 2019;126:105772.
14. Lloyd-Jones DM, Allen NB, Anderson CAM, et al. Life's Essential 8: updating and enhancing the American Heart Association's construct of cardiovascular health: a presidential advisory from the American Heart Association. *Circulation*. 2022;146(5):e18-e43. doi:10.1161/CIR.0000000000001078
15. Quinones AR, Kaye J, Allore HG, Botoseneanu A, Thielke SM. An agenda for addressing multimorbidity and racial and ethnic disparities in Alzheimer's disease and related dementia. *Am J Alzheimers Dis Other Demen*. 2020;35:1533317520960874.
16. Evans MK, Lepkowski JM, Powe NR, LaVeist T, Kuczmarski MF, Zonderman AB. Healthy Aging in Neighborhoods of Diversity across the Life Span (HANDLS): overcoming barriers to implementing a longitudinal, epidemiologic, urban study of health, race, and socioeconomic status. *Ethn Dis*. 2010;20(3):267-275.
17. Beydoun MA, Georgescu MF, Hossain S, et al. Life's simple 7 and its association with trajectories in depressive symptoms among urban middle-aged adults. *J Affect Disord*. 2023;333:447-458.
18. Gamaldo AA, Tan SC, Sardina AL, et al. Older Black adults' satisfaction and anxiety levels after completing alternative versus traditional cognitive batteries. *J Gerontol B Psychol Sci Soc Sci*. 2020;75(7):1462-1474.
19. Basner M, Savitt A, Moore TM, et al. Development and validation of the cognition test battery for spaceflight. *Aerosp Med Hum Perform*. 2015;86(11):942-952.
20. Dobbs D, Sadeq NA, Peterson L, et al. Middle-aged and older Black adults' experiences completing a traditional paper-and-pencil cognitive battery and two contemporary computerized cognitive batteries. *Neuropsychol Dev Cogn B Aging Neuropsychol Cogn*. 2021;28(4):600-615.
21. Radloff LS. The CES-D scale: a self-report depression scale for research in the general population. *Appl Psychol Meas*. 1977;1(3):385-401.
22. Singer JD, Willett JB. *Applied longitudinal data analysis: modeling change and event occurrence*. Oxford University Press;2003.
23. Raftery AE. Bayesian model selection in social research. *Sociol Methodol*. 1995;25:111-163.
24. Vuong QH. Likelihood ratio tests for model selection and non-nested hypotheses. *Econometrica*. 1989;57(2):307-333.
25. Merkle EC, You D. *nonnest2: Tests of Non-Nested Models*. R package version 0.5-6 Web site. Published 2023. Accessed. https://CRAN.R-project.org/package=nonnest2
26. Kahl KG, Stapel B, Heitland I. A lonely heart is a broken heart: it is time for a biopsychosocial cardiovascular disease model. *Eur Heart J*. 2023;44(28):2592-2594.
27. Knopman D, Boland LL, Mosley T, et al. Cardiovascular risk factors and cognitive decline in middle-aged adults. *Neurology*. 2001;56(1):42-48.
28. Kulshreshtha A, Saini J, German T, Alonso A. Association of Cardiovascular Health and Cognition. *Current Epidemiology Reports*. 2019;6(3):347-363.
29. Bauer P, Kraushaar L, Junemann M. Vascular ageing and the complex relationship between cognitive decline and cardiovascular disease. *Eur J Prev Cardiol*. 2023;30(7):533-534.
30. Samieri C, Perier MC, Gaye B, et al. Association of Cardiovascular Health level in older age with cognitive decline and incident dementia. *JAMA*. 2018;320(7):657-664.
31. Wang X, Wang A, Zhang R, Cheng S, Pang Y. Life's Essential 8 and MAFLD in the United States. *J Hepatol*. 2023;78(2):e61-e63.
32. Hill EB, Cubellis LT, Wexler RK, Taylor CA, Spees CK. Differences in adherence to American Heart Association's Life's Essential 8, diet quality, and weight loss strategies between those with and without recent clinically significant weight loss in a nationally representative sample of US adults. *J Am Heart Assoc*. 2023;12(8):e026777.
33. Petermann-Rocha F, Deo S, Celis-Morales C, et al. An opportunity for prevention: associations between the Life's Essential 8 score and cardiovascular incidence using prospective data from UK biobank. *Curr Probl Cardiol*. 2023;48(4):101540.
34. Sun Y, Yu Y, Zhang K, et al. Association between Life's Essential 8 score and risk of premature mortality in people with and without type 2 diabetes: a prospective cohort study. *Diabetes Metab Res Rev*. 2023;39(5):e3636.
35. Zhou R, Chen HW, Li FR, Zhong Q, Huang YN, Wu XB. "Life's Essential 8" cardiovascular health and dementia risk, cognition, and neuroimag-

ing markers of brain health. *J Am Med Dir Assoc*. 2023;24(11):1791-1797.
36. Gao X, Ma X, Lin P, et al. Predictive value of cardiovascular health score for health outcomes in patients with PCI: comparison between Life's Simple 7 and Life's Essential 8. *Int J Environ Res Public Health*. 2023;20(4):3084.
37. Perng W, Aris IM, Slopen N, et al. Application of Life's Essential 8 to assess cardiovascular health during early childhood. *Ann Epidemiol*. 2023;80:16-24.
38. Shetty NS, Parcha V, Patel N, et al. AHA Life's essential 8 and ideal cardiovascular health among young adults. *Am J Prev Cardiol*. 2023;13:100452.
39. Baecke JA, Burema J, Frijters JE. A short questionnaire for the measurement of habitual physical activity in epidemiological studies. *Am J Clin Nutr*. 1982;36(5):936-942.
40. Javed Z, Haisum Maqsood M, Yahya T, et al. Race, racism, and cardiovascular health: applying a social determinants of health framework to racial/ethnic disparities in cardiovascular disease. *Circ Cardiovasc Qual Outcomes*. 2022;15(1):e007917.
41. Nianogo RA, Rosenwohl-Mack A, Yaffe K, Carrasco A, Hoffmann CM, Barnes DE. Risk factors associated with Alzheimer disease and related dementias by sex and race and ethnicity in the US. *JAMA Neurol*. 2022;79(6):584-591.
42. Gonzalez HM, Tarraf W, Harrison K, et al. Midlife cardiovascular health and 20-year cognitive decline: Atherosclerosis risk in communities study results. *Alzheimers Dement*. 2018;14(5):579-589.
43. Cerhan JR, Folsom AR, Mortimer JA, et al, Atherosclerosis Risk in Communities (ARIC) Study Investigators. Correlates of cognitive function in middle-aged adults. *Gerontology*. 1998;44(2):95-105.
44. Ryan CM, Geckle MO. Circumscribed cognitive dysfunction in middle-aged adults with type 2 diabetes. *Diabetes Care*. 2000;23(10):1486-1493.
45. Noble JM, Manly JJ, Schupf N, Tang MX, Mayeux R, Luchsinger JA. Association of C-reactive protein with cognitive impairment. *Arch Neurol*. 2010;67(1):87-92.
46. Schram MT, Euser SM, de Craen AJ, et al. Systemic markers of inflammation and cognitive decline in old age. *J Am Geriatr Soc*. 2007;55(5):708-716.
47. Teunissen CE, van Boxtel MP, Bosma H, et al. Inflammation markers in relation to cognition in a healthy aging population. *J Neuroimmunol*. 2003;134(1-2):142-150.
48. Yaffe K, Lindquist K, Penninx BW, et al. Inflammatory markers and cognition in well-functioning African-American and White elders. *Neurology*. 2003;61(1):76-80.
49. Buxton OM, Lee S, Marino M, Beverly C, Almeida DM, Berkman L. Sleep health and predicted cardiometabolic risk scores in employed adults from two industries. *J Clin Sleep Med*. 2018;14(3):371-383.
50. St-Onge MP, Grandner MA, Brown D, et al. Sleep duration and quality: impact on lifestyle behaviors and cardiometabolic health: a scientific statement from the American Heart Association. *Circulation*. 2016;134(18):e367-e386.
51. Kwok CS, Kontopantelis E, Kuligowski G, et al. Self-reported sleep duration and quality and cardiovascular disease and mortality: a dose-response meta-analysis. *J Am Heart Assoc*. 2018;7(15):e008552.
52. Ji L, Wallace ML, Master L, et al. Six multidimensional sleep health facets in older adults identified with factor analysis of actigraphy: results from the Einstein Aging Study. *Sleep Health*. 2023;9(5):758-766.
53. Lee S, Kaufmann CN. Multidimensional sleep health approach to evaluate the risk of morbidity and mortality in diverse adult populations. *Sleep*. 2023;46(9):zsad075.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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Supplementary Text: Differences in LS7 and LE8 component calculations

First, for the classification of BMI, LE8 provided more specific guidelines (5 vs. 3 categories based in part on National Heart, Lung, and Blood Institute guidelines). Second, the classification of blood pressure and cholesterol in LE8 was handled by subtracting points for taking medications, whereas in LS7, the category was automatically “intermediate” if a participant was “treating to goal”. Moreover, LE8 used non-HDL cholesterol, where LS7 used total cholesterol. For the blood glucose category, LE8 used HbA1c (both fasting and non-fasting), where LS7 required using fasting glucose. The classification of physical activity was broken down by minutes of the total time of moderate and vigorous activities in LE8, while in LS7 the total time of moderate and vigorous activities were counted separately, with only the “ideal” category specified by minutes. Lastly, the smoking classification in LE8 includes quit smoking information over the last 5 years, while LS7 only includes quitting information less than or greater than the last 12 months.

Supplemental Material

Supplemental Table S1. Calculation of Life's Simple 7 and Life's Essential 8

CVH metric	Life's Simple 7*			Life's Essential 8		
	Method of Measurement	*Proposed cut-offs*		*Method of Measurement*	*Proposed cut-offs*	
Sleep health	N/A	N/A		Self-reported sleep duration from PSQI survey	**Points**	**Level**
					100	7–<9
					90	9–<10
					70	6–<7
					40	5–<6 or ≥10
					20	4–<5
					0	<4
Nicotine exposure	Self-reported smoking questionnaire	*Poor*	Current smoker	Self-reported smoking questionnaire	**Points**	**Status**
		Intermediate	Former smoker and smoked in the last 12 months		100	Never smoked (never tried, or tried and never used regularly)
		Ideal	"Never tried" or "Tried, never used regularly", or former smoker who did not smoke in the last 12 months		75	Former smoker, quit ≥5 years
					50	Former smoker, quit 1–<5 years
					25	Former smoker, quit <1 year, or used electronic cigarettes (1+ days) in the past month
					0	Current smoker
Body mass index	Measured height and weight (BMI = kg/m2)	*Poor*	≥30	Measured height and weight (BMI = kg/m2)	**Points**	**Level**
		Intermediate	≥25 and <30		100	<25
		Ideal	<25		70	25.0–29.9
					30	30.0–34.9
					15	35.0–39.9
					0	≥40.0
Physical activity		*Poor*	Not reporting any activities		**Points**	**Minutes**

	Estimated minutes of moderate or vigorous physical activity by self-reported validated Baecke questionnaire (BQ)**	*Intermediate*	Have moderate or vigorous activities, but not meet the Ideal criteria, or reported only having leisure (low) activity	Estimated total minutes of moderate and vigorous physical activity by self-reported validated Baecke questionnaire (BQ)**	100	≥150
		Ideal	≥150min moderate activity, or ≥75min vigorous activity		90	120–149
					80	90–119
					60	60–89
					40	30–59
					20	1–29
					0	0
Diet	Self-reported Healthy Eating Index tool (HEI-2010)	*Poor*	have 0-1 diet elements in the HEI-2010	Self-reported Healthy Eating Index tool; (HEI-2015; HANDLS population quantile)	**Points**	**Quantile**
		Intermediate	have 2-3 diet elements in the HEI-2010		100	≥95th percentile (top/ideal diet)
		Ideal	have 4-5 diet elements in the HEI-2010		80	75th–94th percentile
					50	50th–74th percentile
					25	25th–49th percentile
					0	1st–24th percentile (bottom/least ideal quartile)
Blood lipids	Measured total cholesterol, mg/dL & medication use (Choleserolemia or Statin)	*Poor*	total cholesterol ≥240	Non-HDL cholesterol (calculated using plasma total and HDL cholesterol); subtract 20 points if treated with Statin or Choleserolemia medications	**Points**	**Level**
		Intermediate	total cholesterol 200-239 or taking medication AND total cholesterol<200)		100	<130
		Ideal	total cholesterol <200 and no medication		60	130–159
					40	160–189
					20	190–219
					0	≥220
Blood pressure	Measured systolic (SBP) and diastolic (DSP) blood pressure; average of left	*Poor*	SBP ≥140 OR DBP >=90	Measured systolic and diastolic blood pressure (average of left and right arms);	**Points**	**Level**
		Intermediate	SBP 120–139 AND DBP 80–89; OR taking medication		100	<120/<80 (optimal)
		Ideal	<120 and <80 AND no medication		75	120–129/<80 (elevated)
					50	130–139 or 80–89 (stage 1 hypertension)

	and right arms & medication use (anti-hypertensive medications)			subtract 20 points if treated with anti-hypertensive medications	25	140–159 or 90–99
					0	≥160 or ≥100
Blood glucose	Measured fasting glucose (mg/dl) & medication use (diabetes medication)	*Poor*	Glucose ≥126	Measurement: HbA1c (%); diabetes diagnosis	**Points**	**Level**
		Intermediate	Glucose 100-125 OR taking medication and glucose <100)		100	No diabetes diagnosis and HbA1c < 5.7
		Ideal	Glucose <100 and no medication		60	No diabetes diagnosis and HbA1c 5.7–6.4
					40	Diabetes diagnosis and HbA1c <7.0 OR no diabetes diagnosis (or missing) and HbA1C 6.4-7.0
					30	HbA1c 7.0–7.9 (regardless of dx)
					20	HbA1c 8.0–8.9 (regardless of dx)
					10	HbA1c 9.0–9.9 (regardless of dx)
					0	HbA1c ≥10.0 (regardless of dx)
Score	Each metric is rated as 0: Poor; 1: intermediate; 2: ideal; these are summed to yield LS7 score (higher is better)			The new aggregate score is scaled from 0 to 100 points, calculated as the unweighted average of all 8 component metric scores (higher is better)		

Notes: Refer to 2010 Lloyd-Jones and 2022 Lloyd-Jones for LS7 and LE8 recommended calculations. *Refer to 2023 Beydoun supplemental materials for detailed component calculations of the LS7. **The classification of physical activity (low, moderate, vigorous) was based on self-reported categories of physical activity (low, medium, high). For duration, self-reported category of <1hr was estimated as 30min, 1hr-2hr category was estimated as 90min, 2hr-3hr category was estimated as 150min, 3hr-4hr category was estimated as 210min,>4hr category was estimated as 270min.

Abbreviations

CVH: Cardiovascular Health; PA: physical activity; BPAQ: Bone-specific Physical Activity Questionnaire; kg/m2: kilograms weight/meters height squared; PSQI: Pittsburgh Sleep Quality Index

Supplemental Table S2. Associations between Life's Essential 8 (or Life's Simple 7) and Cognition (n=1428)

	Global Cognitive Performance			Speed			Working Memory			Attention			Executive Function			Visual Orientation		
	B	***95% CI B***	**β**	***B***	***95% CI B***	**β**	***B***	***95% CI B***	**β**	***B***	***95% CI B***	**β**	***B***	***95% CI B***	**β**	***B***	***95% CI B***	**β**
Life's Essential 8	.02***	[.01, .04]	.09	.00	[.00, .01]	.01	.01***	[.01, .02]	.17	.02***	[.01, .03]	.10	.01	[.00, .01]	.04	.00	[.00, .01]	.04
Intercept	1.21	[-.51, 2.93]		1.42***	[.59, 2.25]		-1.11***	[-1.65, -.57]		.97	[-.22, 2.16]		.94*	[.07, 1.81]		-.04	[-.82, .74]	
Male Sex (ref: Women)	.26	[-.07, .59]	.04	-.10	[-.25, .06]	-.03	.21***	[.10, .31]	.10	-.02	[-.25, .20]	.00	-.24**	[-.40, -.07]	-.07	.39***	[.24, .54]	.12
Black Race (ref: White)	-1.23***	[1.57, -.90]	-.17	-.40***	[-.56, -.24]	-.12	-.12*	[-.22, -.01]	-.06	-.69***	[-.92, -.46]	-.14	-.24**	[-.41, -.07]	-.07	-.48***	[-.63, -.33]	-.15
Poverty Status <125% (ref: >125%)	-.59***	[-.93, -.25]	-.08	-.27**	[-.44, -.11]	-.08	-.06	[-.17, .04]	-.03	-.57***	[-.81, -.34]	-.11	.00	[-.17, .18]	.00	-.26***	[-.41, -.11]	-.08
Sleep Apnea (ref: no sleep apnea)	.28	[-.28, .84]	.02	.16	[-.11, .42]	.03	-.04	[-.22, .13]	-.01	.10	[-.29, -.49]	.01	.08	[-.20, .36]	.01	.09	[-.16, .34]	.02
Age	-.11***	[-.13, -.09]	-.28	-.04***	[-.05, -.03]	-.23	.00	[-.01, .00]	-.02	-.07***	[-.08, -.06]	-.26	-.04***	[-.05, -.03]	-.22	-.03***	[-.04, -.02]	-.17
WRAT Literacy	.13***	[.11, .15]	.28	.03***	[.02, .04]	.17	.01***	[.01, .02]	.11	.07***	[.06, .09]	.24	.03***	[.02, .04]	.16	.05***	[.04, .06]	.24
Depressive Symptoms	-.06***	[-.08, -.05]	-.18	-.02***	[-.03, -.01]	-.13	.00	[-.01, .00]	-.03	-.04***	[-.05, -.03]	-.17	-.01**	[-.02, .00]	-.08	-.03***	[-.03, -.02]	-.18
Life's Essential 7	.18***	[.10, .26]	.10	.04	[.00, .07]	.05	.06***	[.04, .09]	.13	.13***	[-.20, 2.13]	.11	.04*	[.00, .08]	.06	.03	[.00, .07]	.04
Intercept	1.13	[-.55, 2.81]		1.19**	[.39, 2.00]		-.88**	[-1.41, -.35]		.96	[.07, .18]		.88*	[.03, 1.73]		-.06	[-.83, .70]	
Male Sex (ref: Women)	.24	[-.09, .56]	.03	-.10	[-.26, .05]	-.03	.20***	[.10, .30]	.10	-.04	[-.26, .19]	-.01	-.25**	[.41, -.08]	-.07	.39***	[.24, .53]	.12
Black Race (ref: White)	-1.25***	[-1.59, -0.91]	-.17	-.40***	[-.56, -.23]	-.12	-.13*	[-.24, -.02]	-.06	-.70***	[-.93, -.47]	-.14	-.24**	[-.41, -.07]	-.07	-.48***	[-.64, -.33]	-.15
Poverty Status <125% (ref: >125%)	-.60***	[-.94, -.26]	-.08	-.27**	[-.43, -.10]	-.08	-.07	[-.18, .04]	-.03	-.57***	[-.81, -.34]	-.11	.00	[-.17, .18]	.00	-.26***	[-.41, -.11]	-.08
Sleep Apnea (ref: no sleep apnea)	.29	[-.27, .85]	.02	.18	[-.09, .44]	.03	-.06	[-.24, .11]	-.02	.10	[-.29, .48]	.01	.09	[-.20, .37]	.02	.09	[-.16, .34]	.02
Age	-.11***	[-.13, -.09]	-.27	-.04***	[-.05, -.03]	-.23	.00	[-.01, .00]	-.02	-.07***	[-.08, -.06]	-.25	-.04***	[-.05, -.03]	-.22	.03***	[-.04, -.02]	-.16
WRAT Literacy	.13***	[.11, .15]	.28	.03***	[.02, .04]	.17	.02***	[.01, .02]	.12	.07***	[.06, -.09]	.24	.03***	[.02, -.04]	.16	.05***	[.04, .06]	.24
Depressive Symptoms	-.07***	[-.08, -.05]	-.19	-.02***	[-.03, -.01]	-.13	.00	[-.01, 00]	-.05	-.04***	[-.05, -.03]	-.18	-.01**	[-.02, -.01]	-.09	-.03***	[-.03, -.02]	-.18

Notes: The column name represents the cognitive outcome. *B* = unstandardized beta, β = standardized beta, CI= confidence interval. Significance codes: ***p<0.001, **p<0.01, *p<0.05, p<.0.1

ICMJE DISCLOSURE FORM

Date: 8/20/2024

Your Name: Lindsay Master

Manuscript Title: Associations between AHA's Life's Essential 8 and cognition in midlife and older adults

Manuscript Number (if known): ADJ-D-24-01073

In the interest of transparency, we ask you to disclose all relationships/activities/interests listed below that are related to the content of your manuscript. "Related" means any relation with for-profit or not-for-profit third parties whose interests may be affected by the content of the manuscript. Disclosure represents a commitment to transparency and does not necessarily indicate a bias. If you are in doubt about whether to list a relationship/activity/interest, it is preferable that you do so.

The author's relationships/activities/interests should be defined broadly. For example, if your manuscript pertains to the epidemiology of hypertension, you should declare all relationships with manufacturers of antihypertensive medication, even if that medication is not mentioned in the manuscript.

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		Name all entities with whom you have this relationship or indicate none (add rows as needed)	**Specifications/Comments (e.g., if payments were made to you or to your institution)**
Time frame: Since the initial planning of the work			
1	All support for the present manuscript (e.g., funding, provision of study materials, medical writing, article processing charges, etc.) **No time limit for this item.**	☐ None	
		The Healthy Aging in Neighborhoods of Diversity across the Life Span (HANDLS) study was supported by the National Institute on Aging's Intramural Research Program (Z01 AG000194 – M.K. Evans & A.B. Zonderman; Z01 AG000513 – M.K. Evans) and the National Institute on Aging (UF1 AG072619 and UF1 AG072619-S1 to A.A. Gamaldo).	
		Support for this work was also partially provided by the South Carolina Alzheimer's Disease Research Center.	
			Click the tab key to add additional rows.
Time frame: past 36 months			
2	Grants or contracts from any entity (if not indicated in item #1 above).	☒ **None**	

		Name all entities with whom you have this relationship or indicate none (add rows as needed)	Specifications/Comments (e.g., if payments were made to you or to your institution)
3	Royalties or licenses	☒ **None**	
4	Consulting fees	☒ **None**	
5	Payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events	☒ **None**	
6	Payment for expert testimony	☒ **None**	
7	Support for attending meetings and/or travel	☒ **None**	
8	Patents planned, issued or pending	☒ **None**	
9	Participation on a Data Safety Monitoring Board or Advisory Board	☒ **None**	
10	Leadership or fiduciary role in other board,	☒ **None**	

		Name all entities with whom you have this relationship or indicate none (add rows as needed)	Specifications/Comments (e.g., if payments were made to you or to your institution)
	society, committee or advocacy group, paid or unpaid		
11	Stock or stock options	☒ **None**	
12	Receipt of equipment, materials, drugs, medical writing, gifts or other services	☒ **None**	
13	Other financial or non-financial interests	☒ **None**	

Please place an "X" next to the following statement to indicate your agreement:

☒ I certify that I have answered every question and have not altered the wording of any of the questions on this form.

ICMJE DISCLOSURE FORM

Date: 8/26/2024

Your Name: Yuqi Shen

Manuscript Title: Associations between AHA's Life's Essential 8 and cognition in midlife and older adults

Manuscript Number (if known): ADJ-D-24-01073

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		The Healthy Aging in Neighborhoods of Diversity across the Life Span (HANDLS) study was supported by the National Institute on Aging's Intramural Research Program (Z01 AG000194 – M.K. Evans & A.B. Zonderman; Z01 AG000513 – M.K. Evans) and the National Institute on Aging (UF1 AG072619 and UF1 AG072619-S1 to A.A. Gamaldo).	
		Support for this work was also partially provided by the South Carolina Alzheimer's Disease Research Center.	
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Time frame: past 36 months			
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8	Patents planned, issued or pending	☒ **None**	
9	Participation on a Data Safety Monitoring Board or Advisory Board	☒ **None**	
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11	Stock or stock options	☒ **None**	
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13	Other financial or non-financial interests	☒ **None**	

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ICMJE DISCLOSURE FORM

Date: 8/27/2024

Your Name: Alexa C. Allan

Manuscript Title: Associations between AHA's Life's Essential 8 and cognition in midlife and older adults

Manuscript Number (if known): ADJ-D-24-01073

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Time frame: Since the initial planning of the work			
1	All support for the present manuscript (e.g., funding, provision of study materials, medical writing, article processing charges, etc.) **No time limit for this item.**	☐ None	
		The Healthy Aging in Neighborhoods of Diversity across the Life Span (HANDLS) study was supported by the National Institute on Aging's Intramural Research Program (Z01 AG000194 – M.K. Evans & A.B. Zonderman; Z01 AG000513 – M.K. Evans) and the National Institute on Aging (UF1 AG072619 and UF1 AG072619-S1 to A.A. Gamaldo).	
		Support for this work was also partially provided by the South Carolina Alzheimer's Disease Research Center.	
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Time frame: past 36 months			
2	Grants or contracts from any entity (if not indicated in item #1 above).	☒ **None**	

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4	Consulting fees	☒ **None**	
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6	Payment for expert testimony	☒ **None**	
7	Support for attending meetings and/or travel	☒ **None**	
8	Patents planned, issued or pending	☒ **None**	
9	Participation on a Data Safety Monitoring Board or Advisory Board	☒ **None**	
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11	Stock or stock options	☒ **None**	
12	Receipt of equipment, materials, drugs, medical writing, gifts or other services	☒ **None**	
13	Other financial or non-financial interests	☒ **None**	

Please place an "X" next to the following statement to indicate your agreement:

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ICMJE DISCLOSURE FORM

Date: 9/1/2024

Your Name: May A. Beydoun]

Manuscript Title: Associations between AHA's Life's Essential 8 and cognition in midlife and older adults

Manuscript Number (if known): ADJ-D-24-01073

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		Support for this work was also partially provided by the South Carolina Alzheimer's Disease Research Center.	
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Time frame: past 36 months			
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6	Payment for expert testimony	☒ **None**	
7	Support for attending meetings and/or travel	☒ **None**	
8	Patents planned, issued or pending	☒ **None**	
9	Participation on a Data Safety Monitoring Board or Advisory Board	☒ **None**	
10	Leadership or fiduciary role in other board,	☒ **None**	

		Name all entities with whom you have this relationship or indicate none (add rows as needed)	Specifications/Comments (e.g., if payments were made to you or to your institution)
	society, committee or advocacy group, paid or unpaid		
11	Stock or stock options	☒ **None**	
12	Receipt of equipment, materials, drugs, medical writing, gifts or other services	☒ **None**	
13	Other financial or non-financial interests	☒ **None**	

Please place an "X" next to the following statement to indicate your agreement:

☒ I certify that I have answered every question and have not altered the wording of any of the questions on this form.

ICMJE DISCLOSURE FORM

Date: 8/26/2024

Your Name: Alan Zonderman

Manuscript Title: Associations between AHA's Life's Essential 8 and cognition in midlife and older adults

Manuscript Number (if known): ADJ-D-24-01073

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		The Healthy Aging in Neighborhoods of Diversity across the Life Span (HANDLS) study was supported by the National Institute on Aging's Intramural Research Program (Z01 AG000194 – M.K. Evans & A.B. Zonderman; Z01 AG000513 – M.K. Evans) and the National Institute on Aging (UF1 AG072619 and UF1 AG072619-S1 to A.A. Gamaldo).	
		Support for this work was also partially provided by the South Carolina Alzheimer's Disease Research Center.	
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Time frame: past 36 months			
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4	Consulting fees	☒ **None**	
5	Payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events	☒ **None**	
6	Payment for expert testimony	☒ **None**	
7	Support for attending meetings and/or travel	☒ **None**	
8	Patents planned, issued or pending	☒ **None**	
9	Participation on a Data Safety Monitoring Board or Advisory Board	☒ **None**	
10	Leadership or fiduciary role in other board,	☒ **None**	

		Name all entities with whom you have this relationship or indicate none (add rows as needed)	Specifications/Comments (e.g., if payments were made to you or to your institution)
	society, committee or advocacy group, paid or unpaid		
11	Stock or stock options	☒ **None**	
12	Receipt of equipment, materials, drugs, medical writing, gifts or other services	☒ **None**	
13	Other financial or non-financial interests	☒ **None**	

Please place an "X" next to the following statement to indicate your agreement:

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ICMJE DISCLOSURE FORM

Date: 9/4/2024

Your Name: Michele K. Evans, M.D,

Manuscript Title: Associations between AHA's Life's Essential 8 and cognition in midlife and older adults

Manuscript Number (if known): ADJ-D-24-01073

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		Support for this work was also partially provided by the South Carolina Alzheimer's Disease Research Center.	
			Click the tab key to add additional rows.
Time frame: past 36 months			
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4	Consulting fees	☒ **None**	
5	Payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events	☒ **None**	
6	Payment for expert testimony	☒ **None**	
7	Support for attending meetings and/or travel	☒ **None**	
8	Patents planned, issued or pending	☒ **None**	
9	Participation on a Data Safety Monitoring Board or Advisory Board	☒ **None**	
10	Leadership or fiduciary role in other board,	☒ **None**	

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	society, committee or advocacy group, paid or unpaid		
11	Stock or stock options	☒ **None**	
12	Receipt of equipment, materials, drugs, medical writing, gifts or other services	☒ **None**	
13	Other financial or non-financial interests	☒ **None**	

Please place an "X" next to the following statement to indicate your agreement:

☒ I certify that I have answered every question and have not altered the wording of any of the questions on this form.

ICMJE DISCLOSURE FORM

Date: 8/30/2024

Your Name: Orfeu M Buxton

Manuscript Title: Associations between AHA's Life's Essential 8 and cognition in midlife and older adults

Manuscript Number (if known): ADJ-D-24-01073

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		Support for this work was also partially provided by the South Carolina Alzheimer's Disease Research Center.	
			Click the tab key to add additional rows.
Time frame: past 36 months			
2	Grants or contracts from any entity (if not indicated in item #1 above).	☐ **None**	
		subcontract grants to Penn State from Mobile Sleep Technologies, doing business as SleepSpace (NSF/STTR #1622766, NIH/NIA SBIR R43-AG056250, R44-AG056250)	

		Name all entities with whom you have this relationship or indicate none (add rows as needed)	Specifications/Comments (e.g., if payments were made to you or to your institution)
3	Royalties or licenses	☒ **None**	
4	Consulting fees	☐ **None**	
		Georgia State University	
		Harvard Chan School of Public Health	
5	Payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events	☐ **None**	
		Tufts School of Dental Medicine,	University of Miami
		University of Utah,	
		University of Arizona,	
6	Payment for expert testimony	☒ **None**	
7	Support for attending meetings and/or travel	☒ **None**	
8	Patents planned, issued or pending	☒ **None**	
9	Participation on a Data Safety Monitoring Board or Advisory Board	☒ **None**	
10	Leadership or fiduciary role in other board,	☒ **None**	

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	society, committee or advocacy group, paid or unpaid		
11	Stock or stock options	☒ **None**	
12	Receipt of equipment, materials, drugs, medical writing, gifts or other services	☒ **None**	
13	Other financial or non-financial interests	☐ **None**	

honorarium from The National Sleep Foundation thensf.org for role as Editor in Chief of Sleep Health	

Please place an "X" next to the following statement to indicate your agreement:

☒ I certify that I have answered every question and have not altered the wording of any of the questions on this form.

ICMJE DISCLOSURE FORM

Date: 8/29/2024

Your Name: Alyssa Gamaldo

Manuscript Title: Associations between AHA's Life's Essential 8 and cognition in midlife and older adults

Manuscript Number (if known): ADJ-D-24-01073

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Time frame: Since the initial planning of the work			
1	All support for the present manuscript (e.g., funding, provision of study materials, medical writing, article processing charges, etc.) **No time limit for this item.**	☐ None	
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		Support for this work was also partially provided by the South Carolina Alzheimer's Disease Research Center.	
			Click the tab key to add additional rows.
Time frame: past 36 months			
2	Grants or contracts from any entity (if not indicated in item #1 above).	☐ **None**	
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		Name all entities with whom you have this relationship or indicate none (add rows as needed)	Specifications/Comments (e.g., if payments were made to you or to your institution)
3	Royalties or licenses	☒ **None**	
4	Consulting fees	☒ **None**	
5	Payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events	☐ **None**	
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6	Payment for expert testimony	☒ **None**	
7	Support for attending meetings and/or travel	☒ **None**	
8	Patents planned, issued or pending	☒ **None**	
9	Participation on a Data Safety Monitoring Board or Advisory Board	☒ **None**	
10	Leadership or fiduciary role in other board,	☒ **None**	

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	society, committee or advocacy group, paid or unpaid		
11	Stock or stock options	☒ **None**	
12	Receipt of equipment, materials, drugs, medical writing, gifts or other services	☒ **None**	
13	Other financial or non-financial interests	☒ **None**	

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☒ I certify that I have answered every question and have not altered the wording of any of the questions on this form.