The association between purpose/meaning in life and verbal fluency and episodic memory: a meta-analysis of >140,000 participants from up to 32 countries

Angelina R. Sutin,[1] Martina Luchetti,[1] Yannick Stephan,[2] Jason E. Strickhouser,[1] and Antonio Terracciano[1]

[1]*Florida State University College of Medicine, Tallahassee, FL, USA*
[2]*Euromov, University of Montpellier, Montpellier, France*

ABSTRACT

Objectives: Feelings of purpose and meaning in life are protective against consequential cognitive outcomes, including reduced risk of Alzheimer's disease and dementia. Purpose and meaning are likely to also be associated with cognitive functions on the pathway to dementia. The objective of the current research was to test whether both purpose in life and meaning in life are associated with higher verbal fluency and better episodic memory and whether these associations varied by sociodemographic characteristics or economic characteristics of the country.

Design: Prospective meta-analysis of cross-sectional associations based on individual participant data.

Setting: Established cohort studies with measures of either purpose in life or meaning in life and verbal fluency and episodic memory.

Participants: Across the cohorts, there were over 140,000 participants from 32 countries from North and South America, Europe, and the Middle East.

Results: The meta-analysis indicated that purpose and meaning were associated with better performance on both the verbal fluency (meta-analytic partial $r = .098$, 95% confidence interval [CI] = .080, .116, $p < .001$) and episodic memory ($r = .117$, 95% CI = .100, .135, $p < .001$) task and that these associations were similar across measures of purpose in life and meaning in life. There was modest evidence that these associations were slightly stronger in relatively lower-income countries, and there was less consistent evidence that they varied by age, gender, or education.

Discussion: These findings indicate a robust association between purpose/meaning and both verbal fluency and episodic memory across demographic groups and cultural context. Purpose/meaning may be a useful target of intervention for healthier cognitive aging.

Key words: fluency, cognitive aging, purpose in life, meaning in life, cross-cultural

Purpose in life is the feeling that one's life is goal-oriented and driven (Ryff, 1989) and is considered a cornerstone of eudaimonic well-being (Ryan and Deci, 2001; Ryff, 2014). The beneficial effects of purpose are now being examined in the context of health. Higher purpose, for example, is associated with better physical function (Kim *et al.*, 2017), lower risk of cardiovascular events (Kim *et al.*, 2013), and ultimately lower risk of premature

mortality (Cohen *et al.*, 2016). These more positive health outcomes may be due, in part, to the healthier behavioral patterns associated with purpose. Individuals who report greater purpose in life, for example, engage in more physical activity (Hooker and Masters, 2016) and are less likely to smoke (Morimoto *et al.*, 2018).

There is growing evidence that feelings of purpose are also associated with better cognitive outcomes. In particular, purpose has been associated with lower risk of Alzheimer's disease (Boyle *et al.*, 2010) and dementia (Sutin *et al.*, 2018b) and with greater resilience to Alzheimer's neuropathology (Boyle *et al.*, 2012). Most research on purpose

and cognition has focused on risk of passing a threshold for cognitive impairment. There is some evidence, however, that it is also associated with cognitive function prior to impairment. Higher purpose, for example, is associated with better memory and executive function (Lewis *et al.*, 2017) and better overall mental status (Kim *et al.*, 2019). It may also be associated with performance on specific cognitive tasks, such as verbal fluency and episodic memory, that are intermediate markers of cognitive health.

Verbal fluency is the ability to generate many words from a single category in a short period of time (Lezak, 2004). It is typically measured as the number of words retrieved correctly from a specific category (e.g. animals) in 60 seconds and is frequently used in research and clinical setting when evaluating cognitive status. Performance on verbal fluency tasks involves the integration of several cognitive functions, including speed, attention, inhibition, and self-monitoring. It is thus a relatively simple task that captures the effective integration of numerous functions (Shao *et al.*, 2014; Troyer *et al.*, 1997). Perhaps because of this integration, performance on verbal fluency tasks has long-term predictive power for consequential cognitive outcomes. In fact, better verbal fluency is associated with lower risk of dementia over time (Sutin *et al.*, 2019b). Episodic memory is likewise a critical cognitive function that is the ability to remember specific events and experiences and is typically measured with immediate and delayed recall of lists of words (Lezak, 2004). Loss of episodic memory is one defining features of ADRD (Alzheimer's Association, 2020). Similar to fluency, performance on tasks that measure memory earlier in adulthood is associated with risk of Alzheimer's disease in older adulthood (Josefsson *et al.*, 2019). Both verbal fluency and episodic memory are thus clinically relevant intermediate markers of cognitive health on the pathway to dementia.

Purpose in life is typically conceptualized as one component of the broader concept of meaning in life (Steger, 2009). Specifically, meaning in life is a superordinate construct that includes purpose (feeling that one's life is goal-directed), coherence (belief that the world is orderly), and significance (sense that one's life has value) (Martela and Steger, 2016). As such, meaning and purpose, although related, are conceptually distinct constructs (George and Park, 2013). Lay conceptions of the terms, however, may not be distinct, and measures for purpose and meaning may capture similar variance for meaningful outcomes. For example, the association in predicting risk of cognitive impairment is similar across measures of purpose in life (Boyle *et al.*, 2010) and meaning in life (Sutin *et al.*, 2020). This pattern suggests that purpose and meaning may have similar associations with intermediate cognitive outcomes.

The present study takes a comprehensive approach to test the association between purpose in life/meaning in life and verbal fluency and episodic memory. Specifically, we examine the association between purpose/meaning and verbal fluency in a combined sample of over 125,000 participants from 24 countries and the association between purpose/meaning and episodic memory in a combined sample of over 140,000 participants from 32 countries. We test the preregistered hypothesis that higher reported feelings of purpose/meaning in life are associated with better performance on a verbal fluency task. Although not part of the original preregistration, we also test whether purpose/meaning in life is associated with better performance on an episodic memory task. With up to 32 countries, we examine whether the economic environment of the country (e.g. gross domestic product per capita; GDP) is associated with the strength of the relation between purpose/meaning and cognition because purpose may be a resource for cognitive function when economic resources are less plentiful. We also examine whether the associations differ across measures that assess purpose in life versus meaning in life. Finally, we address whether the associations differ by age, gender, and education to determine if the benefits of purpose/meaning are limited to specific demographic groups or whether the association generalizes across populations.

Method

Participants and procedure

A total of up to 37 samples from 32 countries from 8 established cohorts were included in this research. The cohorts were the Health and Retirement Study (HRS; Sonnega *et al.*, 2014), the Midlife Development in the United States (MIDUS) study (Brim *et al.*, 2004), the Wisconsin Longitudinal Study (WLS; Herd *et al.*, 2014), the English Longitudinal Study of Ageing (ELSA; Steptoe *et al.*, 2013), the National Child Development Study (NCDS; Power and Elliott, 2006), The Irish LongituDinal study on Ageing (TILDA; Kearney *et al.*, 2011), the Brazilian Longitudinal Study of Aging (ELSI; Lima-Costa *et al.*, 2018), and the Survey of Health, Ageing and Retirement in Europe (SHARE; Börsch-Supan *et al.*, 2013). Each cohort had one sample, except for WLS, which included graduate (WLSG) and sibling (WLSS) samples, and the SHARE, which included samples from up to 28 countries in Europe and

Israel (29 countries total). We identified these datasets through the Interuniversity Consortium for Political and Social Research (ICPSR), the Gateway to Global Aging, and the UK Data Service. All data can be obtained through the websites listed below for each of the studies. The preregistration for this study can be found at https://osf.io/rywhu.

The HRS (https://hrs.isr.umich.edu/) is a longitudinal study of aging of Americans aged 50 years and older and their spouses (regardless of age). Cognition was measured on the entire sample in 2010 and 2012, and purpose was measured for half the sample in 2010 and the other half in 2012. Data on cognition and purpose were combined across the 2010 and 2012 assessments. The MIDUS study (http://midus.wisc.edu/) started as a study of midlife health and has continued to assess participants as they age. Purpose and cognition were first measured at MIDUS II in 2004–2006. A previous publication (Lewis *et al.*, 2017) used MIDUS data to report the association between purpose in life and both memory and executive function that was a composite of serval tasks that included verbal fluency and also the stop and go switch task, number series, digit span backward, and backward counting. The relation between purpose and verbal fluency alone in MIDUS has not yet been reported. The WLS (https://www.ssc.wisc.edu/wlsresearch/) includes two samples: a random sample of individuals who graduated from a Wisconsin high school in 1957 (WLSG) and a selected sibling of the graduates (WLSS). Purpose and cognition were measured in both samples at the 2011 assessment. The ELSA (https://www.elsa-project.ac./uk) is a study of aging of individuals over the age of 50 years in England and their spouses (regardless of age). Meaning and cognition were measured at the baseline assessment in 2002. The NCDS (https://cls.ucl.ac.uk/cls-studies/1958-national-child-development-study/) is a study of individuals all born in the same week in 1958 in England, Scotland, and Wales. Meaning and cognition were measured at the 2008 assessment when study participants were 50 years old. The TILDA (https://tilda.tcd.ie/) is a longitudinal study of aging of individuals over the age of 50 years in Ireland and their spouses. Meaning and cognition were measured at the baseline assessment in 2011 and used in the meta-analysis. In addition, at Wave 4, both meaning and purpose, as well as cognition, were assessed (used in supplemental analysis). ELSI (http://elsi.cpqrr.fiocruz.br/en/) is a longitudinal study of aging of individuals over the age of 50 years and their spouses in Brazil. Meaning and cognition were measured at the baseline assessment in 2015–2016. SHARE (http://www.share-project.org/) is a cross-national study of health and aging in 28 European countries and Israel

(29 countries total). We included 21 countries from SHARE in the analysis of fluency (the other 8 countries did not have data on fluency) and all 29 countries for the analysis of memory. We selected Wave 6 to maximize participants with the necessary data to be included in the analysis. Countries that had data on meaning and fluency at Wave 6 were Austria, Germany, Sweden, Spain, Italy, France, Denmark, Greece, Switzerland, Belgium, Israel, Czech Republic, Poland, Luxembourg, Portugal, Slovenia, Estonia, and Croatia. Three countries had meaning and fluency available at other waves and were included in the analysis: Ireland (Wave 2), Hungary (Wave 4), and the Netherlands (Wave 5). The remaining SHARE countries – Lithuania, Bulgaria, Cyprus, Finland, Latvia, Malta, Romania, and Slovakia – were first assessed at Wave 7 and only had the measure of memory. These countries were included in the analysis of meaning and episodic memory. Across all samples, there was no exclusion of participants based on cognitive status.

Measures

Purpose/Meaning in life. Purpose in Life was measured with a version of Ryff's Purpose in Life scale (Ryff, 1989). A 7-item version was administered in HRS and MIDUS and a 6-item version was administered in WLS. Items were rated on a scale from 1 (*strongly disagree*) to 6 (*strongly agree*) in HRS and WLS and from 1 (*strongly disagree*) to 7 (*strongly agree*) in MIDUS. Meaning in Life was measured with a single-item ("How often do you feel that your life has meaning?") taken from the Pleasure scale of the control-autonomy-pleasure-self-realization scale (CASP-19) of quality of life in older adulthood (Hyde *et al.*, 2003) in ELSA, NCDS, TILDA, ELSI, and SHARE. This item was measured on a four-point scale and reverse-scored when necessary from 1 (*never*) to 4 (*often*) in ELSA, NCDS, TILDA, and SHARE and from 1 (*never*) to 3 (*always*) in ELSI. In Romania, the item that measured meaning was translated as the frequency of no meaning in one's life. To be consistent with the other samples, we scored the item in the direction of higher meaning. In addition, TILDA had both purpose and meaning (and fluency and memory) at Wave 4.

Verbal fluency. Participants completed a standard measure of verbal fluency (Lezak, 2004). Specifically, participants were asked to name as many animals as possible in 60 seconds. The only exception was the WLS samples. Participants in these samples completed a category fluency task, but the category was either animals or food (randomly selected for each participant), and only a random subsample of the WLS participants received this

version of the task. In addition, all participants in both WLS samples were administered a letter fluency task in which they had to generate as many words starting with either the letter "f" or "l" as possible in 60 seconds. We included the association with category fluency in the meta-analysis to be consistent with the other samples. We test and report the association with letter fluency to determine if the associations were similar with a slightly different measure of fluency. In both WLS samples, an additional covariate that accounted for category (animal versus food) or letter ("f" versus "l") was included in the analyses.

Episodic memory. Participants completed a standard episodic memory task. Specifically, a list of words was read to the participant and the participant was instructed to recall the list immediately and again after a brief delay. All samples used a list of 10 words, except for MIDUS, which used a 15-item list. In addition, in TILDA, participants were asked to recall the word list immediately twice and again after a short delay; we used the first immediate recall score, as well as the delayed recall score. Episodic memory was the number of words recalled correctly across both immediate and delayed recall tasks.

Individual-level covariates. Covariates included self-reported age in years and gender (0 = male, 1 = female) in each sample. Education was reported in years in HRS, WLSG, and WLSS; on a scale from 1 (no school) to 12 (advanced or professional degree) in MIDUS; from 0 (no qualification) to 7 (degree) in ELSA; from 0 (no qualification) to 6 (higher degree) in NCDS; from 1 (some primary, not complete) to 7 (postgraduate/higher degree) in TILDA; from 1 (never studied) to 18 (doctoral degree/PhD) in ELSI. The 1997 International Standard Classification of Education was used to categorize and harmonize education statistics across European countries (UNESCO, 2003) in SHARE. Specifically, level of education ranged from 0 (pre-primary level of education) to 6 (second stage of tertiary education). Race was categorized in each sample based on how the data were collected and reported in each sample (see Table 1). Race was dummy-coded, with white as the reference group. SHARE does not collect information on race or ethnicity and thus was not controlled for in samples from this cohort. Year of assessment (0 = 2010, 1 = 2012) in HRS and category (0 = foods, 1 = animals) in WLS were included as sample-specific covariates for analyses on these samples.

Sample-level moderators. We examined sample-level moderators to identify sources of potential heterogeneity in the meta-analysis. We tested characteristics of the sample, specifically mean age of the sample, measure (purpose vs. meaning), samples from SHARE versus samples from other cohorts, and HRS-based versus not HRS-based (the sampling and methodology for ELSA, TILDA, ELSI, and SHARE are based on HRS, whereas the MIDUS, WLS, and NCDS are not). We also tested whether the economic environment of the country was associated with the strength of the association. The economic environment was defined as gross domestic product per capita (GDP) and purchasing power parity (PPP). These indices were obtained from the World Bank (https://www.worldbank.org/) for the year of the assessment in each sample.

Statistical approach

All variables were standardized within sample before analysis. In each sample, linear regression was used to predict fluency and memory from purpose/meaning controlling for the covariates. Follow-up analyses tested whether the associations were moderated by age, gender, or education in each sample by entering the interaction between purpose/meaning and the demographic factor, as well as the main effects and other covariates. A random-effects meta-analysis was done on the partial correlation and sample size to summarize the association between purpose/meaning and fluency and memory across all samples. A similar approach was used to summarize the interaction effects for age, gender, and education. SPSS 25 was used for the analysis of the individual samples. The metafor package in R (Viechtbauer, 2010) was used for the meta-analysis. We followed up the meta-analysis with meta-regressions to identify potential sources of heterogeneity. Specifically, we ran meta-regressions to determine whether the associations varied by GDP, PPP, mean age of the sample, purpose measure versus meaning measure, SHARE versus not SHARE, and HRS versus non-HRS.

We also did two supplemental analyses in specific samples. First, we tested the association between purpose and letter fluency in the WLS samples to see if the association was similar when a different measure of fluency was used. Second, we tested the association between both purpose and meaning and verbal fluency and memory using Wave 4 of TILDA, which was the wave that included both of these measures (the measures at Wave 1 of TILDA were used the meta-analyses).

Results

Descriptive statistics for all samples are shown in Supplemental Table S1a and S1b for verbal fluency and in Supplemental Table S2a and S2b for episodic memory. Figure 1 shows the association between purpose and fluency in each of the samples and the overall meta-analysis. The association was consistent across samples: higher purpose/meaning in life

| Sample	β	95% CI	*p*
HRS (US)	.075	.060, .091	.000
MIDUS (US)	.053	.023, .082	.000
WLSG (US)	.066	.026, .106	.001
WLSS (US)	.051	−.001, .104	.053
ELSA (England)	.058	.041, .075	.000
NCDS (UK)	.041	.021, .062	.000
TILDA (Ireland)	.046	.024, .067	.000
ELSI (Brazil)	.063	.044, .083	.000
SHARE Austria	.142	.111, .174	.000
SHARE Germany	.099	.071, .127	.000
SHARE Sweden	.112	.081, .141	.000
SHARE Netherlands	.068	.039, .095	.000
SHARE Spain	.159	.133, .184	.000
SHARE Italy	.188	.163, .215	.000
SHARE France	.087	.057, .115	.000
SHARE Denmark	.104	.073, .133	.000
SHARE Greece	.109	.081, .137	.000
SHARE Switzerland	.068	.033, .103	.000
SHARE Belgium	.085	.061, .108	.000
SHARE Israel	−.021	−.062, .023	.357
SHARE Czech Republic	.080	.053, .106	.000
SHARE Poland	.099	.054, .142	.000
SHARE Ireland	.073	.013, .133	.017
SHARE Luxembourg	.047	.001, .095	.046
SHARE Hungary	.184	.151, .217	.000
SHARE Portugal	.076	.028, .124	.002
SHARE Slovenia	.123	.095, .150	.000
SHARE Estonia	.136	.111, .162	.000
SHARE Croatia	.120	.083, .159	.000
Meta-analytic partial *r*	.098	.080, .116	.000
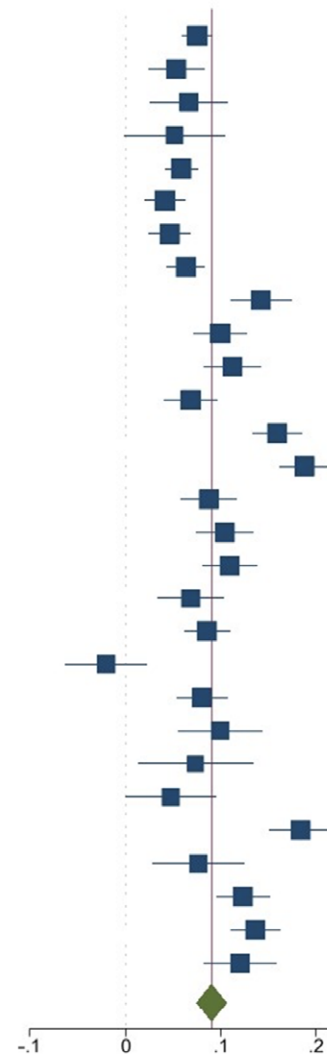
Figure 1. Association between purpose/meaning in life and verbal fluency in 24 samples. *Note:* Total $N = 125{,}746$. Coefficients in the individual studies are standardized beta coefficients and 95% Confidence Intervals from linear regression controlling for age, gender, education, and race (where applicable). HRS = Health and Retirement Study. MIDUS = Midlife in the United States. WLSG = Wisconsin Longitudinal Study Graduate sample. WLSS = Wisconsin Longitudinal Study Sibling sample. ELSA = English Longitudinal Study of Ageing. NCDS = National Child Development Study. TILDA = The Irish LongituDinal study on Ageing. ELSI = Brazilian Longitudinal Study of Aging. SHARE = Survey of Health, Ageing and Retirement in Europe.

was associated with better verbal fluency. The positive association was seen in all samples, even though one smaller sample did not reach statistical significance. The one exception was for Israel, where there was a small nonsignificant negative association with fluency. Overall, though, the estimated meta-analytic association across the 29 samples was nearly .10 ($p < .001$). Figure 2 shows the association between purpose and memory in each sample and the overall meta-analysis. Again, the association was consistent across samples: higher purpose/meaning in life was associated with better episodic memory. The positive association was seen in all 37 samples, even though it did not reach statistical significance in 2 samples (Israel, Malta). Overall, though, the estimated meta-analytic association across the 37 samples was nearly .12 ($p < .001$).

There was significant heterogeneity across the samples for both fluency (Q = 247.549, $p < .001$, $I^2 = 90.41$) and memory (Q = 350.978, $p < .001$, $I^2 = 90.96$). There was, however, no significant difference in the strength of the association for either function between studies that assessed meaning compared to purpose (Table 1). There was only one factor in the meta-regression that was significant for both fluency and memory (Table 1): these association were stronger in samples from SHARE than from the other samples. There was no difference across HRS-based studies or mean age of the sample. There was modest evidence that the associations were moderated by the economic environment of the sample. Specifically, for episodic memory, the associations were stronger in the relatively

Sample	B	95% CI	p
HRS (US)	.108	.093, .124	.000
MIDUS (US)	.080	.050, .110	.000
WLSG (US)	.089	.058, .120	.000
WLSS (US)	.079	.038, .119	.000
ELSA (England)	.054	.038, .071	.000
NCDS (UK)	.038	.018, .058	.000
TILDA (Ireland)	.057	.036, .078	.000
ELSI (Brazil)	.068	.049, .086	.000
SHARE Austria	.145	.114, .177	.000
SHARE Germany	.078	.052, .104	.000
SHARE Sweden	.091	.062, .120	.000
SHARE Netherlands	.046	.019, .073	.001
SHARE Spain	.167	.142, .191	.000
SHARE Italy	.161	.136, .185	.000
SHARE France	.114	.087, .141	.000
SHARE Denmark	.089	.061, .118	.000
SHARE Greece	.152	.126, .178	.000
SHARE Switzerland	.086	.053, .118	.000
SHARE Belgium	.071	.048, .093	.000
SHARE Israel	.036	−.005, .078	.088
SHARE Czech Republic	.065	.039, .091	.000
SHARE Poland	.116	.073, .159	.000
SHARE Ireland	.112	.059, .166	.000
SHARE Luxembourg	.085	.040, .130	.000
SHARE Hungary	.159	.128, .290	.000
SHARE Portugal	.118	.075, .161	.000
SHARE Slovenia	.116	.090, .143	.000
SHARE Estonia	.099	.075, .122	.000
SHARE Croatia	.118	.082, .154	.000
SHARE Lithuania	.089	.051, .126	.000
SHARE Bulgaria	.181	.141, .222	.000
SHARE Cyprus	.113	.067, .160	.000
SHARE Finland	.091	.052, .129	.000
SHARE Latvia	.255	.212, .299	.000
SHARE Malta	.027	−.025, .078	.305
SHARE Romania	.093	.055, .131	.000
SHARE Slovakia	.246	.206, .286	.000
Meta-analytic partial *r*	**.117**	**.100, .135**	**.000**
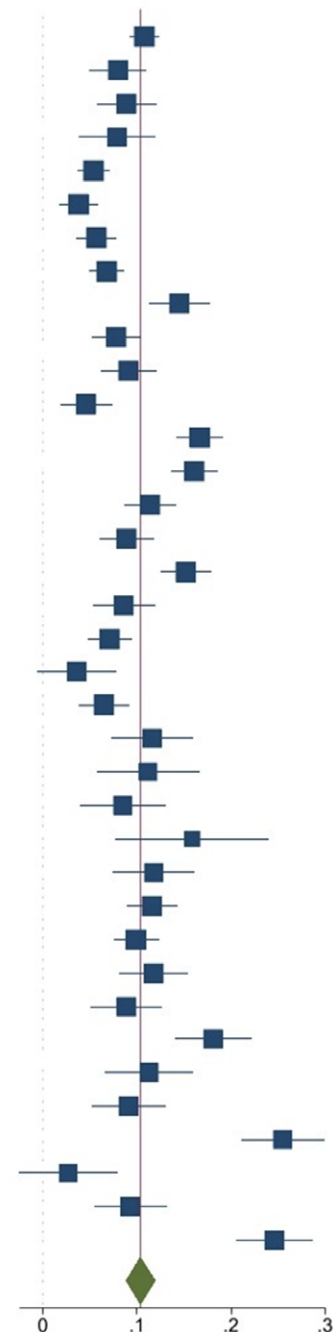
Figure 2. Association between purpose/meaning in life and episodic memory in 32 samples. *Note:* Total *N* = 141,825. Coefficients in the individual studies are standardized beta coefficients and 95% Confidence Intervals from linear regression controlling for age, gender, education, and race (where applicable). HRS = Health and Retirement Study. MIDUS = Midlife in the United States. WLSG = Wisconsin Longitudinal Study Graduate sample. WLSS = Wisconsin Longitudinal Study Sibling sample. ELSA = English Longitudinal Study of Ageing. NCDS = National Child Development Study. TILDA = The Irish LongituDinal study on Ageing. ELSI = Brazilian Longitudinal Study of Aging. SHARE = Survey of Health, Ageing and Retirement in Europe.

lower-income countries than in the relatively higher-income countries. There was a similar trend for verbal fluency that was not significant. This difference between fluency and memory is likely because of the eight additional counties in the analysis of memory increased the range of GDP and PPP.

Finally, across all samples, there was no evidence that age, sex, or education moderated the association between purpose/meaning and verbal fluency (Supplemental Table S3). For memory, there was modest evidence that the association was slightly stronger at older ages and, consistent with the

Table 1. Sample-level moderators of the meta-analytic association for verbal fluency and episodic memory

| | VERBAL FLUENCY | | | EPISODIC MEMORY | | |
| | DIFFERENCE IN | | | DIFFERENCE IN | | |
MODERATOR	PARTIAL r	95% CI	p	PARTIAL r	95% CI	p
GDP per capita	− .083	− .170, .005	.064	− .095	− .178, − .011	.028
PPP	− .111	− .230, .012	.076	− .126	− .247, − .001	.049
Mean age	.0039	− .0019, .0097	.184	.002	− .004, .033	.562
Measure	− .037	− .089, .016	.171	− .024	− .080, .033	.413
SHARE	.052	.017, .088	.004	.051	.012, .089	.011
HRS-based	.050	− .001, .100	.056	.048	− .007, .103	.084

Total N for the meta-analysis = 125,746 for verbal fluency and 141,825 for episodic memory. CI = confidence interval. GDP = gross domestic product per capita. PPP = purchasing power parity. For verbal fluency, age compared samples with a mean age below 65 years (k = 10) to a mean age above 60 years (k = 19), measure compared samples with the purpose in life measure (k = 4) to samples with the meaning measure (k = 25), SHARE compared samples in the SHARE study (k = 21) to samples that were not SHARE (k = 8), and HRS-based compared samples from the HRS suite of studies (k = 25) to samples with other methodologies (k = 4). For episodic memory, age compared samples with a mean age below 65 years (k = 12) to a mean age above 60 years (k = 25). Measure compared samples with the purpose in life measure (k = 4) to samples with the meaning measure (k = 32). SHARE compared samples in the SHARE study (k = 29) to samples that were not SHARE (k = 8). HRS-based compared samples from the HRS suite of studies (k = 32) to samples with other methodologies (k = 4).

country-level moderation by GDP and PPP, at lower levels of education (Supplemental Table S4).

Finally, the supplemental analyses supported the main analyses. That is, similar to category fluency, purpose was associated with letter fluency in both WLSG (β = .077, 95% confidence interval [CI] = .049, .106, p < .001; N = 4,488) and the WLSS (β = .047, 95% CI = .009, .085, p = .014; N = 2,507). Both meaning (β = .039, 95% CI = .013, .065, p = .003; N = 4,795) and purpose (β =. 114, 95% CI = .088, .142, p < .001; N = 4,795) were associated with fluency in Wave 4 of TILDA and moderately correlated with each other (r = .42, p < .001). Meaning (β = .044, 95% CI = .020, .068, p < .001; N = 4,861) and purpose (β = .125, 95% CI = .100, .149, p < .001; N = 4,861) were likewise both associated with episodic memory in this wave of TILDA. Of note, in TILDA, the total CASP-Pleasure scale from which the meaning item was taken from was unrelated to fluency (β = .003, 95% CI = − .039, .051, p = .791) and modestly related to memory (β = .029, 95% CI = .005, .054, p = .017; N = 4,861). Finally, as an additional supplemental analysis, we excluded participants who reported ADRD from the analysis in samples that had this information (HRS, ELSI, and SHARE). The pattern of association was similar when these participants were excluded for both fluency (Supplemental Table S5) and memory (Supplemental Table S6).

Discussion

The present research found that in over 140,000 participants from up to 32 countries, higher purpose/meaning in life was associated with better performance on tasks that measure specific cognitive functions. The consistency across samples

was striking: 28 out of 29 samples had a positive association and 27 of those associations were statistically significant for verbal fluency. Likewise, there was a positive association in all 37 samples with episodic memory, and only 2 were not statistically significant. These associations were similar across countries from three continents (Europe, and South and North America), multiple languages, tasks that measure two cognitive functions, two different measures of fluency (letter and category), and measures of both purpose and meaning. Further, the meta-analysis of the interactions indicated that the association did not vary by sociodemographic characteristics for fluency and only modestly for memory. That is, purpose/meaning was beneficial across different ages (slightly stronger at older ages for memory), both genders, and levels of educational attainment (slightly stronger at lower educational levels for memory). The present study thus indicates a robust association between feeling that one's life has purpose and meaning and better verbal fluency and episodic memory.

There may be a number of mechanisms that contribute to the association between purpose/meaning and cognition. First, purpose is associated with health-related behaviors and outcomes that support healthier cognitive aging. Individuals higher in purpose, for example, engage in more physical activity (Hooker and Masters, 2016), are less likely to smoke (Morimoto et al., 2018), maintain better physical function (Kim et al., 2017), and have a lower burden of disease (Czekierda et al., 2017). This healthier lifestyle may help promote better performance on cognitive tasks, such as verbal fluency and memory. Second, purpose is associated with personality traits, such as higher emotional stability, extraversion, and conscientiousness (Scheier

et al., 2006), which are also implicated in better verbal fluency and memory (Sutin *et al.*, 2019a). Third, individuals higher in purpose tend to have larger social networks (Scheier *et al.*, 2006), greater social support (Musich *et al.*, 2018), and fewer feelings of loneliness (Mwilambwe-Tshilobo *et al.*, 2019). Such social integration helps support cognitive health (Kelly *et al.*, 2017), including lower long-term risk of cognitive impairment (Sutin *et al.*, 2018a). Social integration may also include more social interactions that help promote better cognitive function.

There is also increasing evidence that feelings of purpose and meaning are protective against the development of Alzheimer's disease and other severe cognitive impairments (Boyle *et al.*, 2010; Sutin *et al.*, 2020, 2018b). The processes and behaviors associated with a purposeful/meaningful life may help support healthier cognition across the lifespan. Both fluency (Sutin *et al.*, 2019b) and memory (Josefsson *et al.*, 2019) have been identified as intermediate markers of cognitive health that are predictive of incident cognitive impairment. Similar to cognitive (Stern *et al.*, 2019) and social (Ihle *et al.*, 2019) reserve, purpose/meaning may serve as a reserve of well-being that supports healthier cognitive aging. The present research is a step toward building a model of purpose/meaning and risk of cognitive impairment. Interestingly, there are strong lay beliefs that purpose promotes healthier cognitive aging and is protective against cognitive impairment (Vaportzis and Gow, 2018).

The association between purpose/meaning and better cognition was apparent in almost all of the individual samples, but the meta-analysis indicated significant heterogeneity for both cognitive tasks. The meta-regressions revealed only one potential source of the heterogeneity across both fluency and memory: samples from SHARE had slightly stronger associations than samples from other studies. Interestingly, the difference between HRS-based and non-HRS-based studies was not quite significant. It was, however, suggestive that the associations may be somewhat stronger in studies that used HRS methodology. There was also suggestive evidence of small differences by the economic development of the country, with slightly stronger associations in countries that have lower GDP per capita and less purchasing power parity. This moderation was significant for episodic memory and a trend for verbal fluency. This pattern suggests that, similar to other psychological factors (Luchetti, Terracciano, Stephan, Aschwanden, & Sutin, in press), purpose/meaning may serve as a psychological resource for cognitive function in less economically robust countries. This analysis, however, was limited by the concentration of high-income countries and should be expanded to include more lower- and middle-income countries.

Purpose in life and meaning in life are two related yet distinct constructs. Meaning in life is typically conceptualized as a superordinate construct that is composed of several lower-order constructs, including purpose (Martela and Steger, 2016). Although conceptually distinct, there tends to be overlap in the measurement (e.g. many scales include items on both purpose and meaning; Steger *et al.*, 2006), and, when differentiated, the correlates tend to be similar, even if the magnitude may differ somewhat (Costin and Vignoles, 2020). It was thus expected that similar associations would emerge across measures of purpose and meaning. And, in fact, there was no difference in the strength of the association between measures of purpose versus meaning in the meta-analysis for both fluency and memory. It should be noted that the assessment of meaning was based on a single item that performed as well as the 6-7-item measure of purpose. Independently from the number of items, the pattern of results suggests that measures of purpose and meaning capture similar variance associated with better performance. It may be that the lay understanding of the construct does not make a distinction between purpose and meaning. Regardless of whether participants made this distinction, however, the association with fluency and memory was the same.

Purpose/meaning in life may be a potential target of intervention for healthier cognitive aging. Purpose/meaning can be increased through intervention (Park *et al.*, 2019); whether such interventions that increase purpose also benefit cognitive function still need to be tested. In addition to fostering a general sense of well-being, such interventions may support healthier cognitive aging through both proximal and distal pathways. In a proximal pathway, experimental manipulations of purpose may directly lead to better performance on cognitive tasks that has an immediate benefit and that also may consolidate into maintenance of cognitive function over time. In a more distal pathway, interventions for long-term change in purpose/meaning may help promote behaviors (e.g. more physical activity) and relationship quality (e.g. lower loneliness) that helps protect against long-term risk of cognitive impairment. And, in fact, improvements in psychological well-being through intervention in older adulthood reduce risk factors for cognitive decline (Delhom *et al.*, 2020; Wuthrich *et al.*, 2019). More research needs to test these possibilities and evaluate the full potential of interventions that focus on purpose/meaning.

The present study had several strengths, including a total sample size of up to over 140,000 participants from up to 37 samples in 32 countries. There

are also some limitations that could be addressed in future research. First, the data are cross-sectional. Second, with cross-sectional data, we could not test fluency or memory as a mediator between purpose/ meaning and dementia. Third, although participants were from 32 countries, most of these countries were high income. Future research could examine the longitudinal relations between purpose/meaning and fluency and memory, whether fluency and memory mediate the association between purpose/meaning and risk of cognitive impairment, and whether these associations are apparent in low- and middle-income countries.

Despite these limitations, the present research provides robust evidence that purpose and meaning in life are associated with better verbal fluency and episodic memory. Further, these associations do not seem to be limited to one demographic group or geographical region. Given that purpose/meaning can be increased through intervention (Park *et al.*, 2019), this robustness suggests a promising novel target to promote healthier cognitive aging across the lifespan.

Conflict of interest

None.

Description of authors' roles

A. Sutin designed the study, obtained and analyzed the data from the individual cohorts, and wrote the paper. J. Strickhouser performed the meta-analysis and assisted with writing the paper. M. Luchetti, Y. Stephan, and A. Terracciano provided critical feedback throughout the project and assisted with writing the paper.

Acknowledgments

Supplementary material

To view supplementary material for this article, please visit https://doi.org/10.1017/S1041610220004214

References

Alzheimer's Association. (2020). 2020 Alzheimer's disease facts and figures. *Alzheimer's and Dementia*, 16, 391–460. doi: 10.1002/alz.12068

Boyle, P. A., Buchman, A. S., Barnes, L. L. and Bennett, D. A. (2010). Effect of a purpose in life on risk of incident Alzheimer disease and mild cognitive impairment in community-dwelling older persons. *Archives of General Psychiatry*, 67, 304–310. doi: 10.1001/archgenpsychiatry .2009.208

Boyle, P. A., Buchman, A. S., Wilson, R. S., Yu, L., Schneider, J. A. and Bennett, D. A. (2012). Effect of purpose in life on the relation between Alzheimer disease pathologic changes on cognitive function in advanced age. *Archives of General Psychiatry*, 69, 499–505. doi: 10.1001/ archgenpsychiatry.2011.1487

Brim, O. G., Ryff, C. D. and Kessler, R. C. (2004). *How Healthy Are We? A National Study of Well-Being at Midlife*. Chicago: University of Chicago Press.

Börsch-Supan, A., Brandt, M., Hunkler, C., Kneip, T., Korbmacher, J., Malter, F. ... **on behalf of the SHARE Central Coordination Team.** (2013). Data resource profile: the Survey of Health, Ageing and Retirement in Europe (SHARE). *Internationl Journal of Epidemiology*, 42, 992–1001. doi: 10.1093/ije/dyt088

Cohen, R., Bavishi, C. and Rozanski, A. (2016). Purpose in life and its relationship to all-cause mortality and cardiovascular events: a meta-analysis. *Psychosomatic Medicine*, 78, 122–133. doi: 10.1097/PSY .0000000000000274

Costin, V. and Vignoles, V. L. (2020). Meaning is about mattering: Evaluating coherence, purpose, and existential mattering as precursors of meaning in life judgments. *Journal of Personality and Social Psychology*, 118, 864–884. doi: 10.1037/pspp0000225

Czekierda, K., Banik, A., Park, C. L., and Luszczynska, A. (2017). Meaning in life and physical health: systematic review and meta-analysis. *Health Psychology Review*, 11, 387–418. doi: 10.1080/17437199.2017.1327325

Delhom, I., Satorres, E. and Meléndez, J. C. (2020). Emotional intelligence intervention in older adults to improve adaptation and reduce negative mood. *International Psychogeriatrics*, 1–11. doi: 10.1017/ S1041610220003579

George, L. S., and Park, C. L. (2013). Are meaning and purpose distinct? An examination of correlates and predictors. *Journal of Positive Psychology*, 8, 365–375. doi: 10.1080/17439760.2013.805801

Herd, P., Carr, D. and Roan, C. (2014). Cohort profile: Wisconsin longitudinal study (WLS). *International Journal of Epidemiology*, 43, 34–41. doi: 10.1093/ije/dys194

Hooker, S. A., and Masters, K. S. (2016). Purpose in life is associated with physical activity measured by accelerometer. *Journal of Health Psychology*, 21, 962–971. doi: 10.1177/ 1359105314542822

Hyde, M., Wiggins, R. D., Higgs, P., and Blane, D. B. (2003). A measure of quality of life in early old age: the theory, development and properties of a needs satisfaction model (CASP-19). *Aging and Mental Health*, 7, 186–194. doi: 10.1080/1360786031000101157

Ihle, A. *et al.* (2019). The longitudinal relation between social reserve and smaller subsequent decline in executive functioning in old age is mediated via cognitive reserve. *International Psychogeriatrics*, 1–7. doi: 10.1017/ S1041610219001789

Josefsson, M., Sundström, A., Pudas, S., Nordin Adolfsson, A., Nyberg, L. and Adolfsson, R. (2019). Memory profiles predict dementia over 23-28 years in normal but not successful aging. *International Psychogeriatrics*, 1–9. doi: 10.1017/S1041610219001844

Kearney, P. M. *et al.* (2011). Cohort profile: the Irish Longitudinal Study on Ageing. *International Jouranl of Epidemiology*, 40, 877–884. doi: 10.1093/ije/dyr116

Kelly, M. E., Duff, H., Kelly, S., McHugh Power, J. E., Brennan, S., Lawlor, B. A. and Loughrey, D. G. (2017). The impact of social activities, social networks, social support and social relationships on the cognitive functioning of healthy older adults: a systematic review. *Systematic Reviews*, 6, 259. doi: 10.1186/s13643-017-0632-2

Kim, E. S., Kawachi, I., Chen, Y. and Kubzansky, L. D. (2017). Association between purpose in life and objective measures of physical function in older adults. *JAMA Psychiatry*, 74, 1039–1045. doi: 10.1001/jamapsychiatry .2017.2145

Kim, E. S., Sun, J. K., Park, N., Kubzansky, L. D. and Peterson, C. (2013). Purpose in life and reduced risk of myocardial infarction among older U.S. adults with coronary heart disease: a two-year follow-up. *Journal of Behavioral Medicine*, 36, 124–133. doi: 10.1007/s10865- 012-9406-4

Kim, G., Shin, S. H., Scicolone, M. A. and Parmelee, P. (2019). Purpose in life protects against cognitive decline among older adults. *American Journal of Geriatric Psychiatry*, 27, 593–601. doi: 10.1016/j.jagp.2019.01.010

Lewis, N. A., Turiano, N. A., Payne, B. R. and Hill, P. L. (2017). Purpose in life and cognitive functioning in adulthood. *Neuropsychology Development Cognition B Aging Neuropsychology Cognition*, 24, 662–671. doi: 10.1080/ 13825585.2016.1251549

Lezak, M. D. (2004). *Neuropsychological Assessment* (4th ed.). New York: Oxford University Press.

Lima-Costa, M. F. *et al.* (2018). The Brazilian Longitudinal Study of Aging (ELSI-Brazil): objectives and design. *American Journal of Epidemiology*, 187, 1345–1353. doi: 10.1093/aje/kwx387

Luchetti, M., Terracciano, A., Stephan, Y., Aschwanden, D., and Sutin, A. R. (in press). Personality traits and memory: a cross-national analysis of the Survey of Health, Ageing and Retirement in Europe. Psychological Science.

Martela, F. and Steger, M. F. (2016). The three meanings of meaning in life: Distinguishing coherence, purpose, and significance. *The Journal of Positive Psychology* 11, 531–545. doi: 10.1080/17439760.2015.1137623

Morimoto, Y., Yamasaki, S., Ando, S., Koike, S., Fujikawa, S., Kanata, S., . . . **Nishida, A.** (2018). Purpose in life and tobacco use among community-dwelling mothers of early adolescents. *BMJ Open*, 8, e020586. doi: 10.1136/bmjopen-2017-020586

Musich, S., Wang, S. S., Kraemer, S., Hawkins, K. and Wicker, E. (2018). Purpose in life and positive health outcomes among older adults. *Population Health Management*, 21, 139–147. doi: 10.1089/pop.2017.0063

Mwilambwe-Tshilobo, L. *et al.* (2019). Loneliness and meaning in life are reflected in the intrinsic network architecture of the brain. *Social Cognitive Affective Neuroscience*, 14, 423–433. doi: 10.1093/scan/nsz021

Park, C. L. *et al.* (2019). Effects of psychosocial interventions on meaning and purpose in adults with cancer: A systematic review and meta-analysis. *Cancer*, 125, 2383–2393. doi: 10.1002/cncr.32078

Power, C. and Elliott, J. (2006). Cohort profile: 1958 British birth cohort (National Child Development Study). *International Journal of Epidemiology*, 35, 34–41. doi: 10.1093/ije/dyi183

Ryan, R. M. and Deci, E. L. (2001). On happiness and human potentials: a review of research on hedonic and eudaimonic well-being. *Annual Review of Psychology*, 52, 141–166. doi: 10.1146/annurev.psych.52.1.141

Ryff, C. D. (1989). Happiness is everything, or is it? Explorations on the meaning of psychological well-being. *Journal of Personality and Social Psychology*, 57, 1069–1081.

Ryff, C. D. (2014). Psychological well-being revisited: advances in the science and practice of eudaimonia. *Psychotherapy and Psychosomatic*, 83, 10–28. doi: 10.1159/000353263

Scheier, M. F. *et al.* (2006). The Life Engagement Test: Assessing purpose in life. *Journal of Behavioral Medicine*, 29, 291–298. doi: 10.1007/s10865-005-9044-1

Shao, Z., Janse, E., Visser, K. and Meyer, A. S. (2014). What do verbal fluency tasks measure? Predictors of verbal fluency performance in older adults. *Frontiers in Psychology*, 5, 772. doi: 10.3389/fpsyg.2014.00772

Sonnega, A., Faul, J. D., Ofstedal, M. B., Langa, K. M., Phillips, J. W. and Weir, D. R. (2014). Cohort Profile: the Health and Retirement Study (HRS). *International Journal of Epidemiology*, 43, 576–585. doi: 10.1093/ije/dyu067

Steger, M. (2009). Meaning in life. In S. J. Lopez (Ed.), *Encyclopedia of Positive Psychology* (pp. 605–610). Oxford, UK: Wiley-Blackwell Publishing.

Steger, M. F., Frazier, P., Oishi, S. and Kaler, M. (2006). The Meaning in Life Questionnaire: assessing the presence of an search for meaning in life. *Journal of Counseling Psychology*, 53, 80–93. doi: 10.1037/0022-0167.53.1.80

Steptoe, A., Breeze, E., Banks, J. and Nazroo, J. (2013). Cohort profile: the English longitudinal study of ageing. *International Journal of Epidemiology*, 42, 1640–1648. doi: 10.1093/ije/dys168

Stern, Y., Barnes, C. A., Grady, C., Jones, R. N. and Raz, N. (2019). Brain reserve, cognitive reserve, compensation, and maintenance: operationalization, validity, and mechanisms of cognitive resilience. *Neurobiology of Aging*, 83, 124–129. doi: 10.1016/j.neurobiolaging.2019.03.022

Sutin, A. R., Luchetti, M., Stephan, Y. and Terracciano, A. (in press). Meaning in life and risk of cognitive impairment: a 9-year prospective study in 14 countries. *Archives of Gerontology and Geriatrics*, 88, 104033. doi: 10.1016/j.archger.2020.104033.

Sutin, A. R., Stephan, Y., Damian, R. I., Luchetti, M., Strickhouser, J. E. and Terracciano, A. (2019). Five-factor model personality traits and verbal fluency in 10 cohorts. *Psychology and Aging*, 34, 362–373. doi: 10.1037/pag0000351

Sutin, A. R., Stephan, Y., Luchetti, M. and Terracciano, A. (2018). Loneliness and risk of dementia. *The Journals of Gerontolology, Series B: Psychological Sciences and Social Sciences*, 75(7), 1414–1422. doi: 10.1093/geronb/gby112

Sutin, A. R., Stephan, Y. and Terracciano, A. (2018). Psychological well-being and risk of dementia. *International Journal of Geriatric Psychiatry*, 33, 743–747. doi: 10.1002/gps.4849

Sutin, A. R., Stephan, Y. and Terracciano, A. (2019). Verbal fluency and risk of dementia. *International Journal of Geriatric Psychiatry*, 34, 863–867. doi: 10.1002/gps.5081.

Troyer, A. K., Moscovitch, M. and Winocur, G. (1997). Clustering and switching as two components of verbal fluency: Evidence from younger and older healthy adults. *Neuropsychology*, 11, 138–146. doi: 10.1037/0894-4105.11.1.138

UNESCO. (2003). International standard classification of education, ISCED 1997. In: J. H. P. Hoffmeyer-Zlotnik and C. Wolf (Eds.), *Advances in Cross-National Comparison* (pp. 195–220). New York, NY: Kluwer Academic/Plenum Publishers.

Vaportzis, E. and Gow, A. J. (2018). People's beliefs and expectations about how cognitive skills change with age: Evidence from a U.K.-Wide aging survey. *American Journal of Geriatric Psychiatry*, 26, 797–805. doi: 10.1016/j.jagp.2018.03.016

Viechtbauer, W. (2010). Conducting meta-analyses in R with the metafor package. *Journal of Statistical Software*, 36, 1–48. doi: 10.18637/jss.v036.i03

Wuthrich, V. M., Rapee, R. M., Draper, B., Brodaty, H., Low, L. F. and Naismith, S. L. (2019). Reducing risk factors for cognitive decline through psychological interventions: a pilot randomized controlled trial. *International Psychogeriatrics*, 1–11. doi: 10.1017/S1041610218001485