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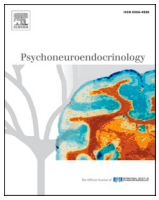

Purpose in life and c-reactive protein: An individual-participant meta-analysis of >50,000 adults

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ABSTRACT

Purpose in life is associated consistently with better health outcomes, which may be due in part to healthier inflammatory profiles. The present research used seven independent cohort studies (total $N = 54{,}491$) to evaluate the association between purpose in life and c-reactive protein (CRP), sociodemographic moderators of the association, and whether purpose is associated with elevated CRP cross-sectionally and longitudinally (three cohorts with longitudinal data). Purpose in life had a modest but consistent association with concurrent CRP (meta-analytic b=-.05, 95 % CI=-.06, −.04, p < .001). The association was apparent across age, sex, race, and education, but was slightly stronger among males and relatively younger participants. Purpose was associated cross-sectionally with lower likelihood of elevated CRP defined either as CRP> 3 (meta-analytic OR=.91, 95 % CI=.88,.94, $p < .001$) or CRP> 10 (meta-analytic OR=.86, 95 % CI=.82,.90, $p < .001$). Although not apparent in all cohorts, the meta-analysis indicated that purpose was associated with lower likelihood of persistently elevated CRP> 3 (meta-analytic OR=.90, 95 % CI=.828,.976, $p = .011$) and lower risk of developing elevated CRP> 3 (meta-analytic HR=.92, 95 % CI=.886,.964, $p < .001$) over the up to 12 years of follow-up. Purpose in life is associated with lower levels of CRP, which may be one mechanism through which purpose is associated with better health outcomes.

Purpose in life – the feeling that one's life is goal-oriented and has direction (Ryff, 1995)– is associated consistently with better health (Irving et al., 2017). Higher in purpose, for example, is associated with fewer chronic diseases (Musich et al., 2018), lower risk of developing neurodegenerative diseases (Sutin et al., 2023a), and greater likelihood of living longer (Cohen et al., 2016). Purpose may be associated with better health outcomes in part through the healthier behavioral patterns associated with it, including greater engagement in physical activity (Sutin et al., 2025) and lower likelihood of smoking (Weston et al., 2024). Purpose in life has also been associated with physiological markers of health, which may act as mechanisms in the association between purpose and better health outcomes (Sutin et al., 2023a). Higher in purpose, for example, is associated with better regulation of hemoglobin A1c (Hafez et al., 2018) and lower allostatic load (Lewis and Hill, 2023). Purpose in life has also been associated with markers of inflammation: Individuals higher in purpose tend to have healthier immune and inflammatory profiles (Sutin et al., 2023b) and show a lower interleukin-6 response to stress (Thoma et al., 2017).

Among common inflammatory markers, higher purpose has been associated with lower c-reactive protein (CRP) (Lachman and Schiloski, 2024). CRP is a non-specific marker of inflammation. Circulating levels of CRP tend to be very low when the individual is healthy and rise rapidly with acute infection (Plebani, 2023). Elevated CRP, however, is not limited to acute infection (Mac Giollabhui et al., 2020). For example, it tends to be higher among individuals living with chronic diseases (Fonseca and Izar, 2016) or chronic stress (Ravi et al., 2021). Elevated CRP is also predictive of the development of chronic disease, including cardiovascular disease and type 2 diabetes (Parrinello et al., 2015). As such, CRP is thought to reflect the general state of inflammation in the body (Banait et al., 2022).

The association between purpose in life and CRP has been tested in large cohort studies. Purpose, for example, has been associated with CRP measured from whole blood from a subset of participants in the Health and Retirement Study (HRS; Sutin et al., 2023a) and a subset of participants from the Midlife in the United States study (MIDUS; Lachman and Schiloski, 2024). A measure of feeling that life is worthwhile (a construct related to purpose) has been associated with lower CRP in the English Longitudinal Study on Aging (ELSA; Steptoe and Fancourt,

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2019). A composite measure of eudaimonic well-being that included purpose but also other components of eudaimonic well-being such as self-acceptance, autonomy, and personal growth, has also been associated with CRP in ELSA, although it was apparent for women but not for men (Steptoe et al., 2012). Longitudinal research using HRS, in contrast, found that purpose was associated with the development of chronic inflammation over time among men but not women (Guimond et al., 2022). Purpose was also found to be unrelated to CRP among a subset of Black participants in HRS (Farmer et al., 2022). These findings suggest that there may be an association between purpose in life and CRP, although there may also be sociodemographic differences in the association. It is difficult to synthesize this published literature with a meta-analysis because there are significant methodological differences across studies (e.g., longitudinal versus cross-sectional, purpose versus a composite well-being factor, focus on specific subpopulations, etc.). As such, missing from this literature is a large-scale, multi-sample study that can increase statistical power to obtain more reliable estimates. This approach is also helpful for identifying sociodemographic moderators because interactions require power and are often difficult to replicate (Sherman and Pashler, 2019). Testing interactions in multiple samples and aggregating the results with meta-analysis can overcome these issues to identify robust moderators.

The aim of this study is to identify the association between purpose in life and CRP. Our primary aim is to test for an association in the general population and establish whether it is apparent across seven independent datasets. A second aim is to evaluate generalizability across major sociodemographic characteristics; that is, to test whether the association is apparent across age, sex, race, and education. A third aim is to examine whether purpose is associated with two thresholds for elevated CRP: CRP> 3 μg/mL (Ridker, 2003) and CRP> 10 μg/mL (Pearson et al., 2003). Note that the threshold of CRP> 10 has been used in the past as a proxy for acute, transient inflammation but it is relatively arbitrary. Here, we do not assume reasons for why CRP is greater than 10 but rather use it as an additional cutoff to classify higher levels of CRP and evaluate whether purpose is associated with higher CRP. A fourth aim is to examine whether purpose is associated with persistently elevated CRP> 3 and the development of elevated CRP> 3 over time in three samples with longitudinal CRP data available. We expect purpose to be associated with lower CRP concurrently and over time. Moderation by sociodemographic factors was considered exploratory due to the conflicting patterns in the literature.

1. Method

1.1. Participants and procedure

Participants were from seven large-scale cohort studies: Health and Retirement Study (HRS; https://hrs.isr.umich.edu), Midlife in the United States (MIDUS; https://www.midus.wisc.edu/), National Health and Aging Trends Study (NHATS; https://www.nhats.org/researcher/nhats), English Longitudinal Study of Ageing (ELSA; https://www.elsa-project.ac.uk/), The Irish LongituDinal study of Ageing (TILDA; https://tilda.tcd.ie/), Survey of Health, Ageing and Retirement in Europe (SHARE; https://share-eric.eu/), and Hispanic Community Health Study/Study of Latinos (HCHS; https://sites.cscc.unc.edu/hchs/). All samples included measures of purpose in their regular psychosocial assessment of participants. HRS measured CRP on a random half of the sample in 2006; the other half was measured in 2008. These two subsamples were combined for analysis. CRP was measured again four and eight years later in HRS. MIDUS measured CRP as part of the Biomarker assessment in MIDUS II. Refresher participants and the Milwaukee sample who had CRP available were also included in the sample. CRP was measured again as part of the Biomarker Project at MIDUS III, 10–12 years later. NHATS measured CRP at Wave 7. ELSA measured CRP as part of the nurse assessment at Wave 4. CRP was measured again four and eight years later in ELSA. TILDA measured CRP at Wave 1. SHARE measured CRP in its biomarker assessment at Wave 6. HCHS measured CRP at the baseline assessment, and purpose was measured as part of the Sociocultural Ancillary Study. All participants provided written informed consent as part of the parent study.

1.2. Measures

Purpose in life. Purpose in life was measured with the Purpose in Life subscale of the Ryff Scales of Psychological Well-Being Ryff, C. D. (1995) in HRS and MIDUS. Items were rated on a scale from 1 (*strongly disagree*) to 6 (*strongly agree*) in HRS and from 1 (*strongly disagree*) to 7 (*strongly agree*) in MIDUS. Purpose in life was measured with a single item ("My life has meaning and purpose.") on a scale from 1 (*agree a lot*) to 3 (*agree not at all*) in NHATS. Purpose was measured with an item ("I feel that my life has meaning.") 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) on a 4-point scale from 1 (*never*) to 4 (*often*) in ELSA, TILDA, and SHARE. Purpose in life was measured with the six items of the Life Engagement Scale (Scheier et al., 2006) on a scale from 1 (*strongly disagree*) to 5 (*strongly agree*) in HCHS. Items were reverse scored when necessary, so that higher scores indicated greater purpose in life in every sample.

C-reactive protein. Blood was collected in each sample either through dried blood spots (HRS, NHATS, SHARE) or through whole blood (MIDUS, ELSA, TILDA, HCHS). Certified labs performed the standard CRP assay on the blood samples in each study. CRP in all samples showed the typical right skew. The natural log of CRP was taken to normalize the distribution in each sample. For some analyses, raw CRP was categorized at > 3.00 μg/mL, which is the clinical threshold associated with poor outcomes (Ridker, 2003). For some analyses, raw CRP was categorized at > 10.00 μg/mL, which is another threshold for elevated CRP (Pearson et al., 2003).

Two additional outcomes were coded for the three samples with repeated assessments of CRP (HRS, MIDUS, ELSA). First, persistently elevated CRP> 3 was defined as two adjacent longitudinal measurements of elevated CRP (>3.00 μg/mL) and coded as 1 and no adjacent elevated CRP coded as 0. This conceptualization of persistence follows the conceptualization of persistence for other longitudinal outcomes (Whitlock et al., 2017). Among participants without elevated CRP< 3 at baseline, incident elevated CRP (>3.00 μg/mL) at the follow-up was coded as 1, and participants without elevated CRP at follow-up were coded as 0.

Covariates. Covariates were age in years, sex (0 =male, 1 =female), race, and education. Race was coded with two dummy-coded variables (1 =Black and 1 =Otherwise identified, both compared to 0 =White) in HRS, MIDUS, and NHATS and as non-white (=1) compared to white (=0) in ELSA (ELSA does not release more specific data on race); SHARE does not collect information on race and TILDA is white. Education was reported in years in HRS, on a scale from 1 (*no school/some grade school*) to 12 (*doctorate or professional degree*) in MIDUS, from 1 (*no schooling completed*) to 9 (*master's, professional, or doctoral degree*) in NHATS, from 1 (*no qualification*) to 7 (*NVQ4/NVQ5/Degree or equivalent*) in ELSA, from 1 (*some primary, not complete*) to 7 (*postgraduate/higher degree*) in TILDA, from 0 (*none*) to 6 (*ISCED-97 code 6*) in SHARE, and from 1 (*less than high school*) to 3 (*more than high school*) in HCHS.

1.3. Statistical analysis

Linear regression was used to examine the association between purpose and CRP. All continuous variables were standardized within each sample before analysis, and dichotomous variables were coded the same across samples (see covariates) to facilitate comparisons. Missing data were deleted listwise in each sample for the cross-sectional analysis. Log transformed CRP was predicted from purpose, controlling for the sociodemographic covariates. Moderation was tested by adding an interaction between purpose and each sociodemographic factor in

separate models for each interaction. Logistic regression was used to test whether purpose was associated with likelihood of elevated levels of CRP, controlling for the sociodemographic covariates. Meta-regression tested whether the strength of the association between purpose and CRP across the three analyses (continuous, CRP>3, CRP>10) varied by the measure of purpose (validated multi-item measure versus single-item measure), mean age of the sample, percent female of the sample, percent of sample with CRP> 3, percent of sample with CRP> 10, and method of sample collection (blood spot versus blood).

Logistic regression tested the association between purpose and persistently elevated CRP longitudinally. This longitudinal analysis included all participants who had at least two longitudinal assessments of CRP. Listwise deletion was used for participants without longitudinal data. Cox regression was used to test whether purpose was associated with risk of developing elevated CRP among participants without elevated CRP at baseline. The Cox regression included participants who did not have elevated CRP> 3 at the baseline assessment and had at least one additional longitudinal assessment of CRP. Listwise deletion was used for participants who did not meet these criteria. For each analysis, a random effects meta-analysis was used to summarize the association across samples. Heterogeneity was evaluated with Q and I^2.

2. Results

Descriptive statistics are in Table 1. Across the seven samples, there were 54,491 participants who ranged in age from 18 to 101, and most samples had an average age of older than 60. The percent female ranged from 54.8 % to 60 % across all samples, and the percent Black ranged from 11.3 % to 18.7 % across the three samples with racial diversity.

The results of the meta-analysis of the cross-sectional association with the continuous measure of CRP are in Fig. 1 and Supplemental Table 1. The meta-analysis indicated a significant association between purpose and CRP: Fig. 1 shows that higher purpose in life was associated with lower CRP. This association was modest (meta-analytic b=-.05, 95 % CI=-.06, −.04, p < .001) but consistent across samples, as indicated by the low heterogeneity (Q=7.90, p = .245; I^2=24.11). Indeed, the association was significant in five of the seven samples. The exceptions were MIDUS and HCHS, which both had a trend (p = .051 and p = .060, respectively) in the same direction and of similar magnitude but note the smaller sample sizes for these two cohorts. Of note, the association was the same when the meta-analysis was limited to the three samples (HRS, MIDUS, HCHS) with validated, multi-item measures of purpose in life (meta-analytic b=-.05, 95 % CI=-.08, −.02, p < .001).

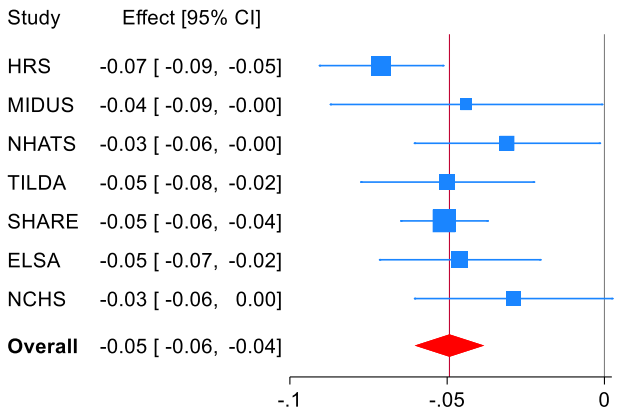

Fig. 1. Forest plot of the association between purpose in life and c-reactive protein.

The interaction analysis indicated moderation by sex and age but not race or education (Supplemental Table S2). When stratified by sex, the meta-analytic association between purpose and CRP was −.06 (p < .001) for males and −.04 (p < .001) for females. This difference was modest but statistically significant as indicated by the statistically significant meta-analytic interaction between purpose in life and sex on CRP (meta-analytic interaction=.02, 95 % CI=.001,.044, p = .010). There was likewise modest moderation by age: Purpose was associated with lower CRP across age, but the association was slightly stronger among relatively younger participants than relatively older participants (meta-analytic interaction=.01, 95 % CI=.006,.022, p < .001). The association between purpose and CRP was similar across race (meta-analytic interaction [Black versus white]=.04, 95 % CI=-.017,.101, p = .165; meta-analytic interaction [otherwise identified versus white]=.01, 95 % CI=-.031,.056, p = .522) and education (meta-analytic interaction=.00, 95 % CI=-.011,.010, p = .622).

Purpose was also associated with lower likelihood of elevated CRP (Table 2). The meta-analysis suggested that for every standard deviation higher purpose in life, there was a 10 % lower likelihood of elevated CRP> 3. This association was significant in the meta-analysis (meta-analytic OR=.91, 95 % CI=.880,.944, p < .001) and in five of the seven samples (HRS, ELSA, TILDA, SHARE, HCHS) (Table 2). There was some heterogeneity across samples (Q=13.66, p = .034; I^2=56.08). Purpose was likewise associated with lower likelihood of elevated CRP> 10

Table 1
Descriptive statistics for all samples.

Variable	HRS	MIDUS	NHATS	ELSA	TILDA	SHARE	HCHS
Age (years)	67.92 (10.29)	53.48 (12.52)	79.00 (7.16)	65.00 (9.13)	62.12 (8.94)	67.72 (9.63)	46.81 (13.64)
Age range	26–100	25–84	67–101	37–90	49–80	30–101	18–75
Sex (female)	60.0 % (6636)	53.9 % (1051)	57.8 % (2486)	55.2 % (3195)	54.8 % (2777)	57.2 % (12,724)	59.6 % (2437)
Race (Black)	11.3 % (1248)	12.2 % (237)	18.7 % (805)	–	–	–	–
Race (Otherwise)	4.5 % (500)	10.5 % (205)	7.8 % (336)	1.8 % (103)	–	–	59.4 % (2427)
Education[b]	12.65 (3.06)	7.85 (2.50)	5.51 (2.23)	4.10 (2.24)	3.86 (1.56)	3.06 (1.45)	2.03 (.86)
Purpose in life	4.59 (.93)	39.20 (6.76)	2.81 (.44)	3.52 (.71)	3.74 (.58)	3.60 (.70)	4.18 (.57)
CRP (ug/mL)	4.62 (9.21)	2.93 (4.98)	2.38 (3.10)	3.68 (7.04)	3.31 (10.06)	3.50 (6.46)	4.31 (7.67)
CRP> 3	38.8 % (4290)	28.3 % (552)	19.2 % (824)	31.9 % (1849)	28.3 % (1435)	28.4 % (6312)	39.4 % (1611)
CRP> 10	10 % (1112)	4.3 % (84)	4.7 % (204)	6.7 % (390)	4.7 % (239)	4.1 % (911)	9.2 % (376)
Incident elevated CRP> 3	15.4 % (1706)	7.1 % (99)	–	8.4 % (484)	–	–	–
Persistent elevated CRP> 3	15.2 % (1680)	7.1 % (138)	–	11.8 % (683)	–	–	–
Blood collection	DBS	Blood	DBS	Blood	Blood	DBS	Blood
N	11,067	1949	4300	5792	5063	22,232	4088

Note. HRS=Health and Retirement Study. MIDUS= Midlife in the United States study. NHATS=National Health and Aging Trends Study. ELSA=English Longitudinal Study of Ageing. TILDA=The Irish LongituDinal Study on Ageing. SHARE=Survey of Health, Ageing and Retirement in Europe. HCHS=Hispanic Community Health Study/Study of Latinos. [a] Compared non-white (=1) to white (=0). [b]Education was reported in years in HRS, on a scale from 1 (*no school/some grade school*) to 12 (*doctorate or professional degree*) in MIDUS, from 1 (*no schooling completed*) to 9 (*master's, professional, or doctoral degree*) in NHATS, from 1 (*no qualification*) to 7 (*NVQ4/NVQ5/Degree or equivalent*) in ELSA, from 1 (*some primary [not complete]*) to 7 (*postgraduate/higher degree*) in TILDA, from 0 (*none*) to 6 (*ISCED-97 code 6*) in SHARE, and from 1 (*less than high school*) to 3 (*more than high school*) in HCHS.

Table 2
The association between purpose in life and likelihood of elevated c-reactive protein.

Sample	N_{total}	n_{event}[a]	OR	95 % CI	P
		C-reactive Protein > 3.00			
HRS	11 067	4290	0.86	0.82, 0.89	< .001
MIDUS	1949	552	0.90	0.82, 1.00	0.051
NHATS	4300	824	0.98	0.91, 1.06	0.571
TILDA	5063	1435	0.94	0.88, 0.99	0.026
SHARE	22 232	6312	0.90	0.87, 0.93	< .001
ELSA	5792	1849	0.94	0.88, 0.99	0.016
HCHS	4088	1611	0.92	0.86, 0.98	0.014
Meta-analysis	54 491	16 873	0.91	0.88, 0.94	< .001
		C-reactive Protein > 10.00			
HRS	11 067	1112	0.79	0.74, 0.84	< .001
MIDUS	1949	84	0.86	0.70, 1.06	0.166
NHATS	4300	204	0.91	0.80, 1.04	0.164
TILDA	5063	239	0.85	0.76, 0.94	0.002
SHARE	22 232	911	0.87	0.82, 0.92	< .001
ELSA	5792	390	0.84	0.77, 0.93	< .001
HCHS	4088	376	0.95	0.85, 1.05	0.315
Meta-analysis	54 491	3316	0.86	0.82, 0.90	< .001

Note. OR=odds ratio. CI=confidence interval. HRS=Health and Retirement Study. MIDUS= Midlife in the United States study. NHATS=National Health and Aging Trends Study. ELSA=English Longitudinal Study of Ageing. TILDA=The Irish LongituDinal Study on Ageing. SHARE=Survey of Health, Ageing and Retirement in Europe. HCHS=Hispanic Community Health Study/Study of Latinos. [a] n_{event} refers to the number of participants in each study who had CRP > 3 or CRP > 10.

(Table 2). This association was significant in the meta-analysis (meta-analytic OR=.86, 95 % CI=.82,.90, $p < .001$) and in four of the seven samples (HRS, ELSA, TILDA, SHARE) (Table 2). Heterogeneity across samples was low (Q=10.17, $p = .118$, I^2=40.99). For both sets of analyses, the association was in the same direction but not significant in MIDUS, NHATS, and HCHS, the smallest of the seven samples.

The results of the meta-regression are in Supplemental Table S3. None of the factors tested was significant: There was not a statistical difference in the association across the measure of purpose (validated multi-item measure versus single-item measure), age of the sample, percent female of the sample, percent of sample with CRP> 3, percent of sample with CRP> 10, or method of sample collection (blood spot versus blood) for any of the three analyses (purpose and continuous CRP, purpose and likelihood of CRP>3, purpose and likelihood of CRP>10).

Finally, three samples (HRS, MIDUS, ELSA) had longitudinal data on CRP. Purpose in life was associated with both persistent elevated CRP> 3 and risk of incident elevated CRP> 3 (Table 3). The meta-analysis suggested that purpose was associated with an approximately 10 % lower likelihood of persistent elevated CRP> 3 (meta-analytic OR=.90, 95 % CI=.828,.976, $p = .011$); this association was significant in HRS and ELSA but not MIDUS (Table 3). Heterogeneity across samples was moderate (Q=4.24, $p = .120$, I^2=52.79). The meta-analysis likewise suggested that purpose was associated with a 9 % lower risk of incident elevated CRP> 3 (meta-analytic HR=.92, 95 % CI=.886,.964, $p < .001$) (Table 3); this association was significant in HRS but not MIDUS or ELSA. Heterogeneity across samples was low (Q=.71, $p = .699$, I^2=0).

Table 3
The association between purpose in life and likelihood of persistent c-reactive protein > 3.00 and incident elevated c-reactive protein.

Sample	N_{total}	N^a_{event}	OR	95 % CI	*p*
		Persistent C-reactive Protein > 3.00			
HRS	5471	1680	0.86	0.80, 0.91	< .001
MIDUS	661	138	1.06	0.86, 1.30	0.606
ELSA	3804	683	0.91	0.83, 0.98	0.020
Meta-analysis	9936	2501	0.90	0.83, 0.98	0.011
	N		HR	95 % CI	p
		Incident Elevated C-reactive Protein			
HRS	5326	1709	0.92	0.87, 0.96	< .001
MIDUS	468	99	0.90	0.71, 1.14	0.375
ELSA	2784	484	0.96	0.87, 1.05	0.367
Meta-analysis	8578	2292	0.92	0.89, 0.96	< .001

Note. OR=odds ratio. CI=confidence interval. HR=hazard ratio. HRS=Health and Retirement Study. MIDUS= Midlife in the United States study. ELSA=English Longitudinal Study of Ageing. a n_{event} refers to the number of participants in each study with persistent CRP > 3 or incident CRP > 3.

3. Discussion

The present study used a coordinated analysis approach across seven independent datasets to examine the association between purpose in life and CRP. The meta-analysis indicated that purpose had a small but consistent association with overall CRP as well as CRP past two common thresholds for elevated levels. The moderation analysis indicated slight differences by sex and age but not race or education. The meta-analysis also indicated that purpose was associated with lower likelihood of persistently elevated CRP> 3 and lower risk of elevated CRP> 3 at a subsequent assessment, although not all samples showed this pattern. Overall, the association between purpose and this marker of inflammation was generally modest but consistent across samples.

Theoretical models implicate purpose in life as a psychological resource that supports better health across the lifespan (McKnight and Kashdan, 2009). These models indicate that purpose is associated with health outcomes through multiple mechanisms, including physiological pathways as well as behavioral ones (Kim et al., 2019). And, indeed, previous research has found that purpose is associated with healthier inflammatory profiles (Lachman and Schiloski, 2024; Sutin et al., 2023a) and other biomarkers, such as better regulation of HbA1c (Hafez et al., 2018) and lower allostatic load (Lewis and Hill, 2023). The present research adds that purpose in life is associated consistently with lower CRP, a nonspecific marker of inflammation (Plebani, 2023). This association likely reflects both the better physical health of the individual and behaviors that tend to reduce inflammation.

The goal of the present research was to assess the association between purpose in life and CRP, regardless of why the association may occur. As such, possible mechanisms of the association were not controlled for in the analyses. There are likely to be numerous reasons why higher purpose would be associated with lower CRP. Individuals higher in purpose, for example, tend to engage in more physical activity (Sutin et al., 2025) and are less likely to smoke (Weston et al., 2024). They also carry a lower burden of chronic disease (Musich et al., 2018), are less likely to report stress (Sutin et al., 2024), are less likely to experience depression (Boreham and Schutte, 2023), and tend to be more socially engaged and less lonely (Sutin et al., 2022). These behavioral, clinical, psychological, and social factors are associated with CRP (Christofaro et al., 2023; Johnson et al., 2013; Mac Giollabhui et al., 2021; Smith et al., 2020), and thus may be pathways in this association. Individuals higher in purpose also use more preventative healthcare services that may reduce the likelihood of conditions that lead to elevated levels of CRP (Kim et al., 2014).

There may also be biological mechanisms in the pathway between purpose and CRP. Activation of the sympathetic nervous system and the hypothalamic–pituitary–adrenal (HPA) axis have been implicated in inflammatory responses and are mechanisms hypothesized to contribute to inflammation, particularly in the context of depression (Slavich and Irwin, 2014). Conserved transcriptional response to adversity (CTRA) has also been identified as a mechanism in the pathway between psychological and social factors and inflammation that may be a mechanism of inflammation (Cole, 2013). Purpose has been associated with less sympathetic nervous system activity in response to psychological stress (Ishida et al., 2011), faster cortisol recovery to baseline after a social stressor (Fogelman and Canli, 2015), and healthier CTRA gene expression (Fredrickson et al., 2015). These biological mechanisms may thus also contribute to the association between purpose and CRP.

Lower CRP may be one mechanism to the better cardiovascular

outcomes associated with purpose (Cohen et al., 2016). Higher CRP is associated with greater risk of incident cardiovascular events (Burger et al., 2023), and thus the lower levels of CRP associated with purpose may be one associated pathway to lower risk of these events for individuals higher in purpose. CRP has also been implicated in the development of other chronic diseases, such as type 2 diabetes (Parrinello et al., 2015) and dementia (Darweesh et al., 2018). Purpose may be associated with lower risk of developing these diseases in part through lower average levels of CRP.

The moderation analysis indicated more similarity than difference in the association between purpose in life and CRP across sociodemographic groups. Indeed, although statistically significant, there was only a modest difference in the association between males (β=-.06) and females (β=-.04) and likewise by age. This similarity across sex and age, as well as race and education, highlights the generalizability of the association across these groups. That is, the protective association is apparent across populations that may differ in average level of CRP.

We included samples that measured purpose in life with either a validated, multi-item scale or a single item. It is of note that the association was the same when the meta-analysis was limited to samples with a multi-item scale. This pattern suggests that the association is not dependent on a specific scale, and that a single item can capture the component of purpose that is associated with CRP. Similar associations support the construct validity of single-item measures of purpose, as well as multi-item measures.

There was modest evidence that purpose in life had a longitudinal relation with CRP: Individuals with more purpose were less likely to have persistently elevated levels of CRP and were less likely to develop elevated levels of CRP over time. Although mostly consistent across the three samples with longitudinal CRP data available, the meta-analytic association was driven largely by the HRS sample. It is important to note that the longitudinal association between purpose in life and incident elevated CRP in HRS was inconsistent with a previous study with a longitudinal analysis of the HRS data (Guimond et al., 2022). This difference is likely due to differences in inclusion criteria between the two studies. Specifically, the previous study focused on CRP between 3 and 10 μg/mL as a marker of chronic inflammation and excluded participants with CRP> 10 μg/mL because the elevated level could be due to acute infection rather than chronic inflammation. We did not have this exclusion criteria as our interest was in level of CRP regardless of cause. In addition, it has been argued that levels > 10 should be included in analyses of CRP, in part because factors other than acute infection can cause higher levels of CRP (Mac Giollabhui et al., 2020). As such, purpose may not be associated with risk of incident chronic inflammation, but it may be associated with likelihood of having highly elevated levels that could be due to any number of factors (including transient infections) as well as systemic inflammation. There may also be other reasons for the inconsistencies in the longitudinal associations across samples, including differences in age, differences in how both purpose and CRP were measured, sample size and time between assessments. It is difficult to evaluate these differences because only three samples were included in the longitudinal analysis. Still, this analysis provides a foundation for future research to address the longitudinal relation between purpose and CRP.

The present research focused on purpose in life as a concurrent correlate and predictor of subsequent CRP measured longitudinally. It is also possible that there are bidirectional associations between purpose and CRP. That is, higher CRP may degrade feelings of purpose over time. There are bidirectional associations between purpose and other health-related factors (e.g., physical activity; Yemiscigil and Vlaev, 2021). Low-grade inflammation has been associated with incident depression over time (Janssen et al., 2021). It is possible that inflammation may also contribute to changes in feeling purposeful over time.

4. Strengths and limitations

The present study had several strengths, including the measurement of CRP in seven independent samples, the use of a coordinated approach to evaluate the association across studies, and longitudinal data in three samples to test associations over time. There are also limitations that could be addressed in future research. CRP was chosen as the measure of inflammation because it is a general biomarker that reflects inflammation in body, regardless of source, and because of its availability in multiple samples. There are, however, many other measures of inflammation, and it would be worthwhilesutin to examine the association with purpose to determine whether it is specific to CRP or generalizes to other markers. The current evidence is mixed, such that purpose is associated with lower interleukin-6 and 10 (Sutin et al., 2023a) but not glial fibrillary acidic protein, a measure of neuroinflammation (Sutin et al., 2025). The correlational approach in this research also means that it is not possible to draw causal conclusions about purpose and CRP. It is possible that a chronic inflammatory state could have detrimental effects on psychological functions, including reducing purpose. Bidirectional effects are also possible, with lacking a sense of purpose and inflammation contributing to and reinforcing a vicious cycle. In addition, we also did not address the reasons for elevated CRP. Future research could test whether the associations differ by the underlying cause (e.g., chronic medical conditions, transient infections, heavy smokers) of elevated CRP. As reviewed in the Introduction, some previous studies have examined the association between purpose in life and CRP, and thus a systematic review and meta-analysis of the published literature might be fruitful for future research. Finally, although there was little evidence of moderation, which suggests generalizability, more research needs to address this association in other populations, particularly samples from middle- and lower-income countries to better evaluate generalizability. We further reiterate the importance of testing these associations in more diverse populations, particularly non-white populations, lower-SES populations, and populations from non-Western countries to fully evaluate generalizability.

5. Conclusion

Despite these limitations, the present research provides replicable evidence for an association between purpose in life and lower levels of c-reactive protein, a measure of non-specific inflammation. Individuals with more purpose in life may have healthier outcomes, in part, through healthier inflammatory profiles, including lower CRP. Purpose in life is malleable and can be increased through intervention (Manco and Hamby, 2021; Park et al., 2019). If the relation between purpose and inflammation is supported with experimental evidence, interventions and public policy to increase purpose may be a promising target to reduce inflammation and improve health.

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N/A

Clinical trial registration

N/A

CRediT authorship contribution statement

Sutin Angelina: Writing – original draft, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Martina Luchetti:** Writing – review & editing, Conceptualization. **Yannick Stephan:** Writing – review & editing, Conceptualization. **Antonio Terracciano:** Writing – review & editing, Conceptualization.

Ethics approval statement

IRB approval was not necessary because this research used de-identified data from public datasets.

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Declaration of Competing Interest

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.psyneuen.2025.107614.

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