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Maintaining sense of purpose in midlife predicts better physical health

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ABSTRACT

Objective: Having a sense of purpose in life is fundamental to psychological and physical well-being. Despite the benefits of purpose, it may be difficult to hold onto purpose as people age. The present research addressed four aims: (1) to estimate average change in sense of purpose during midlife; (2) to test associations between purpose levels and later physical health; (3) to test associations between purpose change and later physical health; (4) to examine the cross-cultural generalizability of findings.

Methods: We used reliable change indices to estimate change in sense of purpose during midlife in three prospective cohorts: one comprised predominately of White participants in the U.S. ($N = 2692$), a second predominately of African American participants in the U.S. ($N = 248$), and a third of Japanese participants in Tokyo ($N = 644$). Next, we used linear regression to examine associations between purpose levels and purpose change and later self-reported general health and chronic health conditions.

Results: At the group level, purpose declined slightly across time (Cohen's $ds = -0.08$ to -0.17). At the individual level, 10–14% of participants reliably decreased in purpose, whereas only 6–8% of participants reliably increased in purpose. Consistent with our preregistered hypotheses, higher purpose levels predicted better health in the two larger samples ($\beta s = 0.10$–0.18, small effects) and more positive purpose change predicted better health in all three samples ($\beta s = 0.08$–0.22., small to medium effects).

Conclusion: Together, these findings suggest that both having a sense of purpose and holding onto it may be important for physical health in middle to older adulthood.

1. Introduction

Experiencing a sense of purpose in life has been shown to predict better physical health and longer survival [1–3]. Despite its importance for healthy aging, levels of sense of purpose appear to decline from middle into older adulthood as people experience more personal losses and set fewer long-term goals [4–6]. Yet, not everyone experiences this normative decline in purpose. Some people experience stable or even increasing purpose throughout adulthood [4,7]. Little is known about whether and how these individual differences in trajectories of sense of purpose are associated with physical health. Does holding onto or a finding greater sense purpose as one ages predict better health? The present study examined mean levels of sense of purpose as well as longitudinal change in sense of purpose as predictors of self-reported general health and chronic health conditions in three samples from the United States and Japan.

Sense of purpose involves having goals and intentions for the future that contribute to a sense that life is meaningful [8]. In addition to being a core component of psychological well-being, sense of purpose has also been linked to aspects of better physical well-being including in one of the samples used in the present research (MIDUS Core Sample). Purposeful older adults tend to report better subjective health, are at lower risk for stroke and dementia [9,10], and live longer [1,2,11] relative to their counterparts with a lower sense of purpose. Similar results have been found in a Japanese sample, in which *ikigai*, or a "life worth living," was associated with lower mortality risk [12].

Having a sense of purpose may promote health via pathways that are shared with other types of well-being, as well as via pathways that are specific to sense of purpose. Well-being is theorized to benefit health by promoting positive health behaviors and improving the functioning of physiological systems [13,14]. Consistent with this view, sense of purpose has been uniquely associated with a greater sense of control over

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one's health and lower allostatic load, a measure of dysregulation across multiple physiological systems [3]. Psychosocial and behavioral mechanisms likely account for these physical health benefits. For instance, purposeful adults tend to have more supportive and less straining social relationships [15]. Sense of purpose also appears promotive of healthier lifestyle behaviors; longitudinal research shows that purposeful adults are less likely to develop sleep issues, become physically inactive, or develop unhealthy body mass index (BMI) [16]. Moreover, sense of purpose appears associated with reduced negative affect and physical symptom reactivity to daily stressors [17]. Taken together, these findings can be interpreted in the context of living a purposeful life, which mandates building positive relations with others, taking better care of oneself, and avoiding being overly reactive to daily events in order to continue progress toward life goal pursuit. Perhaps for these reasons, the longitudinal impact of sense of purpose on health outcomes has been shown even when accounting for other aspects of well-being such as depressive symptoms [11] and positive affect [2].

Given that moving from middle to older adulthood appears to be a particularly vulnerable time for losing one's sense of purpose [4,6], it is important to examine associations between change in sense of purpose during this time and physical health outcomes. Prior research, using earlier waves of one of the samples used in the present research (MIDUS Core sample), found that individuals with declining psychological well-being trajectories experienced negative health changes compared to individuals with persistently high psychological well-being [18]. However, this research compared categorical change profiles, rather than examining the independent effects of level and change. Drawing from research on hedonic well-being and personality, there is reason to believe that longitudinal change may predict health above and beyond mean levels. Differential rates of change may follow any value of initial level and as separate quantities these two estimates (level and change) may relate to outcomes differently [19]. For example, longitudinal increases in positive affect and life satisfaction and decreases in negative affect have been shown to predict better self-reported health and fewer chronic health conditions in both the U.S. and Japan [20], independent of level. Similarly, longitudinal change in personality has been linked to several health outcomes above and beyond personality level, including self-rated health [21], health-related risk factors [22], and mortality [23]. Together, these findings provide initial evidence that sense of purpose change may uniquely predict health outcomes above and beyond sense of purpose level.

In the present study, we investigated four aims concerning sense of purpose level and change and their associations with later physical health. We focused on this directionality given that past work has shown modest effects of self-rated health on later changes in sense of purpose [4] and that experiencing major adverse health events has no clear impact on trajectories for sense of purpose [24]. Moreover, evidence that changes in sense of purpose matter for later health would scaffold recent calls for interventions on this front for promoting healthy aging [25]. First, we aimed to replicate previous findings that sense of purpose tends to decline with age. Second, we aimed to replicate previous findings that higher sense of purpose level predicts better physical health. We preregistered the hypothesis that higher sense of purpose should be associated with better general health and fewer chronic health conditions. Third, we investigated whether sense of purpose change predicts physical health above and beyond sense of purpose level. We preregistered the hypothesis that more positive sense of purpose change should be associated with better general health and fewer chronic health conditions, above and beyond purpose level. Fourth, we examined the replicability and cross-cultural generalizability of sense of purpose change and its associations with health, by testing our research questions in three different samples: one comprised of predominately White participants in the U.S., a second of predominately African American participants residing in Milwaukee, and a third of Japanese participants residing in or near Tokyo.

2. Method

2.1. Samples and longitudinal study design

The present study used data from the Midlife in the United States (MIDUS) and Midlife in Japan (MIDJA) studies [26–32]. The MIDUS is a large publicly available dataset aimed at collecting a large sample of participants from the U.S. during midlife. The MIDUS Core Sample is diverse in terms of age, gender, and geographic location, but is predominately White. Beginning in MIDUS 2, data were collected from a new sample of predominately African American participants residing in Milwaukee. Ninety-three percent of the sample selected Black and/or African American as their primary racial origin. The MIDJA is a sample of Japanese adults from the Tokyo metropolitan area. In the present study, we compared results across the MIDUS Core Sample, the MIDUS Milwaukee African American Sample, and the MIDJA sample. Because a more reliable measure of sense of purpose was introduced in MIDUS 2, we used sense of purpose data from MIDUS 2 (collected in 2004–06) and MIDUS 3 (2013–15) and MIDJA 1 (2008) and MIDJA 2 (2012) to predict self-reported general health and chronic health conditions in MIDUS 3 and MIDJA 2 respectively. Only participants with health data in MIDUS 3/MIDJA 2 and with both measurement occasions of sense of purpose data were included in primary analyses ($N = 2692$ MIDUS Core Sample; $N = 248$ MIDUS Milwaukee African American Sample; $N = 644$ MIDJA Sample). Thus, the present investigation included two waves of data collected approximately nine years apart (in MIDUS) and four years apart (in MIDJA). Within the subsample of participants who participated in at least one of the waves used in the present analyses ($N = 4946$ MIDUS Core Sample; $N = 592$ MIDUS Milwaukee African American Sample; $N = 1027$ MIDJA Sample), missingness ranged from 0.02% to 42.4% across variables of interest in the MIDUS Core Sample, 0% to 45.4% in the MIDUS Milwaukee African American Sample, and 0% to 37.2% in the MIDJA sample.

The present research involved secondary analyses of existing data, so the sample size was predetermined. Sensitivity power analyses showed that we had at least 90% power to detect small to medium associations ($r = 0.06$–0.20 across samples) with an alpha level of 0.05. Power analyses were conducted in R using the pwr package [33].

2.2. Measures

Descriptive statistics were calculated in the samples used in the present research (i.e., participants with health data at the final timepoint and both measurement occasions of sense of purpose). Thus, the reported statistics may differ slightly from those reported in other MIDUS and MIDJA studies.

2.2.1. Sense of purpose

Sense of purpose was assessed using 7 items from the Ryff Psychological Well-being Scale [8]. Responses were made on a 7-point scale that ranged from Strongly Disagree to Strongly Agree. Example items were "*I have a sense of direction and purpose in life*" and "*I live life one day at a time and don't really think about the future*" (reverse-scored). Responses were summed for a total score that ranged from 7 to 49. In the MIDUS 2 Core Sample, the mean response was 39.06 (SD = 6.76). In the MIDUS 2 Milwaukee African American Sample, the mean response was 38.18 (SD = 7.36). In the MIDJA 1 Sample, the mean response was 31.82 (SD = 5.17). Cronbach's alpha ranged from 0.67 to 0.72 across timepoints and samples.

2.2.2. Self-reported general health

Participants were asked "Using a scale from 0 to 10 where 0 means 'the worst possible health' and 10 means 'the best possible health,' how would you rate your health these days?" In the MIDUS 3 Core Sample, the mean response was 7.34 (SD = 1.59; skewness = −0.90). In the MIDUS 3 Milwaukee African American Sample, the mean response was

6.68 (SD = 1.81; skewness = −0.16). In MIDJA 2, the mean response was 7.24 (SD = 2.04; skewness = −0.37).

2.2.3. Chronic health conditions (Multimorbidity)

Participants were asked to report which chronic health conditions they experienced in the past 12 months from a set of 30 common conditions (e.g., stroke, diabetes, migraines, lupus, gall bladder trouble). More than one chronic condition is known as multimorbidity and is a well-known indicator of overall general health [34]. In the MIDUS 3 Core Sample, the mean number of chronic health conditions was 3.25 (range 0–20; SD = 3.14; skewness = 1.50). In the MIDUS 3 Milwaukee African American Sample, the mean number of chronic health conditions was 4.34 (range 0–16; SD = 3.35; skewness = 0.85). In MIDJA 2, the mean number of chronic health conditions was 2.14 (range 0–10; SD = 1.89; skewness = 1.18).

2.2.4. Covariates

Self-reported gender was collected at baseline (56% women in MIDUS Core Sample; 68% women in the MIDUS Milwaukee African American Sample; 53% women in the MIDJA Sample). Baseline age in years was computed by subtracting birthdate from the baseline interview date. Missing ages were found using a combination of public and proprietary databases. In the MIDUS Core Sample, the mean baseline age was 55.23 (range = 30–84; SD = 11.23). In the MIDUS Milwaukee African American Sample, the mean baseline age was 51.01 (range = 34–82; SD = 10.67). In the MIDJA Sample, the mean baseline age was 54.7 (range = 30–79; SD = 13.43). In the two MIDUS samples, education was assessed on a 12-point scale ranging from 1 (*no school/some grade school*) to 12 (*PhD, MD, JD, or other professional degree*). In the MIDUS Core Sample, mean education was 7.51 (*2 or more years of college but no degree or a 2-year college degree*; SD = 2.51). In the MIDUS Milwaukee African American Sample, mean education was 5.75 (*between high school diploma and 1 to 2 years of college*; SD = 2.28). In the MIDJA Sample, education was assessed on an 8-point scale ranging from 1 (*8th grade graduate*) to 8 (*graduate school*); mean education was 4.56 (*vocational or 2-year college degree*; SD = 2.04). Race was assessed in the U.S. samples using the item "What are your main racial origins—that is, what race or races are your parents, grandparents, and other ancestors?" Because more than 90% of the MIDUS Core Sample was White, we created a dummy variable in which White = 0 and Other Race = 1. Because more than 90% of the MIDUS Milwaukee African American Sample was Black and/or African American, we created a dummy variable in which Black and/or African American = 0 and Other Race = 1.

2.3. Analytic strategy

All analyses were conducted in R version 3.6.1. We used the following R packages: mice [36], pscl [37], and MASS [38] in main analyses. To calculate change in sense of purpose, we computed reliable change indices (RCI) for each participant. RCI estimates the degree of reliable change in a measure between two timepoints [39]. First, we computed difference scores by subtracting the second sense of purpose measurement occasion from the first sense of purpose measurement occasion. Second, we calculated the reliability of the measurement by multiplying the standard deviation of sense of purpose by the square root of 1 minus its internal consistency. To estimate internal consistency, we used the average Cronbach's alpha across timepoints and samples (i.e., 0.70). Third, we divided the difference scores by the reliability of the measurement. This approach to calculating sense of purpose change differed from our original pre-registered plan, due to important concerns about our original approach that were raised during the review process. The results of the pre-registered analyses mainly converge with the results reported here and are available on osf (https://osf.io/brcen/).

In primary analyses, we used linear regressions to predict self-reported general health and chronic health conditions (in MIDUS 3 and MIDJA 2) within each sample. Baseline level of sense of purpose and sense of purpose change were entered as predictors, and baseline health, age, gender, and education were included as covariates. Race was also included as a covariate in the U.S. samples. In addition, we conducted three sets of sensitivity analyses to test the robustness of results to the inclusion of covariates, approaches to missing data, and statistical models. In the first set of sensitivity analyses, we did not adjust for baseline health. In the second set of sensitivity analyses, we used multiple imputation to account for missing data. Specifically, we used predictive mean matching in five imputed datasets using the mice package in R. We imputed missing values on all predictor and outcome variables in line with recommendations by van Ginkel and colleagues [40]. In the third set of sensitivity analyses, we used ordinal regression rather than linear regression to predict self-reported general health (a single Likert-type item) and zero-inflated Poisson regression rather than linear regression to predict chronic health conditions (a count variable).

3. Results

R code to reproduce all results is available at https://osf.io/brcen/. Data are available online at the Inter-university Consortium for Political and Social Research.

3.1. Change in sense of purpose

Table 1 displays results of paired sample *t*-tests and reliable change analyses comparing Time 1 sense of purpose to Time 2 sense of purpose. At the group level, sense of purpose decreased slightly in all three samples (small effects [41]). At the individual level, reliable change analyses revealed that 10–14% of participants reliably decreased in sense of purpose as they aged, whereas only 6–8% of participants reliably increased in sense of purpose during the same time period. Although more participants reliably decreased (compared to increased) in sense of purpose, the majority of participants did not experience reliable change in sense of purpose, in line with the small group-level effect.

3.2. Sense of purpose level and change predicting health

Table 2 displays standardized regression coefficients, standard errors, *t*-statistics, *p* values, and 95% confidence intervals (CIs) from multiple regressions predicting self-reported general health from purpose level and purpose change, controlling for baseline health, age, gender, education, and race. Continuous predictor and outcome variables were z-scored and categorical predictors were dummy coded; beta values can be interpreted in units of standard deviations. Higher purpose level was associated with significantly better self-reported general health and significantly fewer chronic health conditions in the MIDUS Core Sample and in the MIDJA Sample (small effects). Purpose level was not significantly associated with either health outcome in the MIDUS Milwaukee African American Sample.

More positive purpose change was associated with better self-reported general health in all three samples (small to medium effects). More positive purpose change was also associated with fewer chronic health conditions in the MIDUS Core Sample and the MIDJA sample (small effects), but the effect was not statistically significant in the MIDUS Milwaukee African American Sample. Despite differences in statistical significance, the 95% CIs among the three samples overlapped.

Tables 3–5 display results from sensitivity analyses. The direction of effects was consistent across primary analyses and three sensitivity analyses in all three samples. Only one statistically significant effect did not hold in sensitivity analyses. Specifically, the association between purpose change and chronic health conditions was not statistically significant in MIDJA when multiple imputation was used (see Table 4). In addition, several effects that were not statistically significant in primary analyses for the MIDUS Milwaukee African American Sample were

Table 1
Change in sense of purpose.

	Time Lag (Years)	*t*	*p*	Cohen's *d*	95% CI	Reliably Decreased	No Reliable Change	Reliably Increased
MIDUS Core Sample	9	8.11	< .001	−0.13	−0.16, −0.10	12%	81%	7%
MIDUS Milwaukee Sample	9	2.77	.006	−0.17	−0.30, −0.05	14%	78%	8%
MIDJA Sample	4	2.52	.012	−0.08	−0.15, −0.02	10%	83%	6%

Note. Percent reliably increased/decreased are based on reliable change indices.

Table 2
Primary analyses: sense of purpose level and change predicting health.

MIDUS Core Sample					
DV = General Health	*β*	*SE*	*t*	*p*	95% CI
Purpose Level	0.18	0.02	9.53	< .001	0.14, 0.21
Purpose Change	0.17	0.02	9.71	< .001	0.14, 0.21
DV = Chronic Conditions	*β*	*SE*	*t*	*p*	95% CI
Purpose Level	−0.10	0.02	5.50	<.001	−0.13, −0.06
Purpose Change	−0.10	0.02	5.65	<.001	−0.13, −0.06
MIDUS Milwaukee African American Sample					
DV = General Health	*β*	*SE*	*t*	*p*	95% CI
Purpose Level	0.14	0.08	1.83	.068	−0.01, 0.30
Purpose Change	0.22	0.07	3.13	.002	0.08, 0.36
DV = Chronic Conditions	*β*	*SE*	*t*	*p*	95% CI
Purpose Level	−0.03	0.06	0.52	.603	−0.16, 0.09
Purpose Change	−0.10	0.06	1.76	.079	−0.21, 0.01
Midlife in Japan (MIDJA) Sample					
DV = General Health	*β*	*SE*	*t*	*p*	95% CI
Purpose Level	0.13	0.04	3.14	.002	0.05, 0.21
Purpose Change	0.09	0.04	2.34	.020	0.01, 0.17
DV = Chronic Conditions	*β*	*SE*	*t*	*p*	95% CI
Purpose Level	−0.13	0.04	3.35	< .001	−0.20, −0.05
Purpose Change	−0.08	0.04	2.09	.037	−0.15, −0.005

Note. Baseline health, age, sex, and education were included as covariates in all models. Race was included as a covariate in the U.S. samples. CI = confidence interval. Purpose change is coded such that higher values indicate greater increases (or less steep decreases) in sense of purpose across time.

Table 3
Sensitivity analyses: not adjusting for baseline levels of health.

MIDUS Core Sample					
DV = General Health	*β*	*SE*	*t*	*p*	95% CI
Purpose Level	0.32	0.02	15.62	< .001	0.28, 0.36
Purpose Change	0.23	0.02	11.26	< .001	0.19, 0.27
DV = Chronic Conditions	*β*	*SE*	*t*	*p*	95% CI
Purpose Level	−0.22	0.02	10.59	< .001	−0.26, −0.18
Purpose Change	−0.13	0.02	6.65	< .001	−0.17, −0.09
MIDUS Milwaukee African American Sample					
DV = General Health	*β*	*SE*	*t*	*p*	95% CI
Purpose Level	0.25	0.08	3.10	.002	0.09, 0.41
Purpose Change	0.28	0.08	3.74	< .001	0.13, 0.43
DV = Chronic Conditions	*β*	*SE*	*t*	*p*	95% CI
Purpose Level	−0.24	0.08	3.07	.002	−0.40, −0.09
Purpose Change	−0.22	0.07	2.99	.003	−0.37, −0.08
Midlife in Japan (MIDJA) Sample					
DV = General Health	*β*	*SE*	*t*	*p*	95% CI
Purpose Level	0.23	0.05	5.00	< .001	0.14, 0.32
Purpose Change	0.11	0.04	2.49	.013	0.02, 0.20
DV = Chronic Conditions	*β*	*SE*	*t*	*p*	95% CI
Purpose Level	−0.22	0.05	4.81	< .001	−0.31, −0.13
Purpose Change	−0.09	0.04	2.06	.039	−0.18, −0.004

Note. Baseline age, sex, and education were included as covariates in all models. Race was included as a covariate in the U.S. samples. CI = confidence interval. Purpose change is coded such that higher values indicate greater increases (or less steep decreases) in sense of purpose across time.

statistically significant in one or more sensitivity analyses. Differences across sensitivity analyses were modest even when statistical significance changed.

Table 4
Sensitivity analyses: multiple imputation.

MIDUS Core Sample					
DV = General Health	*β*	*SE*	*t*	*p*	95% CI
Purpose Level	0.17	0.02	9.35	< .001	0.13, 0.21
Purpose Change	0.16	0.02	10.30	< .001	0.13, 0.19
DV = Chronic Conditions	*β*	*SE*	*t*	*p*	95% CI
Purpose Level	−0.11	0.02	4.95	<.001	−0.16, −0.06
Purpose Change	−0.09	0.02	5.40	< .001	−0.13, −0.06
MIDUS Milwaukee African American Sample					
DV = General Health	*β*	*SE*	*t*	*p*	95% CI
Purpose Level	0.14	0.05	2.52	<.001	0.03, 0.25
Purpose Change	0.19	0.05	3.66	< .001	0.08, 0.30
DV = Chronic Conditions	*β*	*SE*	*t*	*p*	95% CI
Purpose Level	−0.06	0.07	0.80	.447	−0.23, 0.11
Purpose Change	−0.11	0.05	2.48	< .001	−0.21, 0.01
Midlife in Japan (MIDJA) Sample					
DV = General Health	*β*	*SE*	*t*	*p*	95% CI
Purpose Level	0.12	0.04	3.15	.004	0.04, 0.19
Purpose Change	0.10	0.02	2.86	.007	0.03, 0.17
DV = Chronic Conditions	*β*	*SE*	*t*	*p*	95% CI
Purpose Level	−0.11	0.04	2.62	< .001	−0.20, −0.02
Purpose Change	−0.06	0.04	1.69	.110	−0.14, 0.02

Note. Baseline health, age, sex, and education were included as covariates in all models. Race was included as a covariate in the U.S. samples. CI = confidence interval. Purpose change is coded such that higher values indicate greater increases (or less steep decreases) in sense of purpose across time.

4. Discussion

Sense of purpose is a key component of psychological well-being, and has been linked with better physical well-being and healthier aging [2,9,11,42]. The present research replicated two previous findings regarding purpose in midlife and older adulthood and extended those findings to a sample of predominately African American adults and to a sample of Japanese adults. First, at the group level, sense of purpose declined with age in all three samples. However, at the individual level, only 10–14% of individuals reliably decreased in sense of purpose, with the majority of individuals not reliably increasing or decreasing in sense of purpose. Second, participants with higher sense of purpose levels experienced better self-reported general health and reported fewer chronic health conditions in two out of three samples. In addition to replicating and extending previous findings, the present research tested an important open question concerning independent associations of sense of purpose levels and sense of purpose change with physical health. In all three samples, individuals with more positive purpose change experienced better physical health, above and beyond baseline levels of sense of purpose.

The present findings build on previous research suggesting that sense of purpose levels tend to be lower for older compared to younger adults [5,43] and decline during the transition from midlife to older adulthood [4,6,7]. This prior research includes one study conducted on the first two waves of the MIDUS Core Sample [6]. At the group level, average change in sense of purpose was negative in all three samples. This finding extends prior research by showing that a declining sense of purpose in midlife can be observed cross-culturally, in the U.S. and Japan, and in both a predominately White sample and a predominately African American sample. However, at the individual level, reliable

Table 5
Sensitivity analyses: ordinal regression and zero-inflated poisson regression.

MIDUS Core Sample					
DV = General Health	*OR*	*SE*	*t*	*p*	95% CI
Purpose Level	1.46	0.04	9.21	< .001	1.35, 1.59
Purpose Change	1.46	0.04	9.55	< .001	1.35, 1.58
DV = Chronic Conditions	*IRR/ OR*	*SE*	*z*	*p*	95% CI
Count Model: Purpose Level	0.90	0.01	8.15	<.001	0.89, 0.93
Count Model: Purpose Change	0.91	0.01	7.71	< .001	0.89, 0.93
Zero Inflation: Purpose Level	1.11	0.08	1.35	.176	0.95, 1.29
Zero Inflation: Purpose Change	1.02	0.07	0.25	.802	0.88, 1.18
MIDUS Milwaukee African American Sample					
DV = General Health	*OR*	*SE*	*t*	*p*	95% CI
Purpose Level	1.25	0.15	1.48	.140	0.93, 1.69
Purpose Change	1.46	0.14	2.62	.009	1.10, 1.94
DV = Chronic Conditions (Count)	*IRR/ OR*	*SE*	*z*	*p*	95% CI
Count Model: Purpose Level	0.98	0.04	0.37	.712	0.91, 1.07
Count Model: Purpose Change	0.93	0.04	1.99	.046	0.86, 0.99
Zero Inflation: Purpose Level	1.19	0.45	0.38	.703	0.49, 2.89
Zero Inflation: Purpose Change	0.84	0.38	0.45	.653	0.40, 1.76
Midlife in Japan (MIDJA) Sample					
DV = General Health	*OR*	*SE*	*t*	*p*	95% CI
Purpose Level	1.30	0.08	3.06	.002	1.10, 1.53
Purpose Change	1.21	0.08	2.24	.025	1.02, 1.43
DV = Chronic Conditions	*IRR/ OR*	*SE*	*z*	*p*	95% CI
Count Model: Purpose Level	0.87	0.04	3.78	< .001	0.81, 0.94
Count Model: Purpose Change	0.91	0.04	2.69	.007	0.85, 0.97
Zero Inflation: Purpose Level	0.74	0.33	0.92	.360	0.38, 1.42
Zero Inflation: Purpose Change	0.75	0.34	0.84	.399	0.38, 1.46

Note. Baseline health, age, sex, and education were included as covariates in all models. Race was included as a covariate in the U.S. samples. CI = confidence interval. Purpose change is coded such that higher values indicate greater increases (or less steep decreases) in sense of purpose across time.

change indices suggested that only 10–14% of the sample reliably decreased in sense of purpose, with the majority of individuals neither increasing or decreasing reliably. Integrating past and present findings, age-related declines in sense of purpose differ between people and may be relatively small on average [4,6].

The present research also suggests that individual differences in the direction and rate of change in sense of purpose during midlife may be important for physical health. The associations between longitudinal change in sense of purpose and physical health were observed in all three samples, across two health outcomes, and three sets of sensitivity analyses, providing strong evidence for small but robust associations. This finding is consistent with prior research suggesting that longitudinal change in well-being [18,20] is associated with later physical health. Given the importance of both level and change in sense of purpose for later health outcomes, research is needed on three related fronts. First, researchers need to continue working toward identifying those individuals at greater risk for declines in sense of purpose. Past research suggests that positive social support [44] may be valuable for scaffolding purposefulness, as well as health status [4]. Though these findings for health as a predictor of change yield modest effect sizes, it leads to a potentially troubling dynamic. Namely, older adults in worse health are at greater risk for declines in sense of purpose, which the current findings show may in turn put them at risk for greater health concerns in the future. As such, second, interventions are needed to promote sense of purpose, particularly ones that are accessible for those adults with physical limitations. For instance, one program that has shown potential starts by having adults identify obstacles and attitudes that impede their ability to feel purposeful, and then proceeds to help participants develop strategies to overcome those concerns, including age-related losses [45]. Though intervention work for sense of purpose is relatively nascent, programs like these may be particularly important for stemming negative health-purposelessness cycles during adulthood. Finally, more research is needed to identify the mechanisms that explain the link between change in sense of purpose and health (e.g., psychosocial, behavioral, and biological pathways).

Three limitations of the present research warrant discussion. First, sense of purpose change was assessed across only two timepoints, which does not allow for optimal modeling of change (e.g., with growth curve models). Relatedly, sense of purpose change was assessed over a relatively short period of time (4–9 years). The relatively short follow-up period should be considered when interpreting effect sizes. If the relationship between sense of purpose and age in middle and older adulthood is linear, the effects observed in the present study should be expected to accumulate into larger effects over time. Thus, although the effect sizes observed in the present study are small, the cumulative effects of change in sense of purpose on later health outcomes over time may be larger. As the MIDUS accrues more waves of assessment it will be important to follow up on these findings. Second, the relatively smaller sample sizes in the MIDUS Milwaukee African American Sample and the MIDJA Sample compared to the MIDUS Core Sample is a limitation. Because the 95% CIs around the effects of purpose level on physical health overlapped for all three samples, we caution against drawing conclusions about cultural differences based on differences in statistical significance. Third, the present study did not consider potential mechanisms linking change in sense of purpose with health outcomes, such as health behaviors, social support, or mental health, highlighting an important area for future research once the MIDUS accrues enough measurement waves to allow for a test of longitudinal mediation.

5. Conclusion

Setting goals and intentions for the future contributes to a sense that life has meaning and purpose. As people age, set fewer future goals, and experience more personal losses, purpose tends to become more elusive. Yet, maintaining one's sense of purpose or even finding new purpose in midlife may be important for healthy aging. The present study found evidence for this idea, showing that at the group level, sense of purpose tends to decline with age and that individuals differ in the degree and rate of change in their sense of purpose. More positive purpose change throughout midlife prospectively predicted better physical health, above and beyond sense of purpose level. These findings suggest that programs to promote sense of purpose may hold promise for improving health in midlife.

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References

[1] R. Cohen, C. Bavishi, A. Rozanski, Purpose in life and its relationship to all-cause mortality and cardiovascular events: a meta-analysis, Psychosom. Med. 78 (2) (2016) 122–133.

[2] P.L. Hill, N.A. Turiano, Purpose in life as a predictor of mortality across adulthood, Psychol. Sci. 25 (7) (2014) 1482–1486.

[3] S. Zilioli, R.B. Slatcher, A.D. Ong, T.L. Gruenewald, Purpose in life predicts allostatic load ten years later, J. Psychosom. Res. 79 (5) (2015) 451–457.

[4] P.L. Hill, S.J. Weston, Evaluating eight-year trajectories for sense of purpose in the health and retirement study, Aging Ment. Health 23 (2) (2019) 233–237.

[5] M. Pinquart, Creating and maintaining purpose in life in old age: a meta-analysis, Ageing Int. 27 (2) (2002) 90–114.

[6] K.W. Springer, T. Pudrovska, R.M. Hauser, Does psychological well-being change with age? Longitudinal tests of age variations and further exploration of the multidimensionality of Ryff's model of psychological well-being, Soc. Sci. Res. 40 (1) (2011) 392–398.

[7] P.L. Hill, N.A. Turiano, A. Spiro, D.K. Mroczek, Understanding inter-individual variability in purpose: longitudinal findings from the VA normative aging study, Psychol. Aging 30 (3) (2015) 529–533.

[8] C.D. Ryff, Happiness is everything, or is it? Explorations on the meaning of psychological well-being, J. Pers. Soc. Psychol. 57 (6) (1989) 1069–1081.

[9] P.A. Boyle, A.S. Buchman, L.L. Barnes, D.A. Bennett, Effect of a purpose in life on risk of incident Alzheimer disease and mild cognitive impairment in community-dwelling older persons, Arch. Gen. Psychiatry 67 (3) (2010) 304–310.

[10] E.S. Kim, J.K. Sun, N. Park, C. Peterson, Purpose in life and reduced incidence of stroke in older adults: "The Health and Retirement Study", J. Psychosom. Res. 74 (5) (2013) 427–432.

[11] P.A. Boyle, L.L. Barnes, A.S. Buchman, D. Bennett, Purpose in life is associated with mortality among community-dwelling older persons, Psychosomatic Medicine 71 (5) (2009) 574–579.

[12] T. Sone, N. Nakaya, K. Ohmori, et al., Sense of life worth living (Ikigai) and mortality in japan: ohsaki study, Psychosomatic Medicine 70 (6) (2008) 709–715.

[13] J.K. Boehm, Living healthier and longer lives: SWB's association with better health, in: E. Diener, S. Oishi, L. Tay (Eds.), Handbook of Well-being, DEF Publishers, Salt Lake City, UT, 2018.

[14] C.D. Ryff, B.H. Singer, G. Dienberg Love, Positive health: connecting well–being with biology, in: F.A. Huppert, N. Baylis, B. Keverne (Eds.), Phil Trans R Soc Lond B 359(1449), 2004, pp. 1383–1394.

[15] S.J. Weston, N.A. Lewis, P.L. Hill, Building sense of purpose in older adulthood: examining the role of supportive relationships, J. Posit. Psychol. (2020) 1–9.

[16] E.S. Kim, K. Shiba, J.K. Boehm, L.D. Kubzansky, Sense of purpose in life and five health behaviors in older adults, Prev. Med. 139 (2020) 106172.

[17] P.L. Hill, N.L. Sin, N.A. Turiano, A.L. Burrow, D.M. Almeida, Sense of purpose moderates the associations between daily stressors and daily well-being, Ann. Behav. Med. 52 (8) (2018) 724–729.

[18] C.D. Ryff, B.T. Radler, E.M. Friedman, Persistent psychological well-being predicts improved self-rated health over 9–10 years: longitudinal evidence from MIDUS, Health Psychology Open. 2 (2) (2015), 205510291560158.

[19] M. Allemand, V. Job, D.K. Mroczek, Self-control development in adolescence predicts love and work in adulthood, J. Pers. Soc. Psychol. 117 (3) (2019) 621–634.

[20] E.C. Willroth, A.D. Ong, E.K. Graham, D.K. Mroczek, Being happy and becoming happier as independent predictors of physical health and mortality, Psychosomatic Medicine 82 (2020) 650–657.

[21] N.A. Turiano, L. Pitzer, C. Armour, A. Karlamangla, C.D. Ryff, D.K. Mroczek, Personality trait level and change as predictors of health outcomes: findings from a national study of americans(Midus), The Journals of Gerontology: Series B. 67B (1) (2012) 4–12.

[22] I.C. Siegler, P.T. Costa, B.H. Brummett, et al., Patterns of change in hostility from college to midlife in the unc alumni heart study predict high-risk status, Psychosomatic Medicine 65 (5) (2003) 738–745.

[23] D.K. Mroczek, A. Spiro, Personality change influences mortality in older men, Psychol. Sci. 18 (5) (2007) 371–376.

[24] P.L. Hill, E.D. Beck, J.J. Jackson, Maintaining sense of purpose following health adversity in older adulthood: a propensity score matching examination, The Journals of Gerontology: Series B (2021).

[25] P.L. Hill, A.L. Burrow, M. Allemand, Moving beyond promoting 'happiness' in gerontology interventions, Age Ageing 50 (1) (2021) 62–64.

[26] O.G. Brim, P.B. Baltes, L.L. Bumpass, P.D. Cleary, et al., Midlife in the United States (MIDUS 1), 1995-1996, in: Inter-university Consortium for Political and Social Research, 2019. https://doi.org/10.3886/ICPSR02760.v18. distributor.

[27] C. Ryff, D.M. Almeida, J. Ayanian, et al., Midlife in the United States (MIDUS 2), 2004-2006, in: Inter-university Consortium for Political and Social Research, 2017. https://doi.org/10.3886/ICPSR04652.v7. distributor.

[28] C. Ryff, D.M. Almeida, J. Ayanian, et al., Midlife in the United States (MIDUS 3), 2013-2014. Ann Arbor, MI, in: Inter-university Consortium for Political and Social Research, 2019, https://doi.org/10.3886/ICPSR36346.v7 distributor.

[29] C. Ryff, D.M. Almeida, J. Ayanian, et al., Midlife in the United States (MIDUS 2): Milwaukee African American sample, 2005-2006, Ann Arbor, MI, in: Inter-university Consortium for Political and Social Research, 2018, https://doi.org/10.3886/ICPSR22840.v5 distributor.

[30] C. Ryff, D.M. Almeida, J. Ayanian, et al., Midlife in the United States (MIDUS 3): Milwaukee African American sample, 2016-2017, Ann Arbor, MI, in: Inter-university Consortium for Political and Social Research, 2018. https://doi.org/10.3886/ICPSR22840.v5. distributor.

[31] C. Ryff, S. Kitayam, M. Karasawa, et al., Midlife in Japan (MIDJA), 2008, Ann Arbor, MI, in: Inter-university Consortium for Political and Social Research, 2018, https://doi.org/10.3886/ICPSR30822.v3 distributor.

[32] C. Ryff, S. Kitayam, M. Karasawa, et al., Midlife in Japan (MIDJA 2), 2012, Ann Arbor, MI, in: Inter-university Consortium for Political and Social Research, 2018, https://doi.org/10.3886/ICPSR36427.v3 distributor.

[33] S. Champely, pwr: Basic functions for power analysis. R package version 1.2–2, 2018. https://CRAN.R-project.org/package=pwr.

[34] M.E. Salive, Multimorbidity in older adults, Epidemiol. Rev. 35 (1) (2013) 75–83.

[36] S. van Buuren, K. Groothuis-Oudshoorn, mice: Multivariate Imputation by Chained Equations in R. J Stat Software 45, 2011, pp. 1–67.

[37] S. Jackman, pscl: Classes and methods for R developed in the political science computational laboratory. R package version 1.5.5, 2020. https://github.com/atahk/pscl/.

[38] W.N. Venables, B.D. Ripley, W.N. Venables, Modern Applied Statistics with S, 4th ed., Springer, 2002.

[39] N.S. Jacobson, P. Truax, Clinical significance: a statistical approach to defining meaningful change in psychotherapy research, J. Consult. Clin. Psychol. 59 (1991) 12–19.

[40] J.R. van Ginkel, M. Linting, R.C. Rippe, A. van der Voort, Rebutting existing misconceptions about multiple imputation as a method for handling missing data, J. Pers. Assess. 102 (3) (2020) 297–308.

[41] D.C. Funder, D.J. Ozer, Evaluating effect size in psychological research: sense and nonsense, Adv. Methods Pract. Psychol. Sci. 2 (2) (2019) 156–168.

[42] C.D. Ryff, Psychological well-being revisited: advances in the science and practice of eudaimonia, Psychother. Psychosom. 83 (1) (2014) 10–28.

[43] C.D. Ryff, B.H. Singer, Know thyself and become what you are: a eudaimonic approach to psychological well-being, J. Happiness Stud. 9 (1) (2008) 13–39.

[44] S.J. Weston, N.A. Lewis, P.L. Hill, Building sense of purpose in older adulthood: examining the role of supportive relationships, The Journal of Positive Psychology (2020) 1–9. Published online February 16.

[45] E.M. Friedman, C. Ruini, R. Foy, L. Jaros, H. Sampson, C.D. Ryff, Lighten UP! A community-based group intervention to promote psychological well-being in older adults, Aging Ment. Health 21 (2) (2017) 199–205.