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Why is cognitive ability associated with psychological distress and wellbeing? Exploring psychological, biological, and social mechanisms

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ABSTRACT

This study examined whether associations between cognitive ability and mental health (depression, anxiety, and psychological wellbeing) could be accounted for by different categories of risk factors: socioeconomic status, engagement in pleasant activities, coping/appraisal, social relationships, biological risk factors (inflammation, cortisol, heart-rate variability), and reaction time. Participants were from the Midlife in the United States study ($n = 1744$; mean age = 54, range 25 to 84). Adjusting for social relationships, biological risk factors, or reaction time had almost no influence on the association between cognitive ability and mental health. Adjusting for engagement in pleasant activities attenuated the associations with depression and anxiety by one-fourth; adjusting for coping/appraisal by one-third; and adjusting for socioeconomic status by one-fifth. These attenuations were larger for the associations with positive affect and life satisfaction. These findings suggest that the association between cognitive ability and mental health may be partly explained by cognitive-behavioral mechanisms and the protective influence of socioeconomic status.

1. Introduction

Higher cognitive ability predicts lower incidence of psychiatric disorders (Batty et al., 2005) and lower levels of self-rated mental health problems, such as depressive symptoms (Khandaker et al., 2018). Cognitive ability has also been associated with higher psychological wellbeing measured with concepts such as happiness, positive affect, and life satisfaction (Ali et al., 2013).

The mechanisms accounting for the associations between cognitive ability and mental health remain poorly understood. Socioeconomic factors, such as education and income, may help to explain part of the association (Ali et al., 2013). Many other mechanisms are plausible. First, a behavioral perspective on depression views depressed mood as a response to diminished rate of positive reinforcement received from the environment: depressed individuals have lost the opportunity and/or ability to engage with their surroundings in ways that would elicit rewarding experiences, which leads to social avoidance and further loss of behaviors that the individual would find enjoyable (Mazzucchelli et al., 2010). Second, a cognitive perspective suggests that people's coping styles and appraisals of stressful life events are important in determining how strongly those events influence mental health; psychological distress will worsen if people cannot find adaptive ways to interpret their difficult circumstances (Beck & Haigh, 2014). Third, social theories emphasize that the risk of mental health problems are closely linked to lack of supportive personal relationships with friends, family, and others in the wider community (Wang et al., 2018). Fourth, the association between cognitive ability and mental health may be explained by biological factors, such as chronic inflammation which has been associated with both mental health and cognitive ability (Khandaker et al., 2018). Fifth, the mental health associations of cognitive ability might reflect the underlying integrity of the nervous system and the efficiency of information processing. This was originally proposed by a study in which the association between cognitive ability and mortality risk was explained by individual differences in reaction time task (Deary & Der, 2005), which might be interpreted as a proxy for neural efficiency. Thus, efficient information processing may be the active ingredient that explains why higher cognitive ability is related to better health, both physical and mental.

The present study examined whether associations between cognitive ability and mental health could be accounted for by psychological, social, and biological measures selected based on the five perspectives described above. The purpose was to identify the most likely risk factor categories that overlap with the association between cognitive ability and mental health. Some of the covariates may represent mediator effects (e.g., cognitive ability influences formation of social relationships which, in turn, influences mental health) while other covariates may

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Table 1
Associations between cognitive ability and covariates ($n = 1774$).

Covariate	Covariate class	B (95%CI)	R^2
Education	SES	**0.93 (0.81, 1.06)**	0.109
Household income	SES	**0.32 (0.21, 0.44)**	0.019
Pleasant activities	A	**0.06 (0.03, 0.10)**	0.007
Problem-focused coping	CA	**0.05 (0.01, 0.08)**	0.005
Emotion-focused coping	CA	**−0.10 (−0.13, −0.07)**	0.024
Primary control	CA	−0.01 (−0.04, 0.03)	0.000
Secondary control	CA	−0.02 (−0.07, 0.02)	0.001
Cognition control	CA	0.00 (−0.04, 0.04)	0.000
Emotion control	CA	−0.04 (−0.08, 0.00)	0.002
Support, friends	S	**0.06 (0.03, 0.10)**	0.007
Strain, friends	S	−0.01 (−0.04, 0.02)	0.000
Support, family	S	−0.01 (−0.04, 0.03)	0.000
Strain, family	S	0.02 (−0.02, 0.05)	0.001
Support, spouse	S	0.02 (−0.02, 0.06)	0.000
Strain, spouse	S	0.03 (−0.01, 0.07)	0.001
Number of friends	S	0.00 (−0.07, 0.06)	0.000
Inflammation, log(CRP)	B	**−0.10 (−0.16, −0.03)**	0.005
Inflammation, log(IL-6)	B	**−0.05 (−0.09, −0.01)**	0.003
Cortisol, baseline	B	−0.01 (−0.04, 0.02)	0.000
Cortisol, reactivity	B	−0.01 (−0.04, 0.02)	0.000
HRV, baseline	B	0.00 (−0.07, 0.06)	0.000
HRV, reactivity	B	−0.04 (−0.07, 0.00)	0.002
Reaction time	RT	**−0.06 (−0.07, −0.05)**	0.059

Note: Values are linear regression coefficients (and 95% confidence intervals), adjusted for gender, age, study cohort, and race/ethnic background. Cognitive ability was used as a standardized variable (standard deviation = 1), the outcomes were used without standardization. N = 1744 with multiple imputation of 5 datasets. SES=Socioeconomic; A = Activities; CA = Coping/Appraisal; S=Social; B=Biological; RT = Reaction time. R^2 = Proportion of explained variance by cognitive ability. Statistically significant ($p < 0.05$) associations are marked with bold font.

represent components of cognitive functioning (e.g., reaction time) or mental health (e.g., engagement in pleasant activities).

2. Methods

Participants were from the Midlife in the United States (MIDUS; Love et al., 2010; Radler, 2014) prospective cohort study, which is a nationally representative sample of non-institutionalized, English-speaking adults. MIDUS is an interdisciplinary study that explores distributions, predictors, and consequences of adult development in the areas of physical health, psychological well-being, and social responsibility, and how these predict wellbeing at older age. The current data were derived from two separate samples: the original sample (baseline in 1995–1996) and the refresher sample (baseline in 2011–2014). The refresher data were collected with much of the same measures as the original MIDUS. The study protocols for the current measures were the same for the two samples, with data derived from three data collections in both samples: For the original sample, cognitive assessment was carried out in a 2004–2006 substudy; the mental health outcomes, biomarker data, and reaction time were assessed in the later biomarker substudy in 2004–2009; and the rest of the covariates were collected in the main survey carried out in 2004–2006 (second wave of the original MIDUS). For the MIDUS refresher study, cognitive assessment was carried out in the cognition substudy in 2011–2014; mental health outcomes, biomarker data, and reaction time were assessed in the biomarker substudy in 2012–2016; and the rest of the covariates were collected as part of the main survey in 2011–2014. Thus, the mental health outcomes were assessed after the cognitive assessment (an average of 24 months in original MIDUS, and 19 months in MIDUS refresher), and the cognitive assessment was carried out an average of 4 months (original MIDUS) or 3 months (MIDUS refresher) after the main survey.

The MIDUS data are publicly available via the Inter-University Consortium for Political and Social Research (ICPSR; https://www.icpsr.umich.edu/web/ICPSR/series/203). All procedures complied with the ethical standards of the relevant national and institutional committees on human experimentation (Education and Social/Behavioral Sciences and the Health Sciences IRBs at the University of Wisconsin-Madison) and with the Helsinki Declaration of 1975, as revised in 2008.

Depression was assessed with the 20-item Center for Epidemiological Studies Depression Inventory (CES-D; (Radloff, 1977) and the subscales of 'Depressive Symptoms' and 'Loss of Interest' (20 items) of the Mood and Symptom Questionnaire (MASQ; (Watson et al., 1995). Anxiety symptoms were assessed with the 'Anxious Symptoms' and 'Anxious Arousal' subscales of the MASQ (28 items). These three scales were log-transformed to reduce their skewness (natural logarithm). Psychological wellbeing was assessed with the 'Positive Affect' subscale of the MASQ (14 items) and the 5-item Satisfaction with Life Scale (Pavot & Diener, 1993). These data were collected in the biomarker substudy.

Cognitive ability was assessed with the Brief Test of Adult Cognition by Telephone (BTACT; (Tun & Lachman, 2006)), which included five tests: two tests of episodic memory (immediate and delayed free recall of 15 words); inductive reasoning (number series; completing a pattern in a series of five numbers); category verbal fluency (the number of words produced from the category of animals in 60 s); working memory span (backward digit span; the highest span achieved in repeating strings of digits in reverse order). The individual test scores were z-transformed and cognitive ability was determined as the mean of these five z-scores. These data were collected in the cognition substudy.

Socioeconomic status was assessed with educational level (12-point scale ranging from 1 = no school/some grade school, 5 = high school, 12 = PhD) and household income (log-transformed). These data were from the main survey.

Pleasant activities were measured with a 49-item Positive Events Schedule (Douglas & Peter, 1982) that queried how often in the past month the person had engaged in each of the activities (0 = Never, 1 = 1–6 times, 2 = 7+ times) and how "pleasant, enjoyable, or rewarding" this activity was (0 = Neutral or unpleasant, 1 = Somewhat, 2 = Very). Each item was scored by multiplying the frequency by pleasantness (range 0–4), and a total score was calculated as the mean across all the items. These data were collected in the biomarker substudy.

Coping/Appraisal was assessed using six scales: First, *emotion-focused and problem-focused coping* represent how individuals respond to difficult life events (Kling et al., 1997): emotion-focused coping reflects a focus on venting emotions, denial, and behavioral disengagement (12 items, e.g., "I admit to myself that I can't deal with it, and quit trying."); and problem-focused coping reflects a focus on positive reinterpretation and growth, active coping, and planning (12 items, e.g., "I take direct action to get around the problem."). Second, *selective primary and secondary controls* represent how individuals attempt to manage their life (Wrosch et al., 2000): selective primary control is characterized by attempts to work through and solve life problems (5 items, e.g., "When I encounter problems, I don't give up until I solve them.") while selective secondary control is characterized by goal persistence (3 items, e.g., "When I have decided on something, I avoid anything that could distract me."). Third, *cognition and emotion control* (Markus & Kitayama, 1991) were assessed with measures of cognitive flexibility (6 items, e.g., "It is important to me to be able to think, feel, and act differently depending on the needs and demands of the situation.") and emotional reactivity (6 items, e.g., "When I'm faced with a stressful situation, I make myself think about it in a way that helps me stay calm."). Data for these measures were derived from the main survey.

Social relationships were measured with self-rated support received from and strain caused by (1) friends, (2) family, and (3) spouse (i.e., six scales in total; (Walen & Lachman, 2000)), and the number of friends (rated as 1 = 0–5 friends; 2 = 6–10; 3 = 11–20; 4 = 21–50; 5 = 51+). Each of the three support scales included 4 items (e.g., "How much do your friends really care about you?" rated as 1 = A lot; 2 = Some; 3 = A little; 4 = Not at all), and each of the strain scales also included 4 items

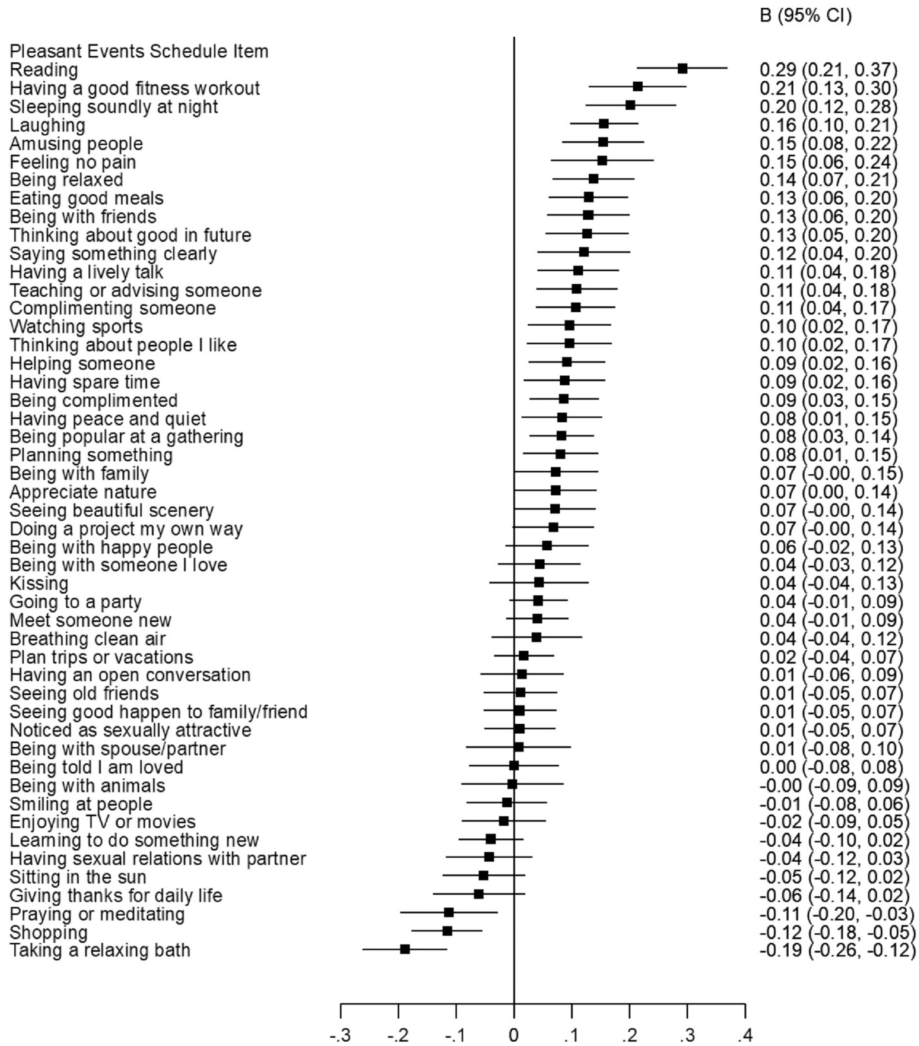

Fig. 1. Associations between cognitive ability and individual items of the Positive Events Schedule. Values are linear regression coefficients (and 95% confidence intervals) of standardized cognitive ability (standard deviation = 1), adjusted for gender, age, cohort, and race/ethnic background. Items are scored as frequency of activity times its pleasantness (range 0 to 4).

(e.g., "How often do your friends get on your nerves?" rated as 1 = Often; 2 = Sometimes; 3 = Rarely; 4 = Never). Given that spousal support and strain were rated only by individuals with a spouse, I recoded the spousal support variable as 0 = no spouse; 1 = 1–3.5; 2 = 3.5–4, and spousal strain as 0 = no spouse; 1 = 1–2; 2 = 2–4. These variables were used as categorical covariates in the models (the scores were categorized because the distributions were very skewed) so that data for individuals with and without a spouse could be incorporated in the same variables, and the cutoffs were selected so as to reduce the skewness of the scales. Except for the number of friends, data for social relationships were derived from the main survey.

Biological risk factors included two measures of inflammation (C-reactive protein [CRP] and interleukin 6 [IL-6], both log-transformed with natural logarithm); and measures of cortisol reactivity and cardiovascular reactivity assessed within a stressful cognitive task paradigm (see Coyle et al., 2020; Love et al., 2010) for detailed description of the protocol). The participants completed two cognitive stress tasks (Stroop and mental arithmetic test). Heart rate variability (HRV) and salivary cortisol were assessed at baseline and resting periods, and after the stress tasks. Indicators of reactivity were calculated as the difference between post-task and resting levels (averaged across the two tasks) for both HRV and cortisol. For the analysis, both the baseline and reactivity indicators were included as covariates. These data were collected in the biomarker substudy.

Reaction time was assessed with the Stop and Go Switch Task (SGST; (Karlamangla et al., 2014)) administered together with the BTACT via telephone, and calculated as the mean of switch and nonswitch trials median latencies on a task that required alternating between the "normal" condition (i.e., respond "Go" to the stimulus "Green" and "Stop" to the stimulus "Red") and the "reverse" condition (i.e., respond "Stop" to the stimulus "Green" and "Go" to the stimulus "Red"). These data were collected in the cognition substudy.

2.1. Statistical analysis

Associations were assessed with linear regression, fitted separately for each outcome. All the regression models included cognitive ability, age, gender, study cohort (1 = MIDUS, 2 = Refresher), and self-reported racial/ethnic background (categorized as 0 = white, 1 = Black/African-American, 2 = Native American or Aleutian Islander, 3 = Asian or Pacific Islander, 5 = Multiracial/Other/Refused) as predictors. The contribution of the covariates to the associations between cognitive ability and mental health outcomes was determined by the percentage decrease in the coefficient of cognitive ability when the covariate was added into the model; the covariate groups were first entered in the models separately and then at the final stage all in the same full model. I

Table 2
Associations between cognitive ability and mental health indicators, adjusted for different covariates.

Adjustment	CES-D	MASQ-DEP	MASQ-ANX
Minimally adjusted	−0.19 (−0.24, −0.14)	−0.12 (−0.17, −0.07)	−0.14 (−0.19, −0.09)
+ Pleasant activities	−0.15 (−0.19, −0.10)	−0.09 (−0.14, −0.04)	−0.12 (−0.17, −0.07)
+ Coping/ Appraisal	−0.14 (−0.19, −0.09)	−0.07 (−0.12, −0.02)	−0.09 (−0.14, −0.04)
+ Social relationships	−0.18 (−0.23, −0.13)	−0.11 (−0.16, −0.06)	−0.13 (−0.18, −0.08)
+ Biological	−0.18 (−0.23, −0.13)	−0.11 (−0.16, −0.05)	−0.13 (−0.18, −0.08)
+ Reaction time	−0.19 (−0.24, −0.14)	−0.12 (−0.18, −0.07)	−0.14 (−0.19, −0.08)
+ Socioeconomic	−0.16 (−0.21, −0.10)	−0.09 (−0.15, −0.04)	−0.11 (−0.17, −0.06)
All	−0.12 (−0.17, −0.07)	−0.07 (−0.12, −0.01)	−0.08 (−0.14, −0.03)

Adjustment	MASQ-PA	LS
Minimally adjusted	0.12 (0.06, 0.17)	0.07 (0.02, 0.12)
+ Pleasant activities	0.06 (0.02, 0.11)	0.03 (−0.02, 0.08)
+ Coping/Appraisal	0.08 (0.03, 0.13)	0.04 (−0.01, 0.09)
+ Social relationships	0.10 (0.05, 0.15)	0.07 (0.02, 0.11)
+ Biological	0.11 (0.06, 0.16)	0.06 (0.01, 0.11)
+ Reaction time	0.11 (0.05, 0.16)	0.07 (0.01, 0.12)
+ Socioeconomic	0.09 (0.03, 0.15)	0.02 (−0.03, 0.08)
All	0.04 (−0.01, 0.09)	0.00 (−0.05, 0.05)

did not apply any adjustments for multiple testing because the main interest was in the associations of cognitive ability, and their attenuations with covariate adjustments, and not in the associations across all the included covariates. For the same reason, I report confidence intervals instead of *p*-values for the coefficients.

In order to avoid losing participants due to missing values in individual covariates, I used $n = 5$ multiple imputation with chained equations to fill in missing data for participants who had data on cognitive ability, gender, age, race/ethnic background, and at least one of the mental health outcomes. This yielded a sample size of $n = 1774$ for all models. A missingness analysis was carried out by examining whether missingness in the variables was associated with cognitive ability or CES-D scale, adjusted for the gender, age, race/ethnic background, and study cohort; each covariate was coded as 0 = data available, 1 = missing data for the 1774 participants, and logistic regressions were fitted to predict the missingness. Statistical analysis was performed with Stata 15.1. statistical software.

3. Results

Supplementary Table 1 shows the descriptive statistics, and Supplementary Table 2 reports the correlations between covariates. Supplementary Table 3 shows the missingness analysis which suggested that most of the missingness was random with respect to levels of cognitive ability and CES-D score. The associations between cognitive ability and the covariates are shown in Table 1. Higher cognitive ability was associated with socioeconomic status; pleasant activities and coping; inflammation and reaction time; but not with primary or secondary control; cognition or emotion control; social relationships; or with HRV and cortisol. Fig. 1 shows in detail the associations of cognitive ability with individual items of the Pleasant Events Schedule: individuals with higher cognitive ability were more likely to report more pleasure from about half of the 49 activities included in the scale. Supplementary Table 4 reports the associations between covariates and mental health outcomes.

Table 2 shows how cognitive ability was associated with mental health, adjusted for different covariate categories; Fig. 2 illustrates the attenuation proportions in percentages. Adjusting for social relationships, biological risk factors, or reaction time had almost no effect on the coefficients. For depression and anxiety, adjusting for pleasant activities attenuated the association by one-fourth (22% to 32%); adjusted for coping/appraisal by one-third (28% to 42%); and adjusted for socioeconomic status by one-fifth (17% to 20%). The attenuations were more marked for positive affect and life satisfaction: adjusting for pleasant activities by 45% to 59%; for cognitive/appraisal by 29% to 51%; and for socioeconomic status by 21% to 72%. Adjusted for all covariates, the associations with depression and anxiety attenuated by 37% to 45%; the association with positive affect by 65%; and the association with life satisfaction was attenuated completely. Variance inflation factors did not exceed 2.7 for any of the variables in any of the models, indicating no problems with multicollinearity.

4. Discussion

Cognitive ability Among the variables included in this analysis, cognitive-behavioral factors and socioeconomic status were the most plausible mechanisms explaining why cognitive ability is related to lower levels of depression and anxiety, and with higher positive affect and life satisfaction. Biological factors, social relationships, and reaction time did not help to explain the associations.

The magnitude of the associations with symptoms of depression and anxiety ranged between standardized $\beta = -0.12$ to $\beta = -0.19$. These are

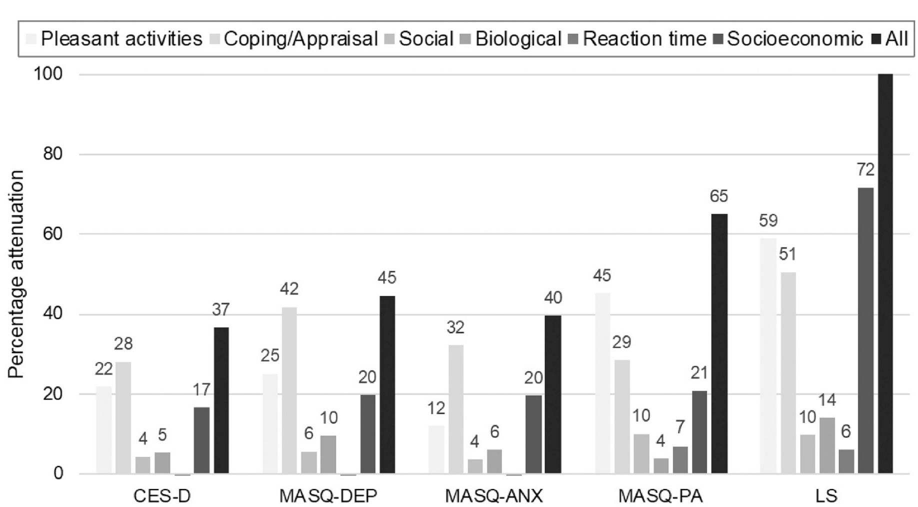

Fig. 2. Proportions of attenuation in the association between cognitive ability and mental health outcomes (x-axis) when adjusted for different covariate groups (separate bars). The order of the bars (from left to right) is the same as the order of the labels on the top. See Table 1 for the coefficients. CES-D = Center for Epidemiological Studies Depression Inventory; MASQ = Mood and Symptom Questionnaire; MASQ-DEP = Depression subscales of MASQ; MASQ-ANX = Anxiety subscales of MASQ; MASQ-PA = Positive affect subscale of MASQ; LS = Life satisfaction.

not large associations with the conventional metrics of psychology. However, these standardized coefficients of cognitive ability were larger than the standardized coefficients of education, household income, CRP, and IL-6, and they were about the same as for the number of friends (see Supplementary Table 4). These are well-established sociodemographic and biological risk factors for depression and anxiety, so cognitive ability can be considered at least on par with other common risk factors for poor mental health. Given that mental health is determined by multiple biological, psychological, and social factors, one would not expect any single variable to overshadow all the other risk factors.

Some limitations need to be noted. First, all the psychosocial factors were self-reported, so their correlations with mental health outcomes might have been inflated by common informant bias. Second, the study design was observational, so the results can only suggest domains of overlap with the risk factors but not demonstrate causal pathways. The study design was longitudinal in that the mental health outcomes were assessed ~2 years after cognitive assessment and the psychosocial risk factors, so reverse causation or concurrent assessment may not have been as problematic as they would have been in a cross-sectional study design; the analysis did not, however, include adjustments for baseline mental health. In addition, the time lag was different for the covariates assessed in the main survey (few months before assessment of cognitive ability) than for covariates assessed in the biomarker survey (about two years after assessment of cognitive ability), which might have influenced their relative contributions. Third, the different categories of risk factors (e.g., social relationships vs. biological risk factors) were assessed with different types and numbers of indicators, which needs to be kept in mind when interpreting their relative contributions. Fourth, the current study focused on specific covariate categories but did not include a measure of "general fitness factor" that has been suggested to represent an individual's genetic quality, which might help to explain the physical health associations of intelligence (Arden et al., 2009). Finally, this study considered only linear associations of cognitive ability; there have been suggestions that very high cognitive ability might also be related to poorer health, manic symptoms in particular (Gale et al., 2013), but the overall evidence for curvilinear associations is very limited (Brown et al., 2021).

Cognitive-behavioral approach is one of the most influential frameworks in understanding mental health problems (Beck & Haigh, 2014). It emphasizes the interplay between thoughts, behaviors, and emotions, and focuses on modifying people's thoughts and behavioral patterns. For example, the method of behavioral activation is based on finding ways to engage in activities that the person enjoys, thereby providing positive reinforcement (Mazzucchelli et al., 2010). This is directly related to the Pleasant Events Schedule used in the present study, which showed that individuals with higher cognitive ability engaged in more pleasant activities, including laughing, sleeping well, being with other people, having discussions, and working out. They also derived less pleasure from some activities, such as shopping, praying or meditating, and taking a relaxing bath. The associations with pleasant social activities are in contrast to some earlier findings suggesting that individuals with higher intelligence would not enjoy the company of others as much as those with lower intelligence (Li & Kanazawa, 2016). The current results suggest that higher cognitive ability is related to more active engagement with a broad range of pleasant activities, though not all activities (Fig. 1). Pleasant activities associated with cognitive ability could account for one-fifth of its associations with symptoms of depression and anxiety.

Problem-focused coping tackles difficult circumstances by looking for ways to actively solve and modify those circumstances. Emotion-focused coping, by contrast, turns the person's attention to the emotional reactions triggered by the difficult circumstances, which is often not adaptive. Cognitive-behavioral perspective emphasizes the flexibility of appraisals, that is, the possibility of interpreting a given situation from multiple perspectives, which gives more flexibility for the individual to respond. Higher cognitive ability was related to more adaptive coping styles (i.e., higher problem-focused and lower emotion-focused style), which helped to account for one-third of its associations with symptoms of depression and anxiety. This could be due to the better problem-solving skills associated with cognitive ability. However, cognitive ability was not related to the other four self-reported scales that assessed how individuals adjust their behavior when encountering obstacles, and how well they are able to modify and control their thoughts and emotions.

Social relationships are important predictors of many mental health problems, with lack of friends and interpersonal conflicts being a major source of distress (Wang et al., 2018). Except for receiving more support from friends, cognitive ability was unrelated to received support and strain from others, and the number of friends. Social relationships were therefore not relevant for the association between cognitive ability and mental health. Of the biological factors included in this study, cognitive ability was related to lower inflammation, but the biological factors were also not important for the association between cognitive ability and mental health. Similarly, some theories of intelligence suggest that the lower-level information processing might be the crucial factor underlying cognitive abilities, and reaction time has been suggested as one mechanism that might explain why higher cognitive ability predicts longevity (Deary & Der, 2005). However, reaction time did not help to explain why cognitive ability was related to better mental health.

Socioeconomic status may promote better mental health by presenting more resources and helping to buffer against life stressors. As previously reported by other studies (Ali et al., 2013; Cheng & Furnham, 2014), adjusting for socioeconomic status attenuated the association of cognitive ability with symptoms of depression and anxiety, but it accounted only for one-fifth of the association, which suggests that socioeconomic status may not be the main, or even major, factor in explaining the mental health associations of cognitive ability.

In addition to symptoms of depression and anxiety, cognitive ability was also related to higher psychological wellbeing, as measured by positive affect and life satisfaction. These associations were related mostly to the same covariates as depression and anxiety, but these covariates were more influential in explaining the associations with psychological wellbeing: coping styles, pleasant activities, and socioeconomic status each accounted for ~50% of the associations of cognitive ability. When adjusted for all the covariates together, cognitive ability was no longer independently associated with positive affect or life satisfaction. This implies that the covariates identified in this study were more important mechanisms for psychological wellbeing than for depression and anxiety.

5. Conclusions

In conclusion, this study demonstrated that higher cognitive ability is associated with lower psychological distress (i.e., symptoms of depression and anxiety) as well as with higher psychological wellbeing (i.e., positive affect and life satisfaction). Cognitive-behavioral factors, such as engagement in pleasant activities and adaptive coping styles, may be most relevant mechanisms accounting for these associations, with higher socioeconomic status also being a contributing factor. By contrast, social relationships, biological risk factors, and reaction time are unlikely to explain why higher cognitive ability is related to better mental health.

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Declaration of competing interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.paid.2022.111592.

References

Ali, A., Ambler, G., Strydom, A., Rai, D., Cooper, C., McManus, S.Hassiotis, A., … (2013). The relationship between happiness and intelligent quotient: The contribution of socio-economic and clinical factors. *Psychological Medicine, 43*(6), 1303–1312. https://doi.org/10.1017/S0033291712002139

Arden, R., Gottfredson, L. S., & Miller, G. (2009). Does a fitness factor contribute to the association between intelligence and health outcomes? Evidence from medical abnormality counts among 3654 US Veterans. *Intelligence, 37*(6), 581–591. https://doi.org/10.1016/j.intell.2009.03.008

Batty, G. D., Mortensen, E. L., & Osler, M. (2005). Childhood IQ in relation to later psychiatric disorder: Evidence from a Danish birth cohort study. *British Journal of Psychiatry, 187*(AUG.), 180–181. https://doi.org/10.1192/bjp.187.2.180

Beck, A. T., & Haigh, E. A. P. (2014). Advances in cognitive theory and therapy: The generic cognitive model. *Annual Review of Clinical Psychology, 10*, 1–24. https://doi.org/10.1146/annurev-clinpsy-032813-153734

Brown, M. I., Wai, J., & Chabris, C. F. (2021). Can you ever be too smart for your own good? Comparing linear and nonlinear effects of cognitive ability on life outcomes. *Perspectives on Psychological Science, 16*(6), 1337–1359. https://doi.org/10.1177/1745691620964122

Cheng, H., & Furnham, A. (2014). The associations between parental socio-economic conditions, childhood intelligence, adult personality traits, social status and mental well-being. *Social Indicators Research, 117*(2), 653–664. https://doi.org/10.1007/s11205-013-0364-1

Coyle, D. K. T., Howard, S., Bibbey, A., Gallagher, S., Whittaker, A. C., & Creaven, A. M. (2020). Personality, cardiovascular, and cortisol reactions to acute psychological stress in the Midlife in the United States (MIDUS) study. *International Journal of Psychophysiology, 148*(June 2019), 67–74. https://doi.org/10.1016/j.ijpsycho.2019.11.014

Deary, I. J., & Der, G. (2005). In , *Reaction time explains IQ's association with death: 16(1)*. *Reaction time explains IQ's association with death* (pp. 64–69). https://doi.org/10.1111/j.0956-7976.2005.00781.x

Douglas, J. M., & Peter, M. L. (1982). The Pleasant Events Schedule: Studies on reliability, validity, and scale intercorrelation. *Journal of Consulting and Clinical Psychology, 50*(3), 363–380.

Gale, C. R., Batty, G. D., Mcintosh, A. M., Porteous, D. J., Deary, I. J., & Rasmussen, F. (2013). Is bipolar disorder more common in highly intelligent people a cohort study of a million men. *Molecular Psychiatry, 18*(2), 190–194. https://doi.org/10.1038/mp.2012.26

Karlamangla, A. S., Miller-Martinez, D., Lachman, M. E., Tun, P. A., Koretz, B. K., & Seeman, T. E. (2014). Biological correlates of adult cognition: Midlife in the United States (MIDUS). *Neurobiology of Aging, 35*(2), 387–394. https://doi.org/10.1016/j.neurobiolaging.2013.07.028

Khandaker, G. M., Stochl, J., Zammit, S., Goodyer, I., Lewis, G., & Jones, P. B. (2018). Childhood inflammatory markers and intelligence as predictors of subsequent persistent depressive symptoms: A longitudinal cohort study. *Psychological Medicine, 48*(9), 1514–1522. https://doi.org/10.1017/S0033291717003038

Kling, K. C., Seltzer, M. M., & Ryff, C. D. (1997). Distinctive late-life challenges: Implications for coping and well-being. *Psychology and Aging, 12*(2), 288–295. https://doi.org/10.1037/0882-7974.12.2.288

Li, N. P., & Kanazawa, S. (2016). Country roads, take me home… to my friends: How intelligence, population density, and friendship affect modern happiness. *British Journal of Psychology, 107*(4), 675–697. https://doi.org/10.1111/bjop.12181

Love, G. D., Seeman, T. E., Weinstein, M., & Ryff, C. D. (2010). Bioindicators in the MIDUS national study: Protocol, measures, sample, and comparative context. *Journal of Aging and Health, 22*(8), 1059–1080. https://doi.org/10.1177/0898264310374355

Markus, H. R., & Kitayama, S. (1991). Culture and the self: Implications for cognition, emotion, and motivation. *Psychological Review, 98*(2), 224–253. https://doi.org/10.4324/9780203891377-32

Mazzucchelli, T. G., Kane, R. T., & Rees, C. S. (2010). Behavioral activation interventions for well-being: A meta-analysis. *Journal of Positive Psychology, 5*(2), 105–121. https://doi.org/10.1080/17439760903569154

Pavot, W., & Diener, E. (1993). Review of the satisfaction with life scale. *Psychological Assessment, 5*(2), 164–172. https://doi.org/10.1037/1040-3590.5.2.164

Radler, B. T. (2014). The Midlife in the United States (MIDUS) series: A national longitudinal study of health and well-being. *Open Health Data, 2*(1), 2–5. https://doi.org/10.5334/ohd.ai

Radloff, L. S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement, 1*(3), 385–401.

Tun, P. A., & Lachman, M. E. (2006). Telephone assessment of cognitive function in adulthood: The Brief Test of Adult Cognition by Telephone. *Age and Ageing, 35*(6), 629–632. https://doi.org/10.1093/ageing/afl099

Walen, H. R., & Lachman, M. E. (2000). Social support and strain from partner, family, and friends: Costs and benefits for men and women in adulthood. *Journal of Social and Personal Relationships, 17*(1), 5–30. https://doi.org/10.1177/0265407500171001

Wang, J., Mann, F., Lloyd-Evans, B., Ma, R., & Johnson, S. (2018). Associations between loneliness and perceived social support and outcomes of mental health problems: A systematic review. *BMC Psychiatry, 18*(1), 1–16. https://doi.org/10.1186/s12888-018-1736-5

Watson, D., Weber, K., Assenheimer, J. S., Clark, L. A., Strauss, M. E., & McCormick, R. A. (1995). Testing a tripartite model: I. Evaluating the convergent and discriminant validity of anxiety and depression symptom scales. *Journal of Abnormal Psychology, 104*(1), 3–14. https://doi.org/10.1037/0021-843X.104.1.3

Wrosch, C., Heckhausena, J., & Lachmanb, M. E. (2000). Primary and secondary control strategies for managing health and financial stress across adulthood. *Psychology and Aging, 15*(3), 387–399. https://doi.org/10.1037/0882-7974.15.3.387