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Supplementary Information for

Psychological resilience predicting cardiometabolic conditions in adulthood in the Midlife in the United States Study.

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Methods

Measures

Early Adversity. Frequency of emotional and physical abuse (never, rarely, sometimes, often) was reported using items from the Conflict Tactics Inventory (1). Two items assessed emotional abuse by one's mother and/or father, such as being insulted or threatened. Consistent with prior work (2), reporting "sometimes" or "often" occurrences by either parent was considered exposure. Four items assessed physical and severe physical abuse by one's mother and/or father, such as being pushed or beat up. Reporting "sometimes" or "often" occurrences of abuse or "rarely" or more frequent severe abuse by either parent was considered exposure. Participants reported whether they lived with both biological parents until age 17; if not, they were asked the reason(s), including parental separation or divorce. If participants reported parental separation or divorce before they were age 17, they were considered exposed. Given the stem question (living with both biological parents until age 17), parental separation/divorce may have been underreported. Participants also reported whether their mother and/or father died before the participant was age 17; any reported death was considered exposure.

Distress. Major depression and generalized anxiety were identified according to Diagnostic and Statistical Manual of Mental Disorders, Third Edition Revised (DSM-III-R) criteria (3). Major depression was defined as at least two weeks of either depressed mood or anhedonia most of the day, nearly every day, and at least four other associated symptoms, based on 19 items (3). Generalized anxiety was defined as at least six months of excessive or unrealistic worry about a variety of life situations, indicated by presence of at least three anxiety symptoms on most days, based on 10 items (3).

Biological cardiometabolic risk. Blood pressure was measured after a five-minute rest, three consecutive times at 30-second intervals; the two most similar readings were averaged. Lipids and glycosylated hemoglobin (HbA1c) were assessed from fasting morning blood samples with automated instruments (Roche Diagnostics, Indianapolis, IN). Waist circumference was measured at the narrowest point between the ribs and iliac crest. C-reactive protein (CRP) was assessed via immunoassay by the BNII nephelometer (Dade Behring Inc., Deerfield, IL).

Analyses

Due to exclusion criteria and attrition over time, we first compared between groups to identify differential inclusion or loss to follow-up, and then created inverse probability weights to account for differences. First, among those with complete exposure and covariate information at baseline (n=5,388), we compared the analytic sample (n=3,254) versus those excluded (n=2,134). Differences were identified for exposures (i.e., analytic sample had lower adversity and higher psychological health versus excluded) and multiple covariates (e.g., analytic sample included more women, white and married individuals, had generally higher socio-economic status [SES], lower body mass index [BMI], and healthier behaviors versus excluded). Second, among the analytic sample (n=3,254), we compared wave 3 (W3) respondents (n=2,180) versus those lost to follow-up by W3 (n=1,074). Differences were also identified for exposures (i.e., W3 respondents had higher psychological health, but similar adversity exposure versus lost to follow-up) and covariates (e.g., W3 respondents included more white and married individuals, had generally higher SES, and healthier behaviors versus lost to follow-up).

Inverse probability weights

We calculated stabilized inverse probability weight $SIPW_i$ to account for 1) selection into the analytic sample and 2) attrition over time.

To account for *selection into the analytic sample*, we calculated inverse probability of being included versus excluded in the analytic sample among all individuals with exposure and covariate information as the product of the inverse probability of inclusion due to NO cardiometabolic disease at W1 weight ($IPICW_i$), the inverse probability of inclusion due to NO death by W2 weight ($IPIDW_i$), and the inverse probability of inclusion due to NO non-response by W2 weight ($IPINW_i$). Exclusion was due to reporting cardiometabolic conditions at W1, death by W2, or non-response by W2. Our final analytic sample was defined as 3,254 participants who had full exposure information (W1), full covariate information (W1), did not report any cardiometabolic conditions by W1, and responded to at least the first outcome wave (W2, or W2 and W3).

$IPICW_i$ was estimated as the inverse of the probability that individual i was included in the analytic sample given that individual i had complete exposure and covariate information and did not have cardiometabolic conditions at W1 accounting for early-life covariates, normalized by the probability that individual i was included in the analytic sample given that individual i had complete exposure and covariate information and did not have cardiometabolic conditions at W1 accounting for early-life

covariates plus adult covariates. $IPIDW_i$ was estimated as the inverse of the probability that individual i was included in the analytic sample given that individual i had complete exposure and covariate information and did not die by W2 accounting for early-life covariates, normalized by the probability that individual i was included in the analytic sample given that individual i had complete exposure and covariate information and did not die by W2 accounting for early-life covariates plus adult covariates. $IPINW_i$ was estimated as the inverse of the probability that individual i was included in the analytic sample given that individual i had complete exposure and covariate information and was not lost to follow-up (non-response) by W2 accounting for early-life covariates, normalized by the probability that individual i was included in the analytic sample given that individual i had complete exposure and covariate information and was not lost to follow-up by W2 accounting for early-life covariates plus adult covariates.

$$IPICW_i = \frac{\Pr\left[CI_i | EC_i, B_i = 1\right]}{\Pr\left[CI_i | EC_i, AC_i, B_i = 1\right]}$$
$$IPIDW_i = \frac{\Pr\left[DI_i | EC_i, B_i = 1\right]}{\Pr\left[DI_i | EC_i, AC_i, B_i = 1\right]}$$
$$IPINW_i = \frac{\Pr\left[NI_i | EC_i, B_i = 1\right]}{\Pr\left[NI_i | EC_i, AC_i, B_i = 1\right]}$$

$IPICW_i$ = inverse probability of inclusion (NO W1 cardiometabolic conditions) weight for individual i
$IPIDW_i$ = inverse probability of inclusion (NO death by W2) weight for individual i
$IPINW_i$ = inverse probability of inclusion (NO non-response by W2) weight for individual i
CI_i = included in the analytic sample due to NO cardiometabolic disease at W1 for individual i
DI_i = included in the analytic sample due to NO death by W2 for individual i
NI_i = included in the analytic sample due to NO non-response by W2 for individual i
EC_i = early-life covariates for individual i
AC_i = adult covariates for individual i
B_i = complete baseline exposure and covariate information

To account for *attrition over time*, we calculated inverse probability of being included versus lost to follow-up by Wave 3 among the analytic sample as the product of the inverse probability of survival weight ($IPSW_i$) and the inverse probability of remaining uncensored weight ($IPUCW_i$) by Wave 3. We estimated incidence outcomes by W2 or W3; therefore, W2 was considered our first outcome wave. As all participants in the analytic sample responded to W2, we calculated weights for the probability of participation and survival by W3. For a participant to be in our sample by an outcome wave (W2 and W3), and therefore uncensored at W2 or W3, the participant had to be alive and responded to the study questionnaires (phone and self-administered questionnaire) and had complete information on cardiometabolic conditions for that wave.

$IPSW_i$ was estimated as the inverse of the probability that individual i survived through W3 given that individual i participated in W2 (UC_{W2i}) and accounting for early-life covariates, normalized by the probability that individual i survived through W3 given that individual i participated in W2 and accounting for early-life covariates plus adult covariates. $IPUCW_i$ was estimated as the inverse of the probability that individual i remained in the study through W3 given that individual i participated in W2 (UC_{W2i}) and accounting for early-life covariates, normalized by the probability that individual i remained in the study through W3 given that individual i participated in W2 and accounting for early-life covariates plus adult covariates.

$$IPSW_i = \frac{\Pr\left[S_i | EC_i, UC_{W2i}, S_{W2i} = 1\right]}{\Pr\left[S_i | EC_i, AC_i, UC_{W2i}, S_{W2i} = 1\right]}$$
$$IPUCW_i = \frac{\Pr\left[UC_{W3i} | EC_i, UC_{W2i}, S_{W2i} = 1\right]}{\Pr\left[UC_{W3i} | EC_i, AC_i, UC_{W2i}, S_{W2i} = 1\right]}$$

$IPSW_i$ = inverse probability of survival (no death by W3) weight by W3 for individual i
$IPUCW_i$ = inverse probability of remaining uncensored (no non-response by W3) weight by W3 for individual i
S_i = survival by W3 for individual i
UC_{W3i} = remaining uncensored by W3 for individual i
EC_i = early-life covariates for individual i

AC_i = adult covariates for individual i
UC_{W2i} = remaining uncensored by W2 (1 for entire analytic sample)
S_{W2i} = surviving by W2 (1 for entire analytic sample)

Numerators and denominators of the weights were estimated with logistic regression models with generalized estimating equations to account for familial clustering. We multiplied all the weights together to account for both initial selection into the sample and differential loss to follow-up. Once multiplied together (i.e., $SIPW_i = IPICW_i * IPIDW_i * IPINW_i * IPSW_i * IPUCW_i$), the final stabilized inverse probability weights were trimmed at the first and 99^{th} percentile.

Table S1. Adjusted Odds Ratios (OR) and 95% Confidence Intervals for the Association of Categories of Psychological Resilience With Incident Cardiometabolic Conditions Across Follow-up (n=3,254)

	Cases n=713	**Model 1**		**Model 2**		**Model 3**	
Exposures	*N cases (%)*	*OR*	*95% CI*	*OR*	*95% CI*	*OR*	*95% CI*
Favorable PF with adversity	103 (14.4)	Ref	Ref	Ref	Ref	Ref	Ref
Unfavorable PF with adversity	309 (43.3)	**1.43**[*†]	**1.10, 1.85**	**1.37**[*†]	**1.05, 1.79**	1.24	0.94, 1.64
Unfavorable PF without adversity	187 (26.2)	1.01	0.76, 1.33	1.00	0.75, 1.33	0.96	0.71, 1.29
Favorable PF without adversity	114 (16.0)	0.94	0.70, 1.28	0.98	0.72, 1.34	1.04	0.76, 1.44

PF=psychological functioning. Odds ratios represent odds of developing incident cardiometabolic conditions across follow-up for each resilience group relative to the group reporting Favorable Psychological Functioning with Adversity (reference group); odds ratios > 1 represent elevated odds of incident cardiometabolic conditions.
Model 1: Socio-demographics (age, sex, race/ethnicity, parental education attainment, financial level growing up, family history of cardiovascular disease).
Model 2: Model 1 and adult circumstances (marital status, educational attainment, household income, health insurance coverage).
Model 3: Model 2 and health and behavioral factors (BMI, smoking, physical activity).
Effects p<.05 are **bolded**. Effects p<.10 are *italicized.*
Tukey post-hoc comparisons:
[*] Unfavorable PF with versus without adversity is significantly different (p<.05)
[†] Unfavorable PF with adversity versus favorable PF without adversity is significantly different (p<.05)

Table S2. Adjusted Risk Ratios (RR) and 95% Confidence Intervals for the Association of Psychological Resilience With Cardiometabolic Risk Score at Wave 2 (n=654)

		Model 1		**Model 2**		**Model 3**	
Exposures	*N (%)*	*RR*	*95% CI*	*RR*	*95% CI*	*RR*	*95% CI*
Favorable PF with adversity	109 (16.7)	Ref	Ref	Ref	Ref	Ref	Ref
Unfavorable PF with adversity	256 (39.1)	*1.11*	*0.99, 1.25*	**1.13**	**1.01, 1.27**	**1.13**	**1.01, 1.25**
Unfavorable PF without adversity	165 (25.2)	1.01	0.89, 1.15	1.03	0.91, 1.17	1.02	0.92, 1.16
Favorable PF without adversity	124 (19.0)	1.04	0.91, 1.18	1.05	0.92, 1.20	1.05	0.93, 1.19

PF=psychological functioning. Risk ratios represent risk of elevated cardiometabolic risk scores for each resilience group relative to the group reporting Favorable Psychological Functioning with Adversity (reference group); risk ratios > 1 represent elevated risk of higher cardiometabolic risk scores.
Model 1: Socio-demographics (age, sex, race/ethnicity, parental education attainment, financial level growing up, family history of cardiovascular disease).
Model 2: Model 1 and adult circumstances (marital status, educational attainment, household income, health insurance coverage).
Model 3: Model 2 and health and behavioral factors (BMI, smoking, physical activity).
Effects p<.05 are **bolded**. Effects p<.10 are *italicized.* No Tukey post-hoc comparisons were significant at p<.05).

Table S3. Adjusted Odds Ratios (OR) and 95% Confidence Intervals for the Association of Continuous Adversity and Psychological Health With Incident Cardiometabolic Conditions Across Follow-up (n=3,254)

	Model 1		**Model 2**		**Model 3**	
Exposures	*OR*	*95% CI*	*OR*	*95% CI*	*OR*	*95% CI*
Individual Models						
Adversity	**1.15**	**1.05, 1.26**	**1.12**	**1.02, 1.23**	*1.09*	*0.99, 1.20*
Psychological Health	**0.90**	**0.86, 0.93**	**0.91**	**0.87, 0.94**	**0.94**	**0.90, 0.98**
Co-adjusted Models						
Adversity	**1.11**	**1.01, 1.21**	*1.09*	*0.99, 1.19*	1.07	0.97, 1.18
Psychological Health	**0.90**	**0.87, 0.94**	**0.91**	**0.88, 0.95**	**0.94**	**0.90, 0.99**
Interaction Models						
Adversity	**1.10**	**1.01, 1.21**	*1.09*	*0.99, 1.19*	1.07	0.97, 1.17
Psychological Health	**0.91**	**0.85, 0.97**	**0.91**	**0.86, 0.97**	0.95	0.89, 1.02
Aversity X Psychological Health	1.00	0.96, 1.03	1.00	0.96, 1.03	0.99	0.96, 1.03

Odds ratios represent odds of developing incident cardiometabolic conditions across follow-up for every one increase in adversity or standard deviation increase in psychological health; odds ratios > 1 represent elevated odds of incident cardiometabolic conditions
Model 1: Socio-demographics (age, sex, race/ethnicity, parental education, financial level growing up, family history of cardiovascular disease).
Model 2: Model 1 and adult circumstances (marital status, education, household income, health insurance coverage).
Model 3: Model 2 and biobehavioral factors (BMI, smoking, physical activity).
Effects p<.05 are **bolded**. Effects p<.10 are *italicized.*

Table S4. Adjusted Risk Ratios (RR) and 95% Confidence Intervals for the Association of Continuous Adversity and Psychological Health With Cardiometabolic Risk Score at Wave 2 (n=654)

	Model 1		**Model 2**		**Model 3**	
Exposures	*RR*	*95% CI*	*RR*	*95% CI*	*RR*	*95% CI*
Individual Models						
Adversity	1.03	0.98, 1.08	1.03	0.98, 1.07	1.02	0.98, 1.06
Psychological Health	0.98	0.97, 1.00	0.99	0.97, 1.01	0.99	0.97, 1.01
Co-adjusted Models						
Adversity	1.03	0.98, 1.07	1.02	0.98, 1.07	1.02	0.97, 1.06
Psychological Health	0.99	0.97, 1.01	0.99	0.97, 1.01	0.99	0.97, 1.01
Interaction Models						
Adversity	1.02	0.98, 1.07	1.02	0.98, 1.07	1.01	0.97, 1.06
Psychological Health	0.99	0.96, 1.02	0.99	0.96, 1.02	1.00	0.97, 1.02
Aversity X Psychological Health	1.00	0.98, 1.01	1.00	0.98, 1.02	0.99	0.98, 1.01

Risk ratios represent risk of elevated cardiometabolic risk scores for every one increase in adversity or standard deviation increase in psychological health; risk ratios > 1 represent elevated risk of higher cardiometabolic risk scores.
Model 1: Socio-demographics (age, sex, race/ethnicity, parental education, financial level growing up, family history of cardiovascular disease).
Model 2: Model 1 and adult circumstances (marital status, education, household income, health insurance coverage).
Model 3: Model 2 and biobehavioral factors (BMI, smoking, physical activity).
Effects p<.05 are **bolded**. Effects p<.10 are *italicized.*

Table S5. Adjusted Odds Ratios (OR) and 95% Confidence Intervals for the Association of Continuous Adversity and Individual Psychological Variables With Incident Cardiometabolic Conditions Across Follow-up (n=3,254)

	Model 1		**Model 2**		**Model 3**	
Exposures	*OR*	*95% CI*	*OR*	*95% CI*	*OR*	*95% CI*
Individual Models						
Adversity	**1.14**	**1.05, 1.25**	**1.12**	**1.02, 1.23**	*1.08*	*0.98, 1.19*
Depression	**1.20**	**1.11, 1.31**	**1.20**	**1.10, 1.30**	**1.13**	**1.03, 1.23**
Anxiety	**1.12**	**1.03, 1.21**	**1.10**	**1.02, 1.19**	1.05	0.96, 1.14
Well-being	**0.83**	**0.76, 0.90**	**0.85**	**0.77, 0.93**	**0.90**	**0.82, 0.99**
Co-adjusted Model						
Adversity	**1.10**	**1.00, 1.21**	*1.08*	*0.99, 1.19*	1.06	0.96, 1.17
Depression	**1.14**	**1.04, 1.24**	**1.14**	**1.05, 1.25**	*1.10*	*1.00, 1.21*
Anxiety	1.04	0.96, 1.13	1.03	0.95, 1.12	1.01	0.92, 1.10
Well-being	**0.87**	**0.80, 0.95**	**0.89**	**0.81, 0.97**	0.93	0.84, 1.02

Odds ratios represent odds of developing incident cardiometabolic conditions across follow-up for every one increase in adversity or standard deviation increase in psychological symptoms; odds ratios > 1 represent elevated odds of incident cardiometabolic conditions.
Model 1: Socio-demographics (age, sex, race/ethnicity, parental education, financial level growing up, family history of cardiovascular disease).
Model 2: Model 1 and adult circumstances (marital status, education, household income, health insurance coverage).
Model 3: Model 2 and biobehavioral factors (BMI, smoking, physical activity).
Effects p<.05 are **bolded**. Effects p<.10 are *italicized.*

Table S6. Adjusted Risk Ratios (RR) and 95% Confidence Intervals for the Association of Continuous Adversity and Individual Psychological Variables With Cardiometabolic Risk Score at Wave 2 (n=654)

	Model 1		**Model 2**		**Model 3**	
Exposures	*RR*	*95% CI*	*RR*	*95% CI*	*RR*	*95% CI*
Individual Models						
Adversity	1.04	0.99, 1.08	1.03	0.99, 1.08	1.02	0.98, 1.07
Depression	1.03	0.99, 1.-07	1.03	0.99, 1.07	1.02	0.98, 1.06
Anxiety	1.02	0.97, 1.07	1.02	0.96, 1.07	1.02	0.98, 1.07
Well-being	*0.96*	*0.92, 1.00*	*0.96*	*0.92, 1.01*	0.97	0.93, 1.02
Co-adjusted Model						
Adversity	1.03	0.98, 1.08	1.02	0.98, 1.07	1.02	0.98, 1.06
Depression	1.02	0.98, 1.06	1.02	0.98, 1.06	1.01	0.97, 1.05
Anxiety	1.01	0.96, 1.06	1.01	0.96, 1.06	1.02	0.97, 1.06
Well-being	0.97	0.93, 1.02	0.97	0.93, 1.02	0.98	0.94, 1.02

Risk ratios represent risk of elevated cardiometabolic risk scores for every one increase in adversity or standard deviation increase in psychological symptoms; risk ratios > 1 represent elevated risk of higher cardiometabolic risk scores.
Model 1: Socio-demographics (age, sex, race/ethnicity, parental education, financial level growing up, family history of cardiovascular disease).
Model 2: Model 1 and adult circumstances (marital status, education, household income, health insurance coverage).
Model 3: Model 2 and biobehavioral factors (BMI, smoking, physical activity).
Effects p<.05 are **bolded**. Effects p<.10 are *italicized.*

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