Relationship of Psychosocial Resources with Allostatic Load: A Systematic Review

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Online Supplement

Search Strategies

The following major databases were searched: PUBMED, CINAHL Plus, PsycInfo, Scopus, EMBASE.

Search strategies aimed to target articles that are related to allostatic load, operationalised as: containing “allostatic”, “allostasis”, or “allostases” in title or abstract (or “allostasis” in MeSH term). A filter for human studies was applied wherever available.

An example search syntax for Pubmed is shown below:

(allostasis[MeSH Terms]) OR (((allostatic[Title/Abstract]) OR allostasis[Title/Abstract]) OR allostases[Title/Abstract])

Filter: human

Supplementary Table S1. Sample Recruitment and Settings

Sample	Recruitment Info	Setting	References
SSAFHAP	Initially recruited from lists of 5th grade students. AL assessed on a random sample of families that participated.	9 rural communities in Georgia, US	Brody 2014a (51); Brody 2014b (51); Brody 2013 (34)
MIDUS	Random digit dialing to form initial sample of middle-aged adults. A subset of these were invited (and agreed) to have biomarkers assessed.	3 US GCRC	Brooks 2014 (46); Chen 2012 (40); Friedman 2015 (41);Gruenewald 2012 (33); Seeman, M. 2014 (31); Song 2014 (38)
I	Children were recruited from public schools and state and federal programs targeting low-income families.	5 rural counties in northeast US	Dich 2015 (35);Evans 2003 (36); Evans 2013 (37)
SEBAS	A random subsample of participants from the Survey of Health and Living Status of the Near-Elderly and Elderly in Taiwan, a national sample of adults aged 60+ in 1989 and expanded in 1996 to include adults 50 - 66 years old were recruited in 2000 for another study including biomarkers, with residents of urban areas oversampled.	3 centers in Taiwan	Glei 2007 (30); Seeman, T. 2004 (45)
CHASRS	Selected from older adults born between 1935 and 1952 living in Illinois US using a multistage probability sampling design designed to obtain approximately equal numbers of females and males who were White, Black, and Hispanic.	Population sample from Illinois, US	Hawkley 2011 (39)
II	Healthy female and male workers recruited through newspapers and community centers in Montreal Canada from 2005 to 2007.	Healthy community sample from Montreal Canada	Juster 2013 (42)
MAC	Adults aged 70-80 were subsampled from the Established Population for Epidemiologic Studies of the Elderly cohort comprised of three communities in the US.	3 communities in the northeast US	Maselko 2007 (43); Seeman, T. 2002 (48)
III	Spousal caregivers of patients with Alzheimer's disease and married non-caregiving controls recruited from the community.	1 community in southwest US.	Roepke 2010 (32)
IV	Random sample of employees from an airplane manufacturing plant in urban Germany.	Manufacturing plant in urban Germany	Schnorpfeil 2003 (44)
CARDIA	Data collection began in 1985-1986 on roughly equal numbers of black and white females and males aged 18 to 30. Current study used year 15 exam data. A subsample was invited to have biomarkers assessed.	2 centers in US	Seeman, T. 2014 (47)
WLS	A random sample (N = 10,317) of women and men who graduated high schools in 1957 in Wisconsin and were interviewed again in 1975 and 1992-1993. A small subsample of these completed additional questionnaires and had biological data collected in 1997.	GCRC in Wisconsin US	Seeman, T. 2002 (48); Singer 2000 (49);

Sample	Recruitment Info	Setting	References
BPRHS	Recruitment of English or Spanish speaking Puerto Rican adults aged between 45 to 75 years from the greater Boston area from 2004 to 2009 using door-do-door enumeration based on the 2000 census.	Boston area community	Sotos-Prieto 2015 (50)
V	In 1997 - 1998 elderly Taiwanese who had participated in the Study of Health and Living Status of the Elderly in Taiwan, a national sample of adults (elderly) aged 60+ in 1989, were recruited from Taichung, Taiwan.	Urban and rural parts of one city in Taiwan	Weinstein 2003 (53)

Note. I – V = unique samples with allostatic load measures. SAAFHAP = Strong African American Families Health Adolescent Project, MIDUS = Midlife in the United States Study; SEBAS = Social Environment and Biomarkers of Aging Study; CHASRS = Chicago Health, Aging, and Social Relations Study; MAC = MacArthur Study of Successful Aging; CARDIA = Coronary Artery Risk Development in Young Adults Study; WLS = Wisconsin Longitudinal Study; BPRHS = Boston Puerto Rican Health Study.

Supplementary Table S2. Study Characteristics

Ref	N	Age M	n (%) Female	n (%) White	In/Exclusion	Design	Length of Longitudinal
Brody 2014a (51)	331	20.2	190 (57%)	Rural African Americans	NR	L1	2 years (AL at age 20; emotional support at age 18; perceived discrimination at ages 16, 17, 18)
Brody 2014b (52)	420	19.2	227 (54%)	Rural African Americans	NR	L1	1 years (AL at age 19; Emotional support at age 18; neighborhood poverty at age 11 and age 19)
Brody 2013 (34)	489	19.2	265 (54%)	Rural African Americans	NR	L1	8 years (AL at age 19; Self Control at ages 11, 12, 13; Perceived Competence at ages 11, 12, 13; SES at ages 11, 12, 13)
Brooks 2014 (46)	949	55.1	512 (54%)	891 (94%)	For a subset of analyses, included only participants with spouses (n = 660)	L1/C	Approximately 9 years but also cross-sectional (AL in mid 2000s, social support and relationships in mid 1990s and mid 2000s)
Chen 2012 (40)	1207	54.5	680 (56%)	970 (80%)	NR	C	N/A
Dich 2015 (35)	239	17.5	116 (48.5%)	NR (mostly Caucasian)	NR	L1/C*	8.3 years on average (average age at study entry was 9.2)
Evans 2003 (36)	339	9.2	166 (49%)	319 (94%)	NR	C	N/A
Evans 2013 (37)	241	9 & 13 (17.3 at study)	121 (50%)	NR	NR	L1/C	4 years (AL at age 9 and 13 were averaged; self-regulation at age 9)
Friedman 2015 (41)	1180	54.5	673 (57.0%)	920 (78.0%)	Complete data on AL, demographics, childhood adversity, social relationships, and health behaviors (94% of all participants of the MIDUS II biomarker project).	C	N/A
Glei 2007 (30)	851	66.1	356 (42%)	Taiwanese	NR except for age	L1	4 years (AL in 2000; PSRs in 1996 and 1999).
Gruenewald 2012 (33)	1008	58.1	552 (55%)	929 (92%)	NR	C	N/A
Hawkley 2011 (39)	208	58.4	110 (53%)	78 (37.5%)	NR	C	N/A

Ref	N	Age M	n (%) Female	n (%) White	In/Exclusion	Design	Length of Longitudinal
Juster 2013 (42)	199	41.4	118 (59%)	173 (87%)	No utilization of mental health services in past year; no medications/health problems affecting cardiovascular, immune, or neuroendocrine functions; no learning/cognitive disabilities that would impair completion of questionnaires or following instructions; no current hormone replacement therapy	C	N/A
Maselko 2007 (43)	853	74.2	460 (54%)	700 (82%)	Included 70y-80y; high physical and cognitive functioning	C	N/A
Roepke 2010 (32)	130	74.5	88 (68%)	121 (95%)	Included 55+; living with spouse; free of serious illness; not on anticoagulant medications	C	N/A
Schnorpfeil 2003 (44)	324	40.6	52 (16.1%)	German Employees	NR	C	N/A
Seeman, M. 2014 (31)	1239	54.5	701 (56.6%)	956 (77.3%)	NR	C	N/A
Seeman, T. 2004 (45)	531 Near Elderly, 419 Elderly	68.4	395 (41.6%)	Taiwanese, Mainland Chinese	NR	L1	11 years (AL in 2000, social resources in 1989, 1996, and 1999)
Seeman, T. 2014 (47)	782	40	453 (57.9%)	354 (45.3%)	NR	C	N/A
Seeman, T. 2002 (48)	**WLS**: 106, **MAC**: 765	**WLS**: 58.5, **MAC**: 74.2	**WLS**: 49 (46.2%), **MAC**: 389 (50.8%)	**WLS**: 100%, **MAC**: 81.7%	**WLS**: NR. **MAC**: Included 70y-80y; high physical and cognitive functioning	C	N/A
Singer 2000 (49)	84	59	NR	NR	NR	L1/C	40 years (AL assessed in 1997, social relationships assessed in 1997, economic indicators assessed in 1957 and 1992-1993)

Ref	N	Age M	n (%) Female	n (%) White	In/Exclusion	Design	Length of Longitudinal
Song 2014 (38)	76	55.1	46 (60.5%)	NR	Participants who self-reported caregiving for a child with child onset ADD/ADHD, learning disabilities, autism, cerebral palsy, epilepsy, Down syndrome, intellectual disabilities, or brain injury. Matched controls were selected from MIDUS participants with children without developmental disorders.	C	N/A
Sotos-Prieto 2015 (50)	787	56.7	568 (72.2%)	Puerto Ricans in Boston	Between 45 to 75, English or Spanish speaking, Puerto Ricans living in Boston. Complete data on all measures.	C	N/A
Weinstein 2003 (53)	101	72.6	47 (46.5%),	Taiwanese	Elderly otherwise NR.	L1	unclear exactly what waves PSRs were assessed.

Note. When possible, age is reported as age when allostatic load data were collected. NR = not reported; N/A = not applicable; L1 = earlier PSRs predicting later AL; C = cross-sectional. MAC = MacArthur Study of Successful Aging; WLS = Wisconsin Longitudinal Study. When reported, data were taken directly from studies. When not directly reported, if possible estimates were calculated from the data provided. * only longitudinal study that also had repeated assessments of AL and controlled for baseline AL when prospectively predicting AL.

Supplementary Table S3. Measures of Allostatic Load

Biomarkers	References
Risk Quartile and Sum	
SBP, DBP, BMI, E, NE, CORT	Brody 2014b (52); Brody 2013 (34); Dich 2015 (35); Evans 2003 (36); Evans 2013 (37)
SBP, pulse pressure, BMI, WHR, HDL, LDL, triglycerides, HbA1c, glucose, HOMA-IR, LFHRV, HFHRV, pulse, SDRR, RMSSD, E, NE, CORT, DHEA-S, CRP, Fibrinogen, IL-6, E-selectin, s-ICAM	Brooks 2014 (46); Friedman 2015 (41); Seeman, M. 2014 (31)
SBP, DBP, BMI, WHR, HDL, LDL, triglycerides, HbA1c, glucose, HOMA-IR, LFHRV, HFHRV, pulse, SDRR, RMSSD, E, NE, CORT, DHEA-S, CRP, Fibrinogen, IL-6, E-selectin, s-ICAM	Chen 2012 (40); Gruenewald 2012 (33)
SBP, DBP, BMI, WHR, HDL, LDL, triglycerides, SDRR, insulin, glucose, HOMA-IR, CRP, TNF-a, IL-6, AUC ground of stress reactivity salivary cortisol	Juster 2013 (42)
SBP, DBP, HDL, TC, HbA1c, E, NE, CORT, DHEA-S	Maselko 2007 (43)
SBP, DBP, BMI, HDL, TC/HDL, plasma norepinephrine, plasma epinephrine	Roepke 2010 (32)
SBP, DBP, BMI, WHR, HDL, TC, HbA1c, E, NE, CORT, DHEA-S, albumin, TNF-a, CRP	Schnorpfeil 2003 (44)
SBP, DBP, WHR, HDL, TC, HbA1c, E, NE, CORT, DHEA-S	Seeman, T. 2004 (45); Seeman, T. 2002 (48); Singer 2000 (49)
SBP, DBP, WHR, HDL, LDL, triglycerides, glucose, insulin, LFHRV, HFHRV, pulse, E, NE, CORT RISE, CORT SLOPE, CRP, IL-6	Seeman, T. 2014 (47)
SBP, DBP, WHR, HDL, TC/HDL, HbA1c, E, NE, CORT, DHEA-S, CRP	Song 2014 (38)
SBP, DBP, WC, HDL, TC, HbA1c, E, NE, CORT, DHEA-S	Sotos-Prieto 2015 (50)
SBP, DBP, WHR, HDL, HDL/TC, HbA1c, E, NE, CORT, DHEA-S	Weinstein 2003 (53)
Standardized and Summed	
SBP, DBP, BMI, E, NE, CORT, CRP	Brody 2014a (51)
SBP, DBP, WC, HDL, TC, HbA1c, E, NE, CORT	Hawkley 2011 (39)
< 10% or > 90% and Sum	
SBP, DBP, BMI, WHR, TC, TC/HDL, triglycerides, HbA1c, glucose, E, NE, dopamine, CORT, DHEA-S, IL-6, IGF-1	Glei 2007 (30)

Note. SBP = systolic blood pressure; DBP = diastolic blood pressure; E = overnight urinary epinephrine; NE = overnight urinary norepinephrine; CORT = overnight urinary cortisol; AUC = area under the curve; TC = total cholesterol; HDL = high-density lipoprotein cholesterol; LDL = low-density lipoprotein cholesterol; CRP = C-reactive protein; HbA1c = glycosylated hemoglobin; HOMA-IR = homeostatic model assessment insulin resistance; WHR = waist-to-hip ratio; BMI = body mass index; DHEA-S = serum dehydroepiandrosterone sulfate; LFHRV = low frequency heart rate variability; HFHRV = high frequency heart rate variability; SDRR = standard deviation of R-R interval; RMSSD = root mean square successive difference; PEF = peak expiratory flow; IL-6 = interleukin; TNF-a = tumor necrosis factor alpha; s-ICAM = soluble intracellular adhesion molecule; WC = waist circumference; IGF-1 = insulin-like growth factor 1.

Supplementary Table S4. Summary of Results for Psychological Resources

Ref	Measure of PSRs	Main Effects	Moderated Effects	Covariates
Brody 2013 (34)	**Self-control/competence**: composite of teacher rated self-control (12-item Self-Control Inventory) and competence (scholastic and social; 14-item Perceived Competence Scale) averaged across repeated assessments at ages 11, 12, and 13.	**Self-control/competence** no main effect (r = -.044, n.s.).	**Self-control/competence** was moderated by SES, β = .12, p < .01, ΔR^2 = .015. The simple slope for low SES risk was β = -.10, n.s., for high SES risk was β = .15, p < .05.	sex, health problems, SES-related risk
Chen 2012 (40)	**Shift (1)**: a composite of positive reappraisal (4-item positive reappraisal of the Primary and Secondary Control questionnaire) and emotion regulation (3-item stress reactivity subscale of the Multidimensional Personality Questionnaire). **Persist (2)**: four items from the "Live for Today" subscale of the Planning and Making Sense of the Past questionnaire.	Based on corrected results following an Erratum. No significant main effects of **(1)** or **(2)**.	In adults where either parent had less than a high school education, there was a significant **(1)** x **(2)** interaction, β = .091, p = .033. In adults where both parents had a high school education or above, the (1) x (2) interaction was not significant (β = .023, p = .546).	age, sex, race
Dich 2015 (35)	**Self-regulation**: delay gratification assessed behaviorally as seconds delayed to receive a larger plate of candy rather than immediately receiving a smaller plate of candy.	No main effect of **self-regulation** on concurrent of future AL (p > .10).	Concurrently, no interaction of **self-regulation** with negative emotionality (p = 0.26). Prospectively, significant **self-regulation** x negative emotionality interaction (p = .025). Simple slopes for negative emotionality were β = .32, p = .04 and β = -.10, p = .22 for those with low and high **self-regulation**, respectively.	Baseline age, gender, income-to-needs ratio, and baseline AL for prospective analyses.
Evans 2003 (36)	**Self-worth (1)**: global self-worth subscale from the Harter Perceived Competency Scale. **Self-regulation (2)**: delay gratification assessed behaviorally as seconds delayed to receive a larger plate of candy rather than immediately receiving a smaller plate of candy. **Persistence (3)**: assessed behaviorally as seconds persisting on an unsolvable task	No associations with AL (all p > .05) **(1)** r = -.04, **(2)** r = .09, **(3)** r = -.07.		none
Evans 2013 (37)	**Self-regulation**: delay gratification assessed behaviorally as seconds delayed to receive a larger plate of candy rather than immediately receiving a smaller plate of candy.	**Self-regulation** no main effects (β = .062, p = .363).	**Self-regulation** not moderated by poverty (β = -.002, p = .979).	single parent status

Ref	Measure of PSRs	Main Effects	Moderated Effects	Covariates
Glei 2007* (30)	**Live with children (1)**: 0-2 variable whether living with children in 1996 and/or 1999. **Contact with children (2)**: 0-2 variable of weekly contact with nonresident child(ren) in 1996 and/or 1999. **Social ties relatives (3)**: sum of relatives with regular contact in 1996 and 1999. **Social ties non relatives (4)**: sum of non relatives with regular contact in 1996 and 1999. **Social activities (5)**: sum of up to 11 social activities engaged in in 1996 and/or 1999. **Emotional support (6)**: 4-items assessing emotional support in 1996 and 1999. **Mastery (7)**: 5-items from the Pearlin scale. **Optimism (8)**: 0-2 variable of response to "do you expect that in the future happy things will occur?" in 1996 and 1999. **Overall Vulnerability (9)**: a composite of the previous 8 measures (reversed so higher is worse) along with four other non PSR variables.	PSRs **(1 - 8)** entered simultaneously as main effects, and their composite **(9)** entered as an interaction with number of stressors. Results for **(1 - 8)** are 'simple main effects' **(7)** associated with lower AL, $\beta = -.077$, $p < .01$, all others were not significant **(1)** $\beta = -.002$, **(2)** $\beta = .001$, **(3)** $\beta = .015$, **(4)** $\beta = .000$, **(5)** $\beta = -.006$, **(6)** $\beta = .060$, or **(8)** $\beta = -.016$.	**(9)** significantly moderated number of stressors, so that the effect of stress was stronger for lower resources (i.e., higher vulnerability), b [95% CI] = .012 [.001, .024], $p < .01$. β/effect size cannot be calculated.	sex, age, urban residence, number of stressors, education, socioeconomic index, engagement, index of advantages of growing old, perceived stress
Gruenewald 2012* (33)	**Positive affect (1)**: 14 item positive affect subscale of the Mood and Symptom Questionnaire. **Perceived Mastery (2)**: 4 items assessing personal mastery/control. **Perceived Constraints (3)**: 8 items measuring perceived lack of control (low mastery/constraints). **Friend contact (4)**: eight level item assessing frequency of contact with friends. **Family contact (5)**: eight level item assessing frequency of contact with family. **Friend Social support (6)**: 4 items assessed perceived social support from friends. **Family Social support (7)**: 4 items assessed perceived social support from family.	Primarily examined relations between SES and AL. PSRs **(1 - 7)** were assessed as covariates. Results are not reported, except that **(4)** was associated with significantly lower AL. Effect sizes cannot be calculated.		age, number of health conditions, current smoker status, anxiety, frequency of fast food consumptions, light alcohol consumption, gender, race/ethnicity, and SES

Ref	Measure of PSRs	Main Effects	Moderated Effects	Covariates
Hawkley 2011* (39)	**Loneliness (1)**: 20-item revised UCLA loneliness scale. **Social support (2)**: 12-item Interpersonal Support Evaluation List. **Optimism (3)**: 6-item Life Orientation Test Revised. **Network roles (4)**: the number of roles reported that involved at least bi-monthly social interactions. **Social network index (5)**: weighted composite of social ties. **Avoidance Coping (6)**: 4-items from Coping Inventory for Stressful Situations (CISS). **Task-oriented coping (7)**: 3-items from CISS. **Emotion-focused coping (8)**: 3-items from CISS. **Active coping (9)**: 2 items from the COPE. **Behavioral withdrawal (10)**: 2 items from the COPE. **Seeking social support (11)**: 2 items from the COPE. **Seeking emotional support (12)**: 2 items from the COPE.	Primarily examined relations between stress and AL; however, partial correlations for PSRs were presented. None were significant. **(1)** r = .09. **(2)** r = -.08. **(3)** r = -.08. **(4)** r = -.07. **(5)** r = -.02. **(6)** r = .13. **(7)** r = .07. **(8)** r = -.08. **(9)** r = -.03. **(10)** r = .07. **(11)** r = -.03. **(12)** r < .01.		sex, and white race/ethnicity
Roepke 2010 (32)	**Mastery**: 7-item Pearlin Mastery Scale	**Mastery** no main effect. Statistics not reported so effect sizes cannot be calculated.	**Mastery** interacted with caregiver status ($t(121) = 2.04$, $p = .043$) such that caregiving status only had an effect on AL when Mastery was high (simple effect for being a caregiver when mastery was high $t(121) = 3.00$, $p = .003$). High mastery exacerbated the deleterious effects of being a caregiver.	age, sex, years smoked, antihypertensive medication, cholesterol-lowering medication
Seeman, M. 2014 (31)	**Perceived Mastery (1)**: 4 items assessing personal mastery/control. **Perceived Constraints (2)**: 8 items measuring perceived lack of control (low mastery/constraints). Single items on a 10 point scale assessing perceived **Work Control (3)**, **Finance Control (4)**, **Contributions to Others Control (5)**, **Relationship with Children Control (6)**, **Marital Relationship Control (7)**. **Domain Control (8)**: composite of 3 - 7.	No association with AL (all $p > .05$): **(1)** $\beta = -.024$, **(6)** $\beta = -.021$, **(7)** $\beta = -.020$. **(2)** associated with higher AL ($\beta = .089$, $p < .01$). Associated with lower AL: **(3)** $\beta = -.036$, $p < .01$, **(4)** $\beta = -.037$, $p < .01$, **(5)** $\beta = -.041$, $p < .01$, **(8)** $\beta = -.067$, $p < .001$.		age, race, sex, income, education, marital status, imputation flag

Ref	Measure of PSRs	Main Effects	Moderated Effects	Covariates
Song 2014 (38)	**Positive affect**: 14 item positive affect subscale of the Mood and Symptom Questionnaire.	No main effect of **positive affect** on AL, β = -.153, p > .05.	**Positive affect** interacted with caregiver status (b = -.104, p < .05). Simple slopes (significance not reported) for **positive affect** were β = .116 in control parents and β = -.366 in parents caring for a child with a developmental disability.	age, sex, medications (antihypertensive, antidepressant), smoking, negative affect

Note. * Indicates studies that assessed both psychological and social resources. Underlined values indicate statistically significant effects. AL = allostatic load; SES = socioeconomic status; NR = not reported; b = unstandardized regression coefficient; β = standardized regression coefficient.

Supplementary Table S5. Summary of Results for Social Resources

Ref	Measure of PSRs	Main Effects	Moderated Effects	Covariates
Brody 2014a (51)	**Emotional support**: composite of primary caregiver support (11-item Family Support Inventory) and peer support (4-item subscale from Carver Support Scale)	**Emotional support** no main effect (r = - .036).	**Emotional support** moderated the effect of perceived discrimination trajectory class (low and increasing vs. high and stable) (b = -1.446, p < .001). Simple slopes (significance not reported) for **emotional support** in the low and increasing class was β = .049 but in the high and stable class was β = -.263.	cumulative socioeconomic risk, perceived stress, depressive symptoms, unhealthy behavior at age 20
Brody 2014b (52)	**Emotional support**: composite of primary caregiver support (11-item Family Support Inventory) and peer support (4-item subscale from Carver Support Scale)	**Emotional support** no main effect (r = -.044).	Three-way interaction **emotional support** x neighborhood poverty in 2010 x neighborhood poverty in 2000 (b = .19, p = .01, n = 284), such that **emotional support** buffered the effects of neighborhood poverty on AL. **Emotional support** buffered the effects of a worsening pattern (i.e., low neighborhood poverty in 2000, high neighborhood poverty in 2010). No differences for improving (high to low) or stable (high high or low low). Similar results adjusting for residential stability using a larger sample (b = .10, p = .04, n = 420). Effect sizes cannot be calculated.	family poverty at age 11, family poverty at age 19 and their interaction; sex, residential stability, and all at age 19: diet, smoking, binge drinking, perceived stress, unemployment, and financial stress

Ref	Measure of PSRs	Main Effects	Moderated Effects	Covariates
Brooks 2014 (46)	**Friend support (1)**: social support from friends (4-items). **Family support (2)**: social support from family (4-items). **Spouse support (3)**: social support from spouses (6-items). **Network support (4)**: composite of 1, 2, & 3. **Friend contact (5)**: single item about amount of contact. **Family contact (6)**: single item about amount of contact. **Network contact (7)**: average of 5 & 6. For all measures, responses at both MIDUS I and MIDUS II were averaged.	**(1)** β = .07, p < .05, **(2)** β = .01, n.s., **(3)** β = -.08, p < .05, **(4)** β = .01, n.s. **(5)** β = .07, p < .05, **(6)** β = .04, n.s. **(7)** β = .08, p < .05.	**(1)** moderated by age (b = .01, p < .05) so that in older adults **(1)** was associated with higher AL but in younger adults there was no effect. **(4)** moderated by age (b = .02, p < .01) such that in younger adults higher **(4)** was associated with lower AL, but in older adults higher **(4)** was associated with higher AL. Age did not moderate **(2)** b = .01, p > .05, **(3)** or **(5)** or **(6)** or **(7)** statistics not reported. In supplementary analyses for (1 - 7), sex did not moderate any of the relationships (statistics not reported). Effect sizes could not be calculated.	age, sex, race, education, major chronic conditions, functional status, smoking, physical activity, and anxiety and depressive symptoms
Friedman 2015 (41)	**Social support:** average of items assessing support across friends, family, and partner/spouse.	No main effect for **social suppor**t, β = -.02.		age, sex, race, Milwaukee sample, data collection site, total early life adversity, education, social strain, smoking, drinking, and exercise
Juster 2013 (42)	**Social support**: 11-items assessing job place social support provided by coworkers and supervisors	**Social support** no association in men (β = .048, p = .333) or women (β = .021, p = .613).	Two-way interactions of **Social support** with age and occupational status were tested but not significant (no statistics were reported).	age, occupational status, psychological demands and decision latitude
Maselko 2007 (43)	**Social integration (1)**: sum of the number of reported ties with children, close relatives, and close friends. **Emotional support (2)**: 6-items assessing emotional support from partners, children, and friends/relatives. **Instrumental support (3)**: 6-items assessing instrumental support from partners, children, and friends/relatives.	In women, **(1)**, **(2)**, and **(3)** were not associated with AL. Results only reported for women to test if they accounted for relationship between religious service attendance and AL, which was significant for women but not men. Effect sizes could not be calculated.		age, income, education, white race, married, physical functioning, diagnoses of CHD, diabetes, or cancer

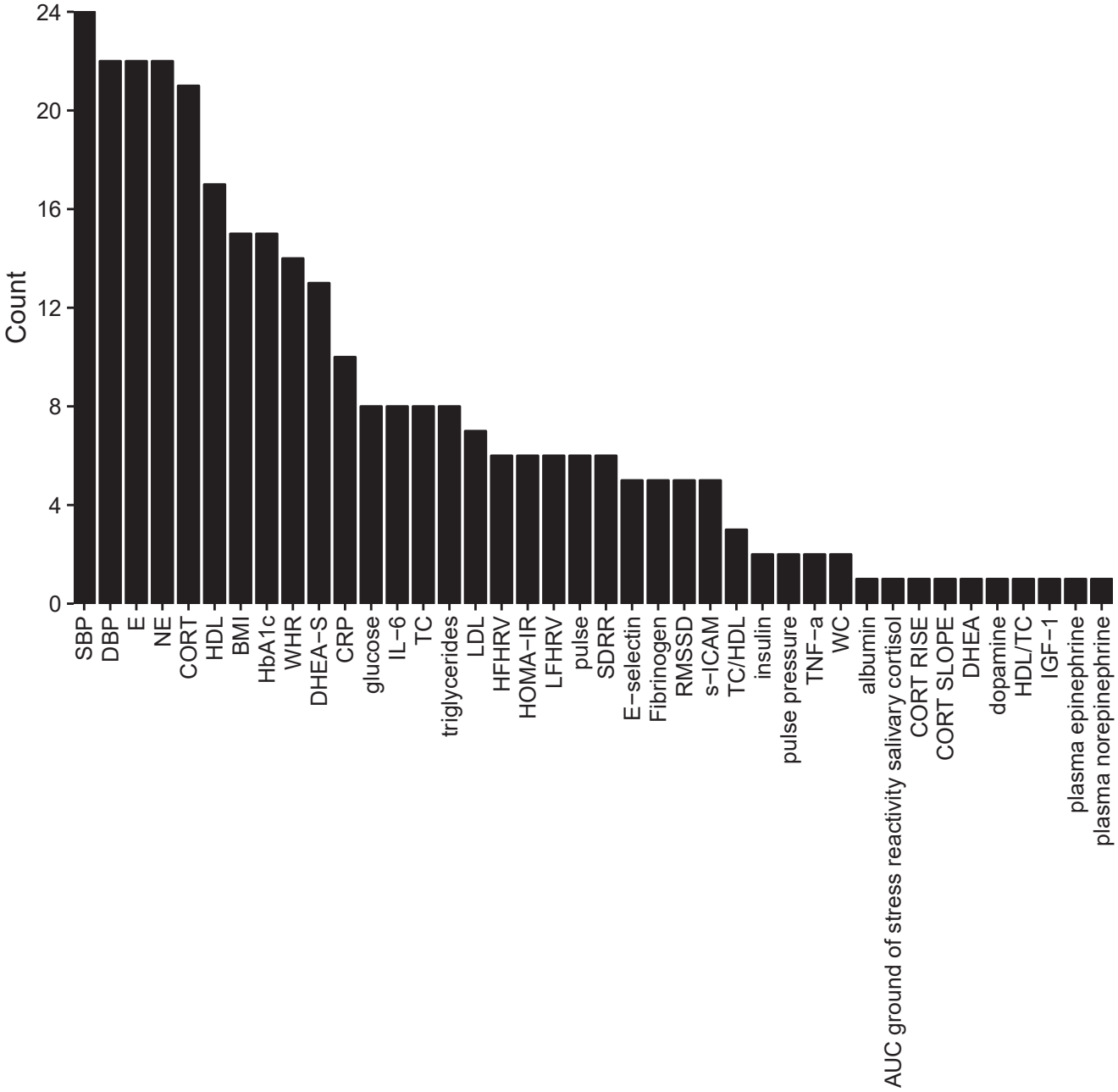
Ref	Measure of PSRs	Main Effects	Moderated Effects	Covariates
Schnorpfeil 2003 (44)	**Social support**: 4 items assessing social support from coworkers and 4 items assessing supportive behavior from supervisors with a composite based on a factor analysis created.	**Social support** not associated with AL. Effect sizes could not be calculated.	**Social support** did not significantly interact with job demands (b = -.003, p = .220). Effect sizes could not be calculated.	sex, smoking status, job demands, decision latitude, age
Seeman, T. 2004 (45)	For the elderly measures were assessed in 1989, 1996, and 1999. For the near elderly, measures were assessed in 1996 and 1999. At each wave, measures were categorized, and then constructs created by summing across waves to generate cumulative measures. **Married at all waves (1)**. **Married at baseline but divorced, separated, or widowed later (2)**. **Low ties with immediate family (3)**. **High ties with immediate family (4)**. **Low ties with other relatives (5)**. **High ties with other relatives (6)**. **Low ties with non relatives (7)**. **High ties with non relatives (8)**. **Living with children (9)**. **Weekly contact with non resident children (10)**. **No social activities (11)**. **Low emotional support (12)**. **High emotional support (13)**. **Low emotional support in any wave (14)**. **High emotional support in any wave (15)**.	Models examined separately for elderly and near elderly. Given the number of social indicators, only significant results are discussed. A first set of models tested indicators individually adjusting for age and sex. Near elderly: no significant main effects. Elderly: significant effect for **(8)**, β = -.14, p = .005.	Near elderly, sex significantly moderated **(1)**, β = -.26, p = .13 for men, β = .20, p = .18 for women; **(5)**, β = .13, p = .04 for men, β = -.07, p = .24 for women; **(12)**, β = .16, p = .27 for men, β = -.24, p = .15 for women; **(14)**, β = .26, p = .16 for men, β = -.39, p = .06 for women. Note that for all but **(1)**, effects are only standardized in the outcome, not the predictor because either the SD was not reported or the predictors are binary variables. Elderly, no significant interactions with sex. Results were similar in multivariate models including variables that had significant main/interactive effects in the individual analyses.	individual models: age, sex; multivariate models: age, sex, ethnicity, male respondent or husband's education, number of waves difficulty meeting expenses, number of waves in poor/not good health, number of waves with any functional difficulties, spouse poor health in any wave
Seeman, T. 2014 (47)	**Social ties (1)**: 2 items assess number of close friends and relatives where possible responses to each item were 0, 1-2, 3-5, 6-9, 10+. Items were averaged and categorized into: 0-2, 2.5, 3-5, and 6+. **Social support (2)**: 4 items assessing social support from family and friends, which were categorized as 1-1.5 ("a little or no support"), 1.75-2.25 ("a little"), 2.75-3 ("some"), 3.25+ ("some" to "a lot").	**(1)** associated with lower AL (p = .018, Cohen's d = .22 for comparison of highest versus lowest level). **(2)** associated with lower AL (p = .011, Cohen's d = .26 for comparison of highest versus lowest level).	No significant interactions (statistics not reported) of sex or race for either **(1)** or **(2)**.	age, sex, race, education, income, smoking, physical activity

Ref	Measure of PSRs	Main Effects	Moderated Effects	Covariates
Seeman, T. 2002 (48)	**WLS. Mother caring (1)** and **Father caring (2)**: 12 caring items from the Parental Bonding Scale. **Emotional/sexual adult pair bonding (3)**: composite of emotional and sexual subscales of the Personal Assessment of Intimacy Relationships (PAIR) Inventory. **Intellectual/recreational adult pair bonding (4)**: composite of intellectual and recreational subscales from PAIR. **Relationship pathways (5)**: summary created coded as "negative" if below median on both **1** & **2** and/or both **3** & **4**; "positive" if above the median on at least one of **1** or **2** and at least one of **3** or **4**. **MAC. Social integration (6)**: sum of the number of reported ties with children, close relatives, and close friends. **Emotional support (7)**: 6-items assessing emotional support from partners, children, and friends/relatives. **Instrumental support (8)**: 6-items assessing instrumental support from partners, children, and friends/relatives.	Classified **(1 - 4)** as above or below the median and comparing mean AL scores separately in women and men. Standardized mean differences (high - low): for men were -.49 **(1)**, +.03 **(2)**, -.21 **(3)**, +.03 **(4)**, all not significant; for women were +.18 **(1)**, +.21 **(2)**, -.27 **(3)**, -.71, $p < .05$ **(4)**, with only **(4)** significant. **(5)** standardized mean difference (positive - negative): for men -.47, $p < .10$, for women -.56, $p < .05$. **(6)** associated with lower AL for men ($\beta = -.10$, $p < .05$) but not women ($\beta = -.03$, $p = .22$). **(7)** associated with lower AL for men ($\beta = -.13$, $p < .05$), but not women ($\beta = -.03$, $p = .52$). **(8)** not significant for men or women (statistics not reported).		NR

Ref	Measure of PSRs	Main Effects	Moderated Effects	Covariates
Singer 2000 (49)	**Mother caring (1)** and **Father caring (2)**: 12 caring items from the Parental Bonding Scale. **Emotional/sexual adult pair bonding (3)**: composite of emotional and sexual subscales of the Personal Assessment of Intimacy Relationships (PAIR) Inventory. **Intellectual/recreational adult pair bonding (4)**: composite of intellectual and recreational subscales from PAIR. **Relationship pathways (5)**: summary created coded as "negative" if below median on both **1** & **2** and/or both **3** & **4**; "positive" if above the median on at least one of **1** or **2** and at least one of **3** or **4**.	Results only presented for **(5)**. Fewer participants in the positive pathway had AL 3+ (28%) than in the negative pathway (56%).	For participants with low household income in 1957, there was a significant difference between the negative and positive pathway (64% vs. 21% AL 3+), $p < .05$, but this was not the case for those with high household income in 1957 (47% vs. 33% AL 3+).	NR
Sotos-Prieto 2015 (50)	**Social support:** composite based on tertiles of size of social network, average emotional support, average assistance from social network, and number of social activities.	**Social support** was associated with lower AL, $\beta = -.11$, $p = .05$ in an adjusted model. High (>= 4) versus low AL associated with 9.9 vs 11.0 **social support** score ($p<.001$) in a univariate model.		age, sex, energy intake, education attainment, income, acculturation, perceived stress, depressive symptoms, activities of daily living score, BMI, diet, physical activity, smoking, sleep.
Weinstein 2003 (53)	**Social activities (1)**: count of assessments below median participation in social activities. **Social contact (2)**: count of assessments below median number of friends or neighbors seen or talked to at least weekly. **Child contact (3)**: count of assessments visiting at least weekly with at least one non-resident child. **Child Residence (4)**: count of assessments co-residing with a child.	**(1)** $r = .15$, $p = .14$. **(2)** $r = .09$, $p = .36$. **(3)** $r = -.04$, $p = .66$. **(4)** $r = .15$, $p = .14$.		none

Note. Underlined values indicate statistically significant effects. AL = allostatic load; SES = socioeconomic status; NR = not reported; b = unstandardized regression coefficient; β = standardized regression coefficient.

Supplementary Figure S1. Frequency of use of each biomarker across the 24 studies



Note. SBP = systolic blood pressure; DBP = diastolic blood pressure; E = overnight urinary epinephrine; NE = overnight urinary norepinephrine; CORT = overnight urinary cortisol; HDL = high-density lipoprotein cholesterol; BMI = body mass index; HbA1c = glycosylated hemoglobin; WHR = waist-to-hip ratio; DHEA-S = serum dehydroepiandrosterone sulfate; CRP = C-reactive protein; IL-6 = interleukin; TC = total cholesterol; LDL = low-density lipoprotein cholesterol; HFHRV = high frequency heart rate variability; HOMA-IR = homeostatic model assessment insulin resistance; LFHRV = low frequency heart rate variability; SDRR = standard deviation of R-R interval; RMSSD = root mean square successive difference; s-ICAM = soluble intracellular adhesion molecule; TNF-a = tumor necrosis factor alpha; WC = waist circumference; AUC = area under the curve; PEF = peak expiratory flow; IGF-1 = insulin-like growth factor 1.