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Early maternal sensitivity, attachment security in young adulthood, and cardiometabolic risk at midlife

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ABSTRACT

Children who experience high-quality early parenting tend to have better physical health, but limited research has tested whether this association extends into adulthood using prospective, observational assessments. Likewise, mechanisms that may explain such links have not yet been illuminated. In this study, we test whether the quality of early maternal sensitivity experienced during the first 3½ years of life predicts cardiometabolic risk at midlife (ages 37 and 39 years) via attachment representations measured in young adulthood (ages 19 and 26 years). We do so by comparing the predictive significance of two different forms of attachment representations coded from the Adult Attachment Interview (AAI): (a) secure base script knowledge and (b) coherence of mind. Using data from the Minnesota Longitudinal Study of Risk and Adaptation, we find that early maternal sensitivity is negatively associated with cardiometabolic risk at midlife. Secure base script knowledge (but not coherence of mind) partially mediated this link. These findings are consistent with the possibility that early parenting has lasting significance for physical health in part by promoting higher levels of secure base script knowledge.

KEYWORDS

Parenting; attachment; cardiometabolic risk; secure base script; coherence of mind

Heart disease is one of the leading causes of death in the United States (National Center for Health Statistics, 2015). Over one-third of Americans have some form of cardiovascular disease, and its prevalence is expected to increase in the future (Heidenreich et al., 2011). Given the prevalence and societal cost of cardiovascular disease, it is important to understand the risk factors associated with its development. One risk factor of growing interest is low-quality social relationships. The impact of social relationships on all-cause mortality rates is roughly equivalent to that of smoking and alcohol use, and it is significantly larger than the effects of exercise or weight (Holt-Lunstad, Smith, & Layton, 2010). Indeed, a recent meta-analysis found that marital quality is associated with cardiovascular outcomes with effect sizes similar in magnitude to many health-related behaviors (Robles, Slatcher, Trombello, & McGinn, 2014).

There is also accumulating evidence that early family environments can have a lasting impact on biological functioning and health in adulthood. Specifically, risky families – those characterized by greater conflict and lower-quality parenting – tend to disrupt psychosocial and biological functioning, resulting in increased risk for disease and early mortality (e.g. Repetti, Taylor, & Seeman, 2002). Children who receive less warmth, support, and responsiveness from their parents typically have higher inflammation levels, blood pressure, and allostatic load, all of which are biomarkers that predict future cardiovascular problems (e.g. Bell & Belsky, 2008; Carroll et al., 2013; Lehman, Taylor, Kiefe, & Seeman, 2009; Tobin et al., 2015). Miller and colleagues (Miller, Brody, Yu, & Chen, 2014), for example, have documented that these effects extend beyond childhood, such that harsher parenting received during childhood predicts greater inflammation in adolescence.

Very little prospective research, however, has examined whether the effects of parenting on health extend beyond adolescence. Studies utilizing retrospective reports suggest that the predictive significance of parenting may continue onward. For example, individuals who report receiving lower-quality parenting in childhood tend to have higher allostatic load and more health problems in adulthood than those who report having received higher-quality parenting (Lundberg, 1993; Russek & Schwartz, 1997). Relying solely on retrospective reports of parenting, however, is problematic. Individuals may not accurately remember their prior experiences (Roisman, Padrón, Sroufe, & Egeland, 2002; Rubin, Rahhal, & Poon, 1998; Yarrow, Campbell, & Burton, 1970), particularly during the very early stages of development when the effects of maternal care are potentially most impactful (Meaney & Szyf, 2005). Additionally, confounding third variables, such as neuroticism (see Holland & Roisman, 2008; Phillips et al., 2010) or depression (see Pan et al., 2012; Roisman, Fortuna, & Holland, 2006), may lead people to exaggerate their earlier life stress and/or the severity of their health problems, artificially inflating these associations.

Past studies have shown that measures of extremely negative parenting can prospectively predict adult health outcomes. Using the data from the Dunedin Multidisciplinary Health and Development Study, Danese et al. (2009) found that childhood maltreatment (indexed by maternal rejection, harsh discipline, changes in primary caregivers, and physical/sexual abuse by parents or others before age 10) forecasted more age-related disease risks, including elevated inflammation and metabolic risk biomarkers at age 32 years. The Dunedin study, however, did not begin assessing their participants until they were 3 years old, and their maltreatment composite was a mixture of observations and retrospective reports of care from parents and others. In the Minnesota Longitudinal Study of Risk and Adaptation, we have similarly found that parental neglect of a child's basic physical and cognitive needs predicts greater cardiometabolic risk, higher self-reported numbers of health problems, and lower ratings of physical health in midlife (Johnson et al., 2017).

There is some evidence that variations in parenting in the more normative range, beyond the extreme cases of abuse and neglect, could also affect adult health. Maternal sensitivity experienced across childhood and early adolescence (based on home and lab observations at seven time-points) has been shown to have a buffering effect on the impact of life stress on health (Farrell, Simpson, Carlson, Englund, & Sung, 2017), but this study did not focus on direct effects of parenting on health. Buchmann et al. (2010)

found that adverse parenting and poor maternal responsiveness, rated from interviews and observations in the home and lab at 3 months, predicted cardiometabolic risk factors such as high-density lipoprotein cholesterol and apolipoprotein A1 at age 19 years. However, very few studies have both prospective, observational data from early childhood and health measures in adulthood to test these longitudinal associations.

If poorer parenting quality early in life prospectively predicts more health problems in adulthood, it is also important to understand how these early experiences “get under the skin” and are carried forward to impact health decades later. Miller et al. (2011) suggest that:

[n]urturant caregivers imbue children with the sense that the world is a safe place and others can be trusted... [which] may enable disadvantaged youngsters to read less threat into their social worlds, with a consequent reduction in the wear-and-tear such vigilance can place on bodily systems...Nurturant parents also help children to learn emotion-regulation strategies, so that when they do encounter stress the physiological consequences are attenuated. (pp. 1597)

This emphasis on instilling feelings of safety and trust, reducing threat, and developing effective emotion-regulation strategies points to the attachment system as one possible key psychosocial mediator of the early parenting/adult health connection.

Attachment theory

Attachment theory (Bowlby, 1969, 1973, 1980) explains how and why early caregiving experiences shape the way in which individuals develop. Young children naturally turn to their primary caregivers for support, care, and protection when they feel threatened, vulnerable, or distressed. Caregivers, however, differ in how responsive they are to their children’s needs and distress, which over time leads children to develop different sets of expectations, attitudes, and beliefs about relationships, known as *internal working models* or *attachment representations*. When caregivers are consistently responsive, children usually develop secure working models characterized by trust that attachment figures (i.e. caregivers) will be available and supportive when needed. In contrast, neglectful, rejecting, or variable parenting behavior often results in working models characterized by distrust of attachment figures and difficulty or discomfort building closeness with them. These individual differences in working models then shape strategies for dealing with distress and conflict as well as expectations/experiences in future relationships, such as with peers and romantic partners, affecting the functioning and quality of these relationships (Groh et al., 2014, 2017; Roisman, Collins, Sroufe, & Egeland, 2005; Waters, Brockmeyer, & Crowell, 2013).

Both theory and research support the possibility of a mediational pathway from early parenting quality to attachment representations in adolescence to adult health outcomes. One key premise of attachment theory is that early experiences with caregivers generate working models, defenses, and biases that can remain with individuals throughout their lifetimes (Bowlby, 1973). Indeed, higher-quality parenting early in life is associated with the development of attachment security (Ainsworth, Blehar, Waters, & Wall, 1978; Verhage et al., 2016), and adult attachment representations are associated

with the quality of early maternal care (Steele et al., 2014). Moreover, some of the cardinal features of insecure attachment representations resulting from insensitive or harsh caregiving – perceiving social situations as more stressful, poorer self-regulation, less effective support-seeking, poorer relationship functioning – should produce over-activation of the biological stress system and, therefore, more health risks stemming from repeated exposure to stress hormones (Farrell & Simpson, 2017; Pietromonaco, Uchino, & Dunkel-Schetter, 2013). Indeed, insecure attachment is associated with greater inflammation (Gouin et al., 2009; Kidd et al., 2014) and incidence of cardiovascular disease (McWilliams & Bailey, 2010). Most notably, Puig, Englund, Simpson, and Collins (2013) found that individuals classified as insecurely attached in infancy were more likely to report experiencing an inflammation-based illness at age 32, showing that attachment can have lasting effects on health.

To test this full mediational path, decisions must be made regarding how to assess attachment insecurity. There are various perspectives on how to operationalize individual differences in adult attachment representations. Over the last thirty years, developmental psychologists have largely focused on an individual's ability to *coherently* organize and narrate his/her early experiences with caregivers during the Adult Attachment Interview (AAI; Main, Goldwyn, & Hesse, 2003; Main, Kaplan, & Cassidy, 1985). Coherence reflects the ability to discuss past relationship experiences involving primary caregivers in an internally consistent, open, and detailed manner. Greater coherence is associated with more adaptive outcomes in adolescence and adulthood, including the ability to regulate one's emotions better during stress and conflict (see Bakermans-Kranenburg & van IJzendoorn, 2009, for a review).

In addition to coherence, some have argued that early attachment experiences are carried forward across development in the form of a cognitive script (i.e. the secure base script; Waters & Waters, 2006). The secure base script is a temporal-causal summary of experiences with sensitive care in the past. Specifically, the secure base script contains eight elements central to sensitive caregiving interactions in times of exploration and distress: (1) an attached individual is engaged in some constructive activity; (2) a challenge is then encountered that disrupts the activity and causes distress; (3) the attached individual signals the need for support; (4) the signal is recognized and appropriate help is offered by an attachment figure; (5) the assistance is accepted; (6) the help is effective in resolving the challenge; (7) comforting, affect regulating behavior occurs and; (8) the attached individual (or dyad) then reengage in some type of meaningful exploration.

Studies validating the secure base script have shown it is associated with early relationship experiences and later relationship behavior, similar to AAI coherence. For example, use of the secure base script in late adolescence/young adulthood has been linked with the quality of early caregiving in normative-risk, high-risk, and genetically unrelated parent-child dyads (Schoenmaker et al., 2015; Steele et al., 2014; Vaughn et al., 2016; Waters, Ruiz, & Roisman, 2017). In terms of predictive significance, secure base script knowledge has been associated with attachment security in the next generation within normative-risk and high-risk samples, across cultures, and with parents and their adopted children (Bost et al., 2006; Coppola, Vaughn, Cassibba, & Costantini, 2006; Monteiro, Veríssimo, Vaughn, Santos, & Bost, 2008; Vaughn et al., 2007; Veríssimo & Salvaterra, 2006; Waters, Raby, Ruiz, Martin, & Roisman, 2018). Secure base script knowledge has been modestly linked with romantic relationship functioning as well (Waters

et al., 2013; Waters et al., 2018). It has also been shown to be associated with stress regulation: When exposed to sounds of babies crying, individuals with low secure base script knowledge report reduced feelings of love towards the baby and greater electrodermal activity, suggesting a great inhibitory response (Groh & Roisman, 2009). Attachment has been proposed as a regulator of stress reactivity in infancy, such that securely attached infants can use the presence of a caregiver to downregulate perceptions of stress and threat responses (Cassidy, Ehrlich, & Sherman, 2013). Given that these attachment orientations continue through into adulthood, individuals with low secure base script knowledge may have heightened stress responses throughout their lifetime. Because the secure base script provides a potential blueprint for how to resolve distress and regulate emotions using an attachment figure, it may play a role in the developmental pathway from early caregiving to later stress-related health outcomes, including cardiometabolic risk.

The current study

In the current study, we examined the links between early parenting quality, two forms of adult attachment security representations (AAI secure base script knowledge and coherence of mind), and cardiometabolic risk in adulthood using data from the Minnesota Longitudinal Study of Risk and Adaptation (Sroufe, Egeland, Carlson, & Collins, 2005), a prospective study of individuals born below the poverty line to first-time mothers and followed into midlife. Being born into low SES families put these individuals at higher risk for receiving poorer parenting (Belsky, 1984) and developing health problems (Chen & Miller, 2013), making it a useful sample for studying these processes. Early parenting quality was assessed by four coder-rated behavioral observations of maternal sensitivity in structured tasks during the first 3.5 years of life. Adult attachment representations were assessed by coding AAI conducted early in adulthood, and cardiometabolic risk was assessed with several objective anthropometric and biomarkers of physical health in middle adulthood. We hypothesized that higher-quality early parenting would predict lower cardiometabolic risk in adulthood (Hypothesis 1), and that adult attachment representations would mediate this link (Hypothesis 2). As an exploratory question, we examined the relative impact of two empirically distinct attachment representations, both derived from the AAI: (a) Secure base script knowledge and (b) Coherence of mind.

Method

Participants

Participants were 118 individuals (57.6% female, 42.4% male) from the Minnesota Longitudinal Study of Risk and Adaptation (MLSRA), all of whom completed the age 37 year assessment. Of the participants, 64.5% were white, 10.7% were black, 19% were multiracial, and 3.3% were of another racial background. With respect to sex, race, maternal age, and education level at the time of the birth, our subsample did not differ significantly from the initial full sample of children recruited in 1975–76 ($N = 267$), all of whom were born to first-time mothers who were living below the

poverty line at the time of recruitment and receiving free prenatal services through the Minneapolis Department of Health (Sroufe et al., 2005). In this subsample, the average age of mothers when they gave birth was 20.88 years ($SD = .73$). Regarding maternal education, 35.1% of mothers had not finished high school, 44.7% had graduated from high school but did not attend college, and 4% had graduated from college when their child was born.

Measures

MLSRA participants have been assessed on a regular basis on many different measures over the years. The following measures were relevant to testing our two hypotheses. Correlations and descriptive statistics for all measures are reported in Table 1.

Early maternal sensitivity

Mother–child interactions during semi-structured tasks were videotaped and coded for maternal sensitivity when participants were 3, 6, 24, and 42 months old (Raby, Roisman, Fraley, & Simpson, 2015). At three months, infant–mother pairs were observed in their homes during a feeding situation. Mothers were instructed to interact with their infant as they normally did. When infants were 6-months-old, two feeding situations and one play interaction were observed in the home on two different days. During the play interactions, mothers were instructed to play with the child, first without using any toys and then using a standard set of toys. For these assessments, maternal sensitivity was operationalized using Ainsworth’s sensitivity scale (Ainsworth et al., 1978), which assessed each mother’s ability to perceive and accurately interpret her infant’s signals and respond appropriately and promptly. At 3 months, interrater agreement was calculated using the Lawlis-Lu index (Tinsley & Weiss, 1975), with agreement defined as a discrepancy of 2 points or less on the 9-point rating scale. The Lawlis-Lu χ^2 was significant at $p < .05$, with a t value of .75, indicating moderate-to-high agreement. At six months, interrater reliability estimates were high ($ICC = .89$); the separate ratings of maternal sensitivity during feeding and play sessions were averaged ($\alpha = .87$).

At 24 and 42 months, mothers and children were observed in a laboratory setting while attempting to solve a series of problem-solving and teaching tasks. At each age,

Table 1. Correlations and descriptive statistics for study variables.

	1	2	3	4	5	6
1. Early maternal sensitivity (0–4 years)	–	.39**	.20**	–.27**	–.07	.27**
2. Secure base script knowledge (19 and 26 years)		–	.33**	–.25**	–.03	.24**
3. Coherence of Mind (19 and 26 years)			–	–.11	–.08	.16*
4. Cardiometabolic risk (37 and 39 years)				–	.35**	–.15
5. Sex (male)					–	–.05
6. Race (white)						–
Mean (SD) or percentage	.03 (.68)	3.22 (1.33)	4.16 (1.50)	–.02 (.79)	42.4%	56.2%

† $p < .10$, * $p < .05$, ** $p < .01$

the tasks gradually increased in complexity, ultimately becoming too difficult for the child to complete on his or her own. Mothers were instructed to first allow the child to try to independently solve each task, and then to give the child any help they thought was needed (for more information, see Erickson, Sroufe, & Egeland, 1985; Matas, Arend, & Sroufe, 1978). Maternal sensitivity at 24 and 42 months was evaluated with a rating of each mother's supportive presence, which assessed the extent to which each mother provided a secure base for her child (i.e. helped the child feel comfortable with the task) as well as each mother's positive involvement during the interaction. For the 24 and 42 month assessments, interrater reliability estimates (ICCs) were .84 and .87, respectively.

An exploratory factor analysis using maximum likelihood estimation indicated that a one-factor solution adequately accounted for the ratings of maternal caregiving quality. Specifically, only the first factor (explaining 50.2% of the variance) had an eigenvalue above 1.0 and all four ratings loaded on the factor in excess of .40. Based on these results, a composite measure of early maternal sensitivity was created by standardizing and averaging the four maternal sensitivity ratings ($\alpha = .67$).

Adult attachment representations

Adult attachment representations were assessed using the secure base script knowledge coding system for the Adult Attachment Interview (AAI; Waters & Fagot, 1998) and coherence of mind from the traditional AAI coding system (Main et al., 2003) at 19 and 26 years. The AAI is a semi-structured audiotaped interview designed to assess adults' state of mind with respect to their attachment relationships with their primary caregivers (Main et al., 2003, 1985). It contains a series of questions that elicit narrative recollections of experiences with caregivers early in life, typically between ages 5 and 12.

Secure base script knowledge

Each participant's secure base script knowledge was coded from his or her transcribed interview on a 9-point scale assessing the extent to which the narrative followed (or implied) knowledge of the secure base script (Waters & Fagot, 1998). Coders focused on two types of content: (a) explicit or implied expectations consistent with the secure base script (e.g. caregivers were available, responsive, and/or provided effective comfort), and (b) recall of specific autobiographical memories that follow the secure base script. Narratives receiving a score of 9 contained several specific events that followed the secure base script structure. Those receiving a score of 4 did not contain any specific events that were organized around the secure base script, but did contain numerous expectations consistent with secure base script knowledge. Narratives receiving a score of 1 contained several specific events that directly violated secure base script structure (e.g. the caregiver rejected signal or did not offer help when the participant reported being hurt, ill, or afraid in childhood) or reflected other relationship expectations (e.g. recurring abuse). The AAIs were coded by two trained, reliable coders, with 54% of the 19-year AAIs and 55% of the 26-year AAIs coded by both coders. All coder disagreements were resolved through consensus. The remaining AAIs were coded independently by one coder. ICCs for the 19- and 26-year AAIs were .83 and .82, respectively. Scores were averaged across the two assessments ($r = .55$, $p < .001$, Cronbach's $\alpha = .69$).

Coherence of mind

Coherence of Mind was coded on a 9-point scale from AAI at both ages using the most recent version of the Main and Goldwyn system available at the time of coding (1984–1998). Higher coherence of mind scores are assigned to AAI narratives that are internally consistent, detailed, plausible, and not emotionally overwrought. All AAI transcripts were coded by trained and certified reliable coders. For the 19-year assessment, six coders rated the AAI transcripts and for the 26-year assessment, five coders rated the AAI transcripts. For reliability purposes, at least two coders independently rated 28% of the transcripts at 19 years and 27% of the transcripts at 26 years. All coder disagreements were resolved through consensus. The remaining transcripts were rated by one coder. Intraclass correlations (ICCs) for the age 19 and 26-year coherence of mind ratings were .83 and .87, respectively. Scores were averaged across the two assessments ($r = .36, p < .001$, Cronbach's $\alpha = .53$).

Adult cardiometabolic risk

When participants were age 37, four anthropometric indicators and biomarkers of cardiometabolic risk were assessed. Each was measured by trained researchers during a lab session. Blood pressure was measured while participants were seated at the start and end of each session using an Omron Model BP785 oscillometric blood pressure monitor. Mean arterial pressure (MAP), the average level of pressure in the arteries during the cardiac cycle, was calculated by doubling diastolic blood pressure, adding systolic blood pressure, and dividing the sum by three: $MAP = [(2 \times \text{diastolic}) + \text{systolic}] / 3$ (Katz & Ruoff, 2004). The two MAP readings were averaged ($r = .85$). BMI was calculated based on height and weight measurements: $BMI = \text{bodyweight (kg)} / \text{height (m)}^2$ (Centers for Disease Control and Prevention, 2015). Waist-to-hip ratio was assessed by dividing the measurement of each participant's waist at the narrowest point from the measurement of his or her hips at the widest point (World Health Organization, 2011). C-reactive protein (CRP) was assayed from finger pricks using hs-CRP kits from Health Management Systems. The blood samples were assayed for CRP by DBS Diagnostics at CoreMedica Labs. CRP values were dropped for individuals who scored abnormally high (i.e. ≥ 10 mg/l), following guidelines set by other studies that have analyzed CRP (e.g. Miller & Cole, 2012; Yeh & Willerson, 2003). CRP was also collected at age 39 from 67 participants, 57 of whom also had provided CRP at age 37. For those with two viable (i.e. both < 10 mg/l) CRP assays, the two CRP measurements were averaged ($r = .60$).

An exploratory factor analysis using maximum likelihood estimation indicated that a one-factor solution adequately explained all four biomarkers of cardiometabolic risk (see Johnson et al., 2017). Specifically, only the first factor (explaining 56.5% of the variance) had an eigenvalue greater than 1.0, and all four ratings loaded more than .72 on this factor. Based on these results, a composite measure of cardiometabolic risk was created by standardizing and averaging the four biomarker measures ($\alpha = .74$).

Control variables

The sex and race/ethnicity of each participant were assessed at birth. Because most participants were white, race/ethnicity was treated as a binary variable: White (1) or non-White (0). Sex was also measured using a binary variable: male (1) or female (0).

Results

Correlations

Zero-order correlations were first calculated for all of the variables (see Table 1). White individuals received greater maternal sensitivity and scored higher in attachment security (on both measures) than nonwhite individuals did, and males had higher cardiometabolic risk scores than females. Providing preliminary evidence consistent with our hypotheses, higher levels of early maternal sensitivity were associated with greater attachment security in early adulthood, assessed using either AAI measure (secure base script knowledge or coherence of mind), as well as with lower cardiometabolic risk in middle adulthood. However, only secure base script knowledge was significantly negatively associated with cardiometabolic risk; the correlation between coherence of mind and cardiometabolic risk, while negative, was not significant.

Hypothesis 1: early maternal sensitivity predicts cardiometabolic risk

To test Hypothesis 1, we performed a multiple regression analysis treating early maternal sensitivity scores as the primary predictor variable and adult cardiometabolic scores as the outcome variable. As shown in Table 2, there was a significant association in the predicted direction, such that experiencing greater maternal sensitivity early in life predicted lower cardiometabolic risk in adulthood. This effect remained significant when the covariates (race and sex) were added to the model. The model predicted 7.4% of the variance (i.e. R^2) in cardiometabolic risk without the covariates, and 20.2% of the variance with them.

Hypothesis 2 and exploratory question: attachment security as a mediator

To test Hypothesis 2, we next ran mediation analyses in PROCESS using 20,000 bootstrapped samples to estimate the indirect effect through the attachment security measures. We ran three models: Mediation only through secure base script knowledge (Model 1), mediation only through coherence of mind (Model 2), and mediation through both attachment measures simultaneously (Model 3).

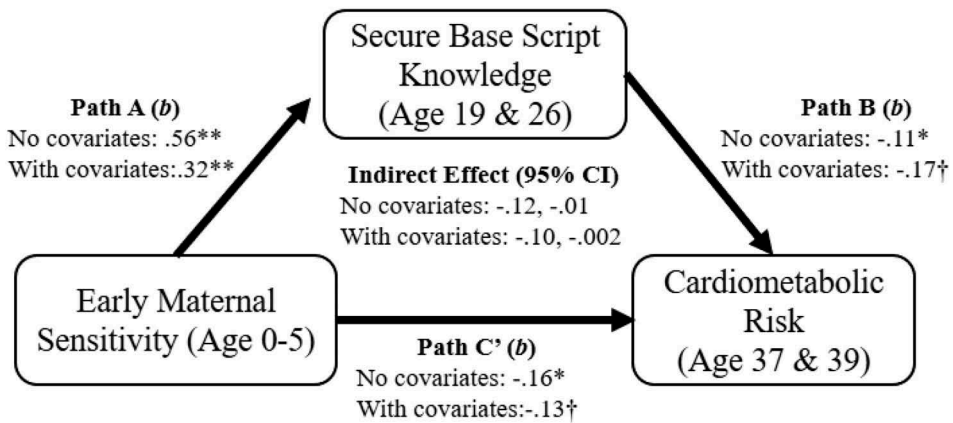
As shown in Figures 1 and 2, there was a significant indirect path through secure base script knowledge in Models 1 and 3. It revealed that a significant portion of the link between maternal sensitivity and cardiometabolic risk was explained by secure base script knowledge, such that experiencing greater maternal sensitivity during the first four years of life predicted greater secure base script knowledge at ages 19 and 26,

Table 2. Standardized regression coefficients predicting cardiometabolic risk from early maternal sensitivity.

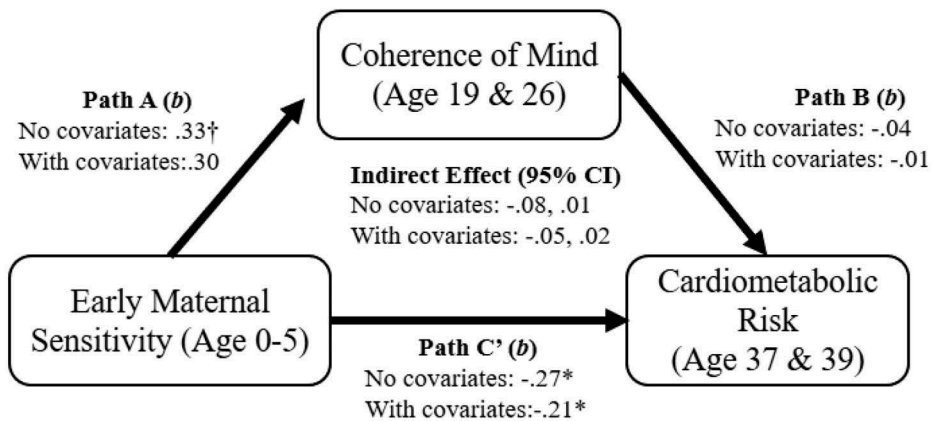
	Model 1: No covariates <i>b</i>	Model 2: With covariates <i>b</i>
Early maternal sensitivity	-.26**	-.22*
Sex	–	.35**
Race	–	-.09

† $p < .10$, * $p < .05$, ** $p < .01$

Model 1



Model 2

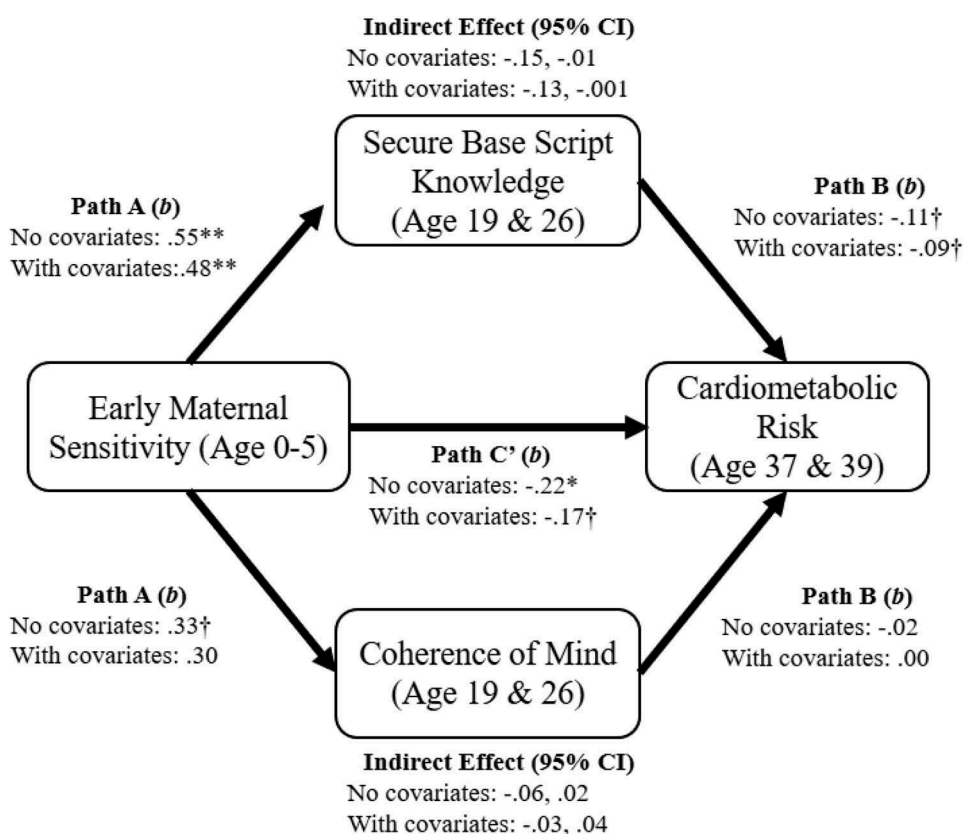


† $p < .10$, * $p < .05$, ** $p < .01$

Note: Covariate models include sex and race.

Figure 1. Models testing secure base script knowledge (Model 1) and coherence of mind (Model 2) as mediators of the link between early maternal sensitivity and adult cardiometabolic risk.

which in turn predicted lower cardiometabolic risk at age 37 and 39. The indirect effect of secure base script knowledge remained significant in both models when sex and race were added as covariates. However, given that the direct effect of early maternal sensitivity remained significant when the indirect effect was included, attachment security only partially mediated this link. There was no significant indirect effect of



† $p < .10$, * $p < .05$, ** $p < .01$

Note: Covariate models include sex and race.

Figure 2. Model testing secure base script knowledge and coherence of mind as simultaneous mediators of the link between early maternal sensitivity and adult cardiometabolic risk (Model 3).

coherence of mind in Models 2 or 3 (whether covariates were included or not), and coherence of mind was not significantly associated with cardiometabolic risk. However, the indirect effect of secure base script knowledge was not significantly larger than the indirect effect of coherence.

To ensure that this pattern of associations was not due to collapsing across AAI assessments at age 19 and 26, we also estimated correlations and mediation models for age 19 and age 26 coherence of mind and secure base script knowledge separately. Secure base script knowledge at age 19 ($r = -.22$, $p = .02$) and age 26 ($r = -.24$, $p = .01$) were both significantly correlated with cardiometabolic risk, but coherence of mind at 19 years ($r = -.14$, $p = .13$) and 26 years ($r = -.04$, $p = .63$) was not. When tested as mediators, the individual assessments of secure base script knowledge served as significant mediators (and the direct effect remained significant), but the individual coherence of mind assessments were not significant mediators.

Discussion

This study is among the first to test the association between early caregiving, measured prospectively using behavioral observations, and adult physical health, and to examine whether attachment representations mediate the link between the quality of early care and adult health outcomes. In line with our hypotheses, we found that experiencing more maternal sensitivity during the first few years of life predicted lower cardiometabolic risk more than 30 years later, and that attachment security in young adulthood partially mediated this association. However, the representation of attachment security made a difference: Significant mediation effects emerged for secure base script knowledge, but not for coherence of mind, although the effect for secure base script knowledge was not significantly larger than for coherence.

Consistent with previous work indicating that retrospective reports of parental care predict adult health (e.g. Lundberg, 1993; Russek & Schwartz, 1997) and with prospective studies revealing that early parenting impacts health outcomes throughout childhood (e.g. Bell & Belsky, 2008; Carroll et al., 2013; Lehman et al., 2009; Tobin et al., 2015) and into early adulthood (Brody et al., 2014; Buchmann et al., 2010), we found that the predictive significance of high-quality parenting extends well into middle adulthood (ages 37 and 39 years). Previous work has documented that early maternal sensitivity prospectively predicts academic and social competence (Raby et al., 2015). The current findings add physical health to the list of potentially salutary effects.

This study also identifies one of the mechanisms through which early parental care may “get under the skin” and remain there for decades to eventually impact adult health outcomes. Attachment representations, specifically secure base script knowledge, in young adulthood mediated the link between maternal sensitivity and cardiometabolic risk in the MLSRA. Coherence of mind was more weakly associated with maternal sensitivity and was unrelated to cardiometabolic risk. This pattern of results is in line with previous research from the MLSRA comparing AAI coherence and secure base script knowledge on their associations with theoretically central outcomes and antecedents. Waters et al. (2017) found that secure base script knowledge had a significantly stronger correlation with maternal sensitivity measured across infancy and childhood as well as significantly greater stability from age 19 to 26 years. In addition, secure base script knowledge predicted attachment security in the children of the target participants whereas AAI coherence did not (Waters et al., 2018). This general pattern – with secure base script knowledge yielding significant effects, but coherence of mind not doing so – provides initial evidence that, at least in high-risk samples, secure base script knowledge may serve as a more valid and reliable indicator of secure attachment in young adulthood (see Waters et al., 2017).

This emerging evidence suggests that certain features underlying secure attachment representations may be more relevant than others when predicting specific outcomes. Secure base script knowledge, for example, assesses the extent to which individuals are able and willing to seek and expect to receive effective support from attachment figures during distressing and challenging situations. Coherence of mind, in contrast, focuses on narrative quality and is thought to indicate attentional strategies implemented during attachment distress (e.g. high coherence indicating a fluid attentional style in which attention flexibly moves between attachment figure and the environment; Main, 2000). Although flexible attention during distress may prove useful in certain contexts, the ability to seek and

receive support should be a particularly relevant and adaptive facet of attachment representations. This is especially true for regulating stress and promoting long-term health, given that the quality of social support is a strong predictor of a number of long-term health outcomes (see Uchino, 2006, for a review). Future research should examine the effects of additional features of secure attachment representations security to pinpoint its “active ingredients” that shape different types of health outcomes (Kemeny, 2003). Moreover, secure base script knowledge only partially mediated the maternal sensitivity→cardiometabolic risk link in our study, and the size of the mediational effects were small, indicating that other important mediators beyond the attachment system still need to be identified.

Although the prospective, longitudinal design and high-quality measurement employed in the current study are notable strengths, this study has some limitations. This study had observations of maternal parenting, but no observations of fathers interacting with their children. Thus, the lasting effects of early paternal caregiving on health still need to be documented. Furthermore, we did not have information on the parents’ cardiometabolic risk or genetic markers that could explain these links. Additionally, the potential moderating role of other childhood risk factors, such as birthweight or child temperament, should be explored in future work examining parenting and adult health. Future research should also explore the myriad ways in which attachment quality might lead to physical health problems. For example, attachment representations could affect tendencies to seek help when minor health symptoms develop or effectively use relationship partners to regulate negative emotions instead of engaging in unhealthy coping behaviors, such as overeating or smoking.

In conclusion, there appears to be an enduring legacy of the quality of early experiences with caregivers on adult physical health several decades later, which may be maintained in part by mental representations of attachment security in early adulthood. We studied these processes in a sample of individuals born into poverty and, thus, at risk for experiencing deleterious health outcomes as they age. These findings suggest that one way reduce health disparities in low SES populations may be to intervene early with parents to help them provide more sensitive and responsive care to their young children. Miller et al. (2014) have found that a parenting intervention deployed in middle childhood in a sample of rural, low-income Black families reduced inflammation levels when children reached early adulthood. Such findings suggest that, by building more secure attachment representations, the effects of parenting interventions could continue to support better health and well-being outcomes for at-risk individuals across their lives.

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