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Implicit Measures of Early-Life Family Conditions: Relationships to Psychosocial Characteristics and Cardiovascular Disease Risk in Adulthood

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Objectives: An implicit measure of early-life family conditions was created to help address potential biases in responses to self-reported questionnaires of early-life family environments. We investigated whether a computerized affect attribution paradigm designed to capture implicit, affective responses (anger, fear, warmth) regarding early-life family environments was (a) stable over time, (b) associated with self-reports of childhood family environments, (c) able to predict adult psychosocial profiles (perceived social support, heightened vigilance), and (d) able to predict adult cardiovascular risk (blood pressure) either alone or in conjunction with a measure of early-life socioeconomic status. ***Method:*** Two studies were conducted to examine reliability and validity of the affect attribution paradigm (Study 1, $N = 94$) and associated adult psychosocial outcomes and cardiovascular risk (Study 2, $N = 122$). ***Results:*** Responses on the affect attribution paradigm showed significant correlations over a 6-month period, and were moderately associated with self-reports of childhood family environments. Greater attributed negative affect about early-life family conditions predicted lower levels of current perceived social support and heightened vigilance in adulthood. Attributed negative affect also interacted with early-life socioeconomic status (SES) to marginally predict resting systolic blood pressure (SBP), such that those individuals high in early-life SES but who had implicit negative affect attributed to early-life family conditions had SBP levels that were as high as individuals low in early-life SES. ***Conclusion:*** Implicit measures of early-life family conditions are a useful approach for assessing the psychosocial nature of early-life environments and linking them to adult psychosocial and physiological health profiles.

Keywords: early-life socioeconomic status, family environment, implicit affect, psychosocial profile, cardiovascular risk

The notion that early-life experiences, such as with low socioeconomic status (SES) or family adversity, can influence health years later has been receiving increasing attention in recent years. In particular, the early-life family environment provides a background for development that has long-term implications for mental and physical outcomes in adulthood (Conger & Donnellan, 2007). However, one of the prevailing issues in this field is whether there are biases in how adults respond to questions about their early-life family environments. To overcome some of these potential biases, this paper introduces an implicit measure of early-life family conditions (affect attribution) and discusses its implications for health research.

Growing evidence suggests that low early-life SES is a determinant of susceptibility to chronic diseases later in life. Individuals from low early-life SES backgrounds are vulnerable to numerous health problems in adulthood, including respiratory and cardiovascular diseases, arthritis, certain cancers as well as elevated inflammation levels and clustering of metabolic risk markers (Blane, Bartley, & Davey-Smith, 1997; Cohen, Doyle, Turner, Alper, & Skoner, 2004; Danese et al., 2009; Galobardes, Lynch, & Davey-Smith, 2004; Galobardes, Smith, & Lynch, 2006; Lawlor, Ronalds, Leon, Macintyre, & Clark, 2006; Poulton et al., 2002). These relationships are generally true irrespective of SES in adulthood (Kittleson et al., 2006; Kuh, Hardy, Langenberg, Richards, & Wadsworth, 2002; Poulton et al., 2002), suggesting that early-life SES is not merely serving as a proxy for current socioeconomic conditions. In particular, some studies have suggested there may be a "sensitive period," whereby SES during the first 5 years of life predicts later life health outcomes (Cohen et al., 2004; Miller & Chen, 2007).

Understanding the psychosocial conditions during the first years of life may help shed light on why low early-life SES affects adult health (Conger & Donnellan, 2007; Matthews & Gallo, 2011; Shonkoff, Boyce, & McEwen, 2009). In particular, low SES has been closely tied to an adverse family environment marked by higher levels of family conflict, harsh restrictive parenting styles, chaotic, or neglectful parenting, as well as inadequate emotional nurturing, such as family relationships that are cold, neglectful, and lacking support (Dodge, Pettit, & Bates, 1994; Emery & Laumann-Billings, 1998; Lehman, Taylor, Kiefe, & Seeman, 2005; McLoyd, 1998).

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In turn, there is increasing evidence that individuals who reported adverse family conditions during childhood have increased rates of physical health problems in adulthood (Repetti, Taylor, & Seeman, 2002). Exposure to abuse during childhood has been linked with a heightened risk of neurological problems, respiratory problems, ischemic heart disease, cancer, skeletal fracture, and liver disease (Dong et al., 2004; Felitti et al., 1998; Wegman & Stetler, 2009). Individuals who reported a "risky family environment" during upbringing show elevated physiological responses to stress (e.g., autonomic and cortisol), compromised metabolic functioning (Lehman et al., 2005; Luecken, Rodriguez, & Appelhans, 2005; Taylor, Lerner, Sage, Lehman, & Seeman, 2004), and have elevated inflammatory profiles (Danese et al., 2009; Taylor, Lehman, Kiefe, & Seeman, 2006; Miller & Chen, 2010).

In sum, diverse research literatures have consistently pointed to the long-term impact of adverse early-life family conditions on health. Some birth cohort or longitudinal studies were able to obtain assessments during childhood that would not be subject to recall biases later in life (e.g., Danese et al., 2009). However, many studies assessed health status in adulthood and were constrained to asking adults to retrospectively describe the nature of their family environments during upbringing (e.g., Dong et al., 2004; Felitti et al., 1998). In general, these approaches are particularly vulnerable to respondent biases, especially when recalling interpersonal information (Metts, Sprecher, & Cupach, 1991). A review of previous studies using retrospective accounts of childhood adversity revealed that measurement error and bias exist in these reports (Hardt & Rutter, 2004). More important, reporting on one's feelings about family conditions can be a sensitive issue, and it may be difficult for some people to be completely open and honest. Thus, retrospective self-report measures may not represent the optimal approach for assessing early-life family environments.

One method in the social psychology literature that is sometimes used in lieu of self-report measures (particularly for sensitive issues such as prejudice) is implicit attitude assessments, which are paradigms designed to capture attitudes that are expressed when individuals are unable to overtly monitor and control the influence of their attitudes on judgments (Fazio & Olson, 2003; Gawronski & Bodenhausen, 2006). Because monitoring and control is limited, implicit measures are extremely useful for investigating socially sensitive attitudes such as prejudice (Fazio, Jackson, Dunton, & Williams, 1995; Greenwald, McGhee, & Schwartz, 1998; Wittenbrink, Judd, & Park, 1997). However, to our knowledge implicit measures have yet to be adopted within health studies of physiological risk markers.

We developed a behavioral paradigm based on that by Payne, Cheng, Govorun, and Stewart (2005) to measure implicit affect elicited by early-life family conditions. The original affect misattribution procedure (AMP) is a computer-based implicit attitude assessment tool that combines projective testing with computer-based quantitative measurements of evaluations. Affect-laden pictures are presented visually and then paired with ambiguous stimuli, which participants in turn rate on dimensions such as attractiveness or pleasantness. Misattributions of affect onto the ambiguous stimuli indicate unintentional expression of attitudes. The AMP can predict outcomes such as intended voting behavior and attitudes toward political candidates as well as actual voting behavior during presidential elections (Payne et al., 2005; Payne et al., 2010).

In the present set of studies, we created a novel application of the AMP in which we used a modified version to probe participants' feelings about their early-life family conditions. Participants' own childhood family photographs were used as the affect-laden picture, and the evaluative judgments of ambiguous images in our paradigm were made on three affect dimensions—anger, fear, and warmth. These dimensions were chosen based on the Risky Families model that posits a central role for conflict and aggression in the home (generating anger and fear) and to cold, unsupportive, and neglectful environments (indicating a lack of parental warmth) in risky family environments (Taylor et al., 2004). We examined the stability and validity of our affect attribution paradigm across two studies. In the first study, we tested the stability of the paradigm across a 6-month period, and tested whether this implicit measure of early-life family conditions correlated with explicit measures of childhood family environments and parenting styles. In the second study, we examined whether this implicit measure of early-life family conditions could predict unfavorable adult psychosocial profiles and cardiovascular risk (resting blood pressure) in a healthy sample of adults.

Study 1

Method

Participants. Ninety-four participants aged 18 to 43 years ($M = 22.21$, $SD = 5.069$) participated in a three-wave study. Participants were recruited at the University of British Columbia (UBC), and represented a variety of ethnic groups, socioeconomic classes, as well as both student and nonstudent populations. The sample included 79.8% female participants, with the majority of participants being of Chinese descent (53.2%), followed by European descent (23.4%), and other ethnicities (23.4%). Eighty-six (91%) participants completed the second visit 1 month later, and 85 (90%) participants completed all three time points over the course of 7 months.

Measures.

Affect attribution. Developed by Payne et al. (2005), the AMP is a computer-based implicit attitude assessment tool that combines projective testing with computer-based quantitative measurements. The "attitude object" image is presented for 75 ms, followed by a blank screen for 125 ms, then the ambiguous pictograph for 100 ms. Following this, the participant is asked to make an affective judgment of the ambiguous pictograph. They are instructed that the "attitude object" image is a warning signal for the ambiguous pictograph and that they should not respond to it. Of note, Payne at al. (2005) highlighted that across all studies, the task was unaffected by direct warnings to avoid influence of the affect-laden pictures, suggesting that it is resistant to correction attempts. The AMP has proven to have excellent psychometric characteristics, with attitude ratings showing high levels of internal consistency ($\alpha = .88$) and reliable correlations with criterion variables such as self-reported political attitudes and intended voting behavior (Payne et al., 2005; Payne et al., 2010).

Our study involved a modified version of the AMP. First, our attitude object of interest consisted of two early childhood family

photographs meant to elicit implicit affect toward one's early-life family conditions. Participants were asked to bring their own personal photographs for inclusion in the experiment, with the stipulations that each picture had to contain an image of themselves age 0 to 5 years, and include at least one primary caregiver. This age range was selected based on previous research pointing to a "sensitive period" that impacts health later in life (Cohen et al., 2004; Miller & Chen, 2007). Second, participants were asked to evaluate ambiguous images of Jackson Pollock-style splatter paintings, rather than the Chinese pictographs used in the original AMP studies, due to the large number of Chinese descent individuals (for whom the Chinese pictographs would have had meaning, rather than being ambiguous) in the greater Vancouver community. Finally, we asked participants to rate each splatter painting on three affect dimensions—anger, fear, and warmth—rather than the ratings of pleasantness made in the original AMP studies because of the relevance of these emotions to childhood family psychosocial environments.

In an initial study to validate the splatter paintings, 80 unique splatter paintings were generated. These splatter paintings were then evaluated by 10 psychology-trained raters on a 9-point scale ranging from 1 (*unpleasant*) to 9 (*pleasant*). The 40 splatter paintings with the most *neutral* ratings (mean ratings of 4.2 to 5.8) were selected for inclusion in the task. An additional seven paintings were excluded because of high variance in their ratings. The remaining 33 splatter paintings were then reversed and rotated to create six images each, which led to a total of 198 splatter paintings that were included in the paradigm.

Participants completed 72 trials in our paradigm, which took on average 5 min to complete. Each trial involved a family photograph or a gray-colored control image followed by a splatter painting that had been randomly selected from the pool. The participant was then asked to indicate whether the painting did versus did not convey a target affect (anger, fear, warmth). The trials varied in terms of the prime that was used (three possibilities: 1 of 2 family photographs or a gray control image) and the affect rating that was made (three possibilities: anger, fear, or warmth). There were a total of eight trials for each combination of prime and rating. Ratings were averaged within each category to form separate attribution scores for the active and control primes. Values could range from 0 to 1.

Family environment. The 13-item Risky Families measure (RF) assesses early-life family environment (Taylor et al., 2004). Participants are asked to think about their family life between the ages of 5 and 15 years, and answer questions on a 5-point scale ranging from 1 (*not at all*) to 5 (*very often* or *very much*). Question items include: "How often did a parent or other adult in the household swear at you, insult you, put you down, or act in a way that made you feel threatened?" and "How often would you say you were neglected while you were growing up, that is, left on your own to fend for yourself?" The RF measure has been shown to have high agreement and reliability with clinical interviews conducted and coded by trained clinical interviews (Taylor et al., 2004).

Parenting. Paternal and maternal warmth in the first 16 years of the participants' lives were measured using the 25-item Parental Bonding Instrument (Parker, Tupling, & Brown, 1979). Participants filled out the questionnaire for maternal and paternal bonding separately and had to rate how true the statements were on a 5-point scale ranging from 0 (*not at all true*) to 4 (*very much true*). Scores for the Warmth subscale (12 items; e.g., "Spoke to me in a warm and friendly voice") were computed for each parent and higher scores indicated higher levels of parental warmth. This questionnaire has been shown to have good test–retest reliability and has been validated with actual parental behavior recorded by family observers and expert judges (Wilhelm & Parker, 1990).

Procedure. After arriving at the laboratory and providing informed written consent, participants were taken to a private room and seated at a computer. Participants were asked to bring in two childhood family photographs, and these were inserted into the affect attribution computer program. Participants completed the affect attribution task and questionnaires described above via MediaLab software, version 2008.1.22 (Jarvis, 2008). Participants were invited back to the lab 1 month (Visit 2) and 6 months (Visit 3) after their first visit. The same family photographs were used and the same study procedure was repeated. To thank them for their time, each participant received $10 for each of three visits, with a $10 bonus for completing all three visits. The study was approved by the Behavioral Research Ethics Board of the University of British Columbia.

Results

Stability across visits. Overall, correlations of affect attribution tendencies over all three visits during the 6-month study period were highly significant. Pearson correlations revealed that attribution of anger in the first and second visits (1 month apart), and the first and last visits (6 months apart) were significant respectively, $r = .458$, $p < .001$ and $r = .522$, $p < .001$. Similarly, attribution of fear in the first and second visits, and the first and last visits were significantly correlated, $r = .670$, $p < .001$ and $r = .463$, $p < .001$. Last, attribution of warmth in the first and second visits, and the first and last visits were significantly correlated, $r = .524$, $p < .001$ and $r = .467$, $p < .001$. These correlations were somewhat weaker than the correlation over the same time period of a questionnaire, self-report measure of family environment, rs $> .891$, ps $< .001$. However, the stability estimates of our implicit paradigm are comparable to those of other implicit tasks (Cunningham, Preacher, & Banaji, 2001). Affect attribution responses were subsequently aggregated across the three visits to create a more reliable indicator.

Affect attribution analyses. Attribution of affect was computed by summing up the number of times participants attributed the different emotions toward the splatter paintings following a family photograph and as well, following the gray colored control image. A percentage score was calculated (number of times participants endorsed an emotion divided by the number of trials probing that emotion) per each emotion for family photographs and for the control image. Attribution of affect following the two different family photographs were averaged to obtain one family affect attribution score per each affect dimension. In all analyses examining associations between affect attribution and other measures, affect attribution after the control image were subtracted out from affect attribution after a family photograph. This controlled for individual differences in the tendency to endorse the various affect descriptors.

After their own early childhood family photograph, participants attributed significantly less anger and fear in comparison to the

control image, $M_{diff} > 3.089$, $ts > 2.021$, $ps < .04$. Also, participants attributed significantly more warmth after a family photograph, $M_{diff} = -14.259$, $t = -7.821$, $p < .001$.

Relationships among the three affect dimensions. Attributions of anger correlated with attributions of fear, $r = .659$, $p < .001$, but neither correlated with attribution of warmth, $rs < .002$, $ps > .380$.

Affect attribution and the family.

Family environment. Pearson correlation analyses were conducted to examine the association between affect attribution and explicit measures of childhood family environment (RF scores). Participants who reported more negative childhood family environments on the RF measure also significantly attributed more anger after a family photograph, $r = .374$, $p < .001$. Similarly, these participants also significantly attributed more fear after a family photograph, $r = .266$, $p = .012$. However, higher RF scores were not significantly correlated with attribution of warmth, $r = -.157$, $p = .143$.

Parenting. Paternal warmth during childhood was significantly correlated with less attribution of anger, indicating that participants who had warmer fathers during childhood also attributed significantly less anger after a family photograph, $r = -.319$, $p = .002$. Paternal warmth was also significantly correlated with less attribution of fear, $r = -.276$, $p = .009$. Furthermore, paternal warmth was significantly associated with greater attribution of warmth, $r = .223$, $p = .036$. Maternal warmth was correlated with less attribution of anger, $r = -.249$, $p = .019$, but not attribution of fear or attribution of warmth, $rs < -.165$, $ps > .123$.

In sum, these findings indicate that a new measure of implicit attributed affect about childhood family conditions was associated with explicit self-report measures of childhood family environments and parenting styles during upbringing, and showed consistency over a 6-month period. A second study was then conducted with a healthy sample of adults to examine the validity of this measure by testing whether this implicit early-life measure could predict adult psychosocial and physiological profiles. In particular, individuals who grow up in adverse early-life environments have been found to display more negative affect, to perceive greater threat, and to have less social support as adults (Luecken, Appelhans, Kraft, & Brown, 2006; Repetti et al., 2002). In addition, adverse early-life environments have been associated with greater cardiovascular risk profiles in adulthood (Repetti et al., 2002; Wegman & Stetler, 2009). As such, we tested associations of our implicit childhood family environment measure with adult depressive symptoms, vigilance for threat, social support, and resting blood pressure. In addition to the main effects of implicit affect on these adult psychosocial and physiological outcomes, we also tested the hypothesis that the quality of early childhood family environments might interact with broader social environment characteristics, such as SES to impact outcomes. Previous research has documented that childhood family relationship quality can moderate or buffer the effects of SES on cardiovascular and inflammatory profiles (Chen, Miller, Kobor, & Cole, in press; Evans, Kim, Ting, Tesher, & Shannis, 2007). Hence we tested whether implicit attributions about early childhood environments might also interact with early-life SES in predicting adult characteristics.

Study 2

Method

Participants. Participants were recruited from Vancouver, Canada, through postings in local media and public transit as part of a larger study examining the biological embedding of early-life SES. To be eligible, they had to be (1) between 15 and 55 years of age; (2) North American born; (3) fluent in English; (4) in good health, defined as being free of acute infectious disease the past 2 weeks, and without a history of chronic disease; and (5) from high or low socioeconomic categories. SES was obtained using the National Statistics Socioeconomic Classification guide (Office for National Statistics, 2005) to code current occupation (8-point scale, ranging from 1 (*high SES*) to 8 (*low SES*)), as well as early-life (age 0 to 5 years) occupation of parents. Those in midrange SES categories (3 to 4 on 9-point scale) were excluded from the larger study to better contrast low and high SES. There were 122 individuals ($M_{age} = 32.46$, $SD = 10.92$) who participated in this study, with 52.5% of individuals in the low early-life SES category. The sample consisted of 54.1% female participants, with the majority of participants being of European descent (68.0%), followed by Chinese descent (13.1%), and other ethnicities (18.9%).

Measures.

Attribution of affect. The same modified affect attribution paradigm from Study 1 was used. We replaced the gray colored control image in Study 1 with an image of a neutral face obtained from a face database created in the Karolinska Institute in Sweden (Lundqvist, Flykt, & Ohman, 1998; Oosterhof & Todorov, 2008), so that both the image of interest (early childhood family photograph) and the control image would contain faces. This face database contains previously established images of different emotional expressions and we used an image drawn from their neutral expression database.

Social support. An abbreviated version of the Interpersonal Support Inventory List (ISEL) developed by Cohen, Mermelstein, Kamarck, and Hoberman (1985) was used. The 12-item version of ISEL provides a global measure of perceived social support, with higher scores indicates greater support. Participants rate how true statements are on a 4-point scale ranging from 1 (*definitely false*) to 4 (*definitely true*). The ISEL has demonstrated validity with moderate correlations to other social support measures, such as the Moos Family Environment Scale (FES; Moos & Moos, 1981). Adequate internal and test–retest reliabilities have been found for the total ISEL scale and the subscales in several samples (Cohen et al., 1985).

Depression. Depressive symptoms were assessed using the Center for Epidemiological Studies Depression Scale (CES–D; Radloff, 1977), which has been widely used in clinical trials in both general and psychiatric populations and has excellent psychometric characteristics with a Cronbach's alpha of .85. The 10-item version included items assessing the frequency of experiencing depressive cognitions, affect, and behaviors during the past week (e.g., feeling depressed and lonely, having poor appetite and sleep). Responses are based on a scale ranging from 0 (*none of the time or rarely; less than 1 day*) to 3 (*most or all of the time; 5–7 days*). Scores are summed, with higher scores reflecting greater depressive symptoms.

Vigilance of threat. To assess vigilance for threat, we administered a slightly modified version of Payne's weapon identification procedure (Payne, 2001). The original paradigm measures the tendency to misidentify neutral objects (e.g., tools) as threatening (e.g., guns) after presentation of African American versus European American faces. Participants are asked to decide whether the second image is a gun or a tool. Incorrect responses, or in other words false-positives, occur when participants misidentify a tool as a gun (Payne, 2001).

In our modified version of this paradigm, we probed the tendency to perceive threat after either neutral (i.e., a parrot) or threatening (i.e., snake) images that were selected from the International Affective Picture System, and which were presented prior to images of a gun or a tool (Lang, Bradley, & Cuthbert, 2008). False-positives occur when participants misidentify a tool as a gun. In this study, we focused on the percentage of false-positives that occur after the neutral image, which provides a general measure of automatic heightened vigilance tendencies.

Blood pressure. Blood pressure was recorded with a standard occluding cuff on the participant's nondominant arm. The VSM-100 BpTRU (VSM MedTech, Coquitlam, BC) automatic blood pressure monitor is a reliable noninvasive device. Validation studies indicate that its measurements are within 5 mmHg of a gold standard auscultatory mercury sphygmomanometer measurements 89.2% of the time, and within 10 mmHg 96.4% of the time (Mattu, Heran, & Wright, 2004). Following a 5-min period in which participants acclimated to the device, blood pressure readings were taken every 2 min over a 6-min period, totaling three readings that were averaged.

Procedure. Participants were seated in a private room to rest for 5 minutes. Blood pressure readings were then taken by placing the occluding cuff on the upper aspect of the participant's nondominant arm with the microphone placed above an area where the brachial artery could be palpated. Participants were then seated at a computer and completed the same Study 1 affect attribution task and questionnaires described above via MediaLab software, version 2008.1.22 (Jarvis, 2008). This study was approved by the Clinical Research Ethics Board of the University of British Columbia.

Results

Affect attribution analyses. Attributions of anger and fear after a family photograph were significantly correlated with each other, $r = .565$, $p < .001$. However, attribution of warmth after a family photograph was not associated with attribution of anger and fear, rs $< .064$, ps $> .487$, similar to Study 1. Hence anger and fear attributions were aggregated to create a more reliable indicator of negative affect attribution. Warmth was retained as a separate indicator of positive affect attribution. See Table 1 for descriptive information.

Psychosocial analyses. Multiple-regression analyses were conducted to test whether attribution of negative affect toward early-life family conditions could predict adult psychosocial profiles. In all analyses, affect attribution after the control image was subtracted out from affect attribution after a family photograph. Covariates of age, gender, ethnicity, early-life and current SES were included.

Social support. Greater attribution of negative affect significantly predicted lower levels of current perceived social support, such that individuals who attributed more anger and fear after their own childhood family photographs reported lower levels of current perceived social support on the ISEL, $\beta = -.191$, $p = .028$.

Depression. Attribution of negative affect did not significantly predict levels of depressive symptoms as measured by the CES–D Scale, $\beta = .097$, $p = .287$.

Vigilance of threat. Greater attribution of negative affect significantly predicted higher vigilance scores, such that individuals who attributed more anger and fear after their own childhood

Table 1
Study 1 and 2 Descriptive Information Including Affect Attribution Tendencies, Resting Blood Pressure, and Heart Rate; Self-Reported Depressive Symptoms; Current Perceived Support; and Vigilance Tendencies

Measures	Minimum	Maximum	*M*	*SD*
Study 1				
Anger attributed to family photo (%)	0	87.50	24.81	22.84
Fear attributed to family photo (%)	0	87.50	24.48	22.58
Warmth attribute to family photo (%)	0	100.00	45.58	27.64
Anger attributed to control image (%)	0	100.00	27.90	25.01
Fear attributed to control image (%)	0	100.00	29.42	26.60
Warmth attributed to control image (%)	0	100.00	31.32	25.40
Study 2				
Negative affect attributed to family photo (%)	0	78.13	17.62	20.12
Warmth attributed to family photo (%)	0	100	49.49	32.42
Negative affect attributed to control image (%)	0	100	26.79	27.71
Warmth attributed to control image (%)	0	100	30.94	29.69
Systolic blood pressure (mmHg)	84	150	107.49	12.35
Diastolic blood pressure (mmHg)	49	120	70	11.18
Heart rate (bpm)	42	93	68.64	9.90
Depressive symptoms	0	26	7.85	5.00
Current perceived social support	20	48	39.95	6.34
Vigilance of threat (%)	0	100	18.56	19.03

Note. bpm = beats per minute.

family photograph exhibited greater tendencies to automatically overinterpret cues as threatening as adults, $\beta = .217$, $p < .018$.

In addition to main effects, we also tested for interactions between affect attribution and early-life SES, using the procedures recommended by Aiken and West (1991). No significant interactions were found for adult psychosocial outcomes, $\beta s < |.118|$, $ps > .349$. To further test the specificity of the main effects, we conducted subsequent analyses in which we included explicit childhood family environment measures (the RF measures) as a simultaneous predictor of adult psychosocial profiles. Implicit childhood negative affect attributions continued to predict lower levels of adult perceived social support and a greater tendency toward heightened vigilance, above and beyond explicit childhood family environments, $\beta s > |.148|$, $ps < .074$.

Cardiovascular risk. Multiple-regression analyses were conducted to test whether resting blood pressure could be predicted from implicit negative affect attributions. Covariates of age, gender, ethnicity, and current SES were included in each analysis. Systolic and diastolic and blood pressure were not predicted by affect attribution, $\beta s < .085$, $ps > .354$. However, the interaction between negative affect attributions and early-life SES was marginally significant in predicting systolic blood pressure (SBP), $\beta = .210$, $p = .089$. This interaction indicates that SBP levels are lowest for those individuals who are both from a high early-life SES background and who attributed low levels of negative affect after a family photograph. On the other hand, among those from a high early-life SES background, as attributed negative affect increases, SBP also increases, such that those individuals who are from a high early-life SES background but who attributed high levels of negative affect after a family photograph actually have SBP levels similar to individuals from low early-life SES backgrounds (see Figure 1). Subsequent analyses revealed that when entered simultaneously with explicit childhood family measures, the interaction between implicit negative affect toward early-life family conditions and SES in predicting SBP remained marginally significant, $\beta = .218$, $p = .079$. In contrast, the interaction between negative affect attribution and early-life SES did not predict diastolic blood pressure, $\beta = .119$, $p = .332$.

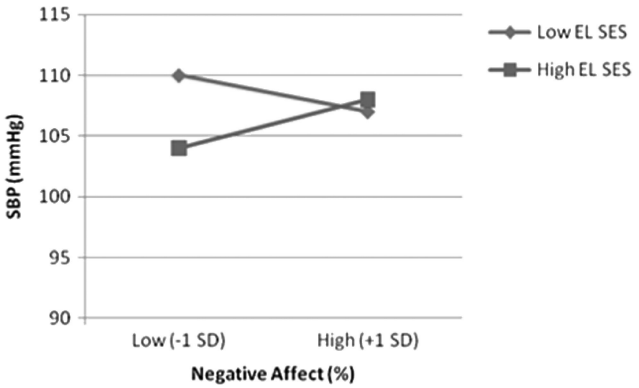

Figure 1. The interaction between negative affect attribution tendencies and early-life (EL) SES predicting resting SBP. SBP levels are lowest for those individuals who are both from a high early-life SES background and have low levels of attributed negative affect after a family photograph. On the other hand, those individuals who are from a high early-life SES background but have high levels of attributed negative affect after a family photograph have blood pressure levels similar to individuals from low early-life SES backgrounds. SES = socioeconomic status; SBP = systolic blood pressure.

Discussion

Across two study samples, we demonstrated reliability and validity for a novel measure of early-life family environments, an implicit affect attribution paradigm that tapped implicit affect about early-life family conditions in adults. Implicit affective judgments of anger, fear, and warmth were significantly correlated over a 6-month period, and this test–retest estimate was comparable to the consistency of personality traits over a 1-year period (Roberts & DelVecchio, 2000). Our paradigm showed construct validity in being associated with explicit self-report measures of childhood family environments as well as parenting styles during childhood. Our measure showed predictive validity in implicit negative affect toward one's childhood family being associated with unfavorable adult psychosocial profiles, including lower levels of current perceived social support and a greater tendency toward heightened vigilance (overinterpreting threat). Last, this measure of implicit affect marginally predicted an indicator of cardiovascular risk (e.g., elevated resting SBP) in conjunction with a measure of early-life family SES.

The finding that greater attributed negative affect after one's own early childhood family photograph was associated with lower levels of current perceived social support and a greater tendency toward heightened vigilance is consistent with a large body of literature documenting damaging psychosocial consequences for individuals from an adverse childhood family environment. For instance, previous research has demonstrated that children reared in a family environment characterized by overt conflict, aggression, and inadequate emotional nurturance, are at an increased risk of a wide array of current and future emotional or behavioral problems, such as anxiety, depression, conduct disorder, antisocial behavior, and suicide (Emery & Laumann-Billings, 1998; Repetti et al., 2002). Moreover, our findings document that implicit measures of affect regarding one's childhood family environment predict adult psychosocial profiles after controlling for explicit measures of childhood family environment, suggesting that implicit measures of childhood environments add unique predictive power beyond what explicit measures can explain.

We did not observe a direct association between our measure of implicit affect toward early-life family conditions and blood pressure. However, there was evidence that implicit affect interacted with early-life SES in SBP levels. Levels of SBP were lowest for those individuals who were both from a high early-life SES background and who implicitly attributed low levels of negative affect after a family photograph. Among those high in early-life SES, as attributed negative affect increased, SBP also increased. Thus, those individuals from a high early-life SES background who attributed negative affect to childhood family photographs actually had SBP levels similar to individuals low in early-life SES. This suggests that implicit affect toward early-life family conditions can at times override the effects of early-life SES on resting blood pressure, and suggests the importance of considering both implicit and explicit assessments when exploring the influences of early-life factors on later life health. All that said, because the findings were only marginally significant, they will need to be replicated in

other samples before any definitive conclusions about the value of implicit measures in predicting health-relevant outcomes can be reached.

This finding is in line with a large body of evidence documenting damaging physical health outcomes for individuals who explicitly report adverse early-life family circumstances. For instance, individuals who reported a childhood risky family environment consistently showed increased rates of physical health issues in adulthood, such as elevated stress responses, major physical disorders, and a compromised metabolic functioning (Felitti et al., 1998; Lehman et al., 2005; Luecken et al., 2005; Taylor et al., 2004). We add to this literature by showing that indirectly measured implicit affect toward early-life family conditions have implications for cardiovascular functioning in adulthood. We unmasked a subgroup of individuals who may be at risk—those who were from a high early-life SES background but had implicit negative affect toward early-life family conditions. Thus, this suggests that our implicit measure may have incremental utility in health research, as this subgroup would not have been identified on the basis of explicit measures alone.

Limitations

There are several limitations in our two studies. First, we explored a limited selection of criterion variables. Future studies should conduct a broader assessment to determine the scope of our paradigm's associations with psychosocial and psychobiological outcomes relevant to health. Second, our validation study findings were cross-sectional and longitudinal studies are needed to determine whether implicit negative affect truly precede change in health-relevant processes. Third, our two samples were not identical in composition (and consisted primarily of Chinese and European descent adults with no chronic health conditions). As has been done in almost every validation study of implicit attitude measures (Nosek & Smyth, 2007; Payne et al., 2005), participants in Study 1 were a sample recruited from the university setting (both students and nonstudents). In contrast, Study 2 drew on data from a larger, ongoing community study, and hence the demographics of the two studies are different. Future prospective studies should examine our paradigm's temporal stability and associations with health processes in broader, population-based samples. Fourth, because participants self-selected their family photographs, participants from adverse childhood environments may have fewer photographs from which to choose. We are also unable to verify that participants' responses are specific to early childhood. Last, although automatic affective responses are less explicitly biased than self-report measures that require participants to recall detailed information from the past, emotional recall may also reflect some bias. Other measures that capture the early-life environment are still warranted.

Conclusions

Across two study samples, our affect attribution paradigm designed to capture implicit affect toward early-life family conditions showed moderate associations with explicit measures of childhood family environment, predicted unfavorable adult psychosocial processes, and interacted with a measure of SES to predict cardiovascular risk. More important, our results indicate that implicit characteristics can potentially override the effects of early-life characteristics on adult blood pressure. These findings highlight the potential importance of incorporating implicit measures together with explicit measures when assessing early-life factors, especially given the relative ease with which these measures could be incorporated into future research studies (approximately five minutes to administer), the advantage that this approach brings of eliminating self-presentation biases, and the fact that these implicit measures have predictive power over and above explicit measures of early-life family environments. Implicit measures may be useful when exploring socially sensitive situations, such as the early-life family environment because it can circumvent social desirability pressures. This new affect attribution paradigm as an indirect measure of early-life factors may help address some of the prevailing issues surrounding retrospective assessments of early-life circumstances, thus providing a practical method for further exploring the implications of early-life social environments on later life health.

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