Culture and the Socialization of Child Cardiovascular Regulation at School Entry in the US

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ABSTRACT The measurement of cardiovascular functioning targets an important bridge between social conditions and differential well-being. Nevertheless, the biocultural, psychosocial processes that link human ecology to cardiovascular function in children remain inadequately characterized. Childrearing practices shaped by parents’ cultural beliefs should moderate children’s affective responses to daily experience, and hence their psychophysiology. The present study concerns interactions among family ecology, the normative social challenge of entry into kindergarten, and parasympathetic (vagal) cardiac regulation in US middle-class children (N = 30). Although parents believed children must be protected from overscheduling to reduce stress and improve socio-emotional adaptation, maternal rather than child schedules predicted parasympathetic regulation during a nonthreatening social engagement task following school entry. Children of busier married mothers, but less busy single mothers, showed the context-appropriate pattern of parasympathetic regulation, low respiratory sinus arrhythmia (RSA). These findings are expected if: maternal and family functioning, rather than the scheduling of the child’s daily life, principally drive young children’s cardiovascular responsiveness to a normative challenge; and busy schedules represent high family functioning with married mothers, but not under single-parent conditions wherein adult staffing is uniquely constrained. Family ecology is shaped by culture, and in turn shapes the development of children’s cardiovascular responses. Appropriately fine-grained analysis of daily experience can illustrate how culturally driven parenting practices may have unintended consequences for child biological outcomes that vary by family structure. Am. J. Hum. Biol. 20:572–583, 2008. © 2008 Wiley-Liss, Inc.
The present study focuses upon parasympathetic cardiac regulation, which independent of sympathetic or endocrine activity has implications both for socio-emotional development and cardiovascular health.

**PARASYMPATHEtic REGULATION AS A MARKER OF ADAPTIVE FUNCTIONING**

Social engagement is facilitated by the parasympathetic (vagal) brake, a mechanism for self-soothing and arousal inhibition. Research concerning parasympathetic regulation has moved beyond a stimulus–response paradigm, toward recognition that the ANS is part of a regulatory feedback loop responsive to social conditions (Porges, 2007), placing such work within the mainstream of contemporary stress research (Ice and James, 2007). Under low threat conditions that call for social engagement, the well-regulated child should display parasympathetic engagement. Conversely, in the context of a perceived threat, the adaptive response is parasympathetic withdrawal, releasing constraints on sympathetic mobilization and hypothalamic–pituitary–adrenal arousal (Doussard-Roosevelt et al., 2003; Porges et al., 1996).

Parasympathetic activity can be non-invasively assessed through quantification of respiratory sinus arrhythmia (RSA) on an electrocardiogram trace. RSA is a normal sinus arrhythmia, reflecting fluctuations in ventral-vagal control over cardiac activity across the respiratory cycle. More pronounced heart period variation within an age-specific high frequency band indicates higher RSA, and hence parasympathetic activity. Because parasympathetic activity slows heart rate, high RSA is a marker of low arousal (Cacioppo et al., 1994).

Low resting or ambulatory RSA (often identified as “high frequency power” or “vagal tone”) in the absence of a threat is a prospective cardiovascular risk factor in adults (Kors et al., 2007). For instance, in the Framingham Heart Study (Tauji et al., 1996), previously disease-free adults in the lowest tertile for ambulatory RSA had substantially higher rates of incident cardiac events than did the second and third tertiles (event rates per 1,000 person years were 11.84, 5.78, and 2.06, respectively). The regulation of parasympathetic activity is therefore emerging as an important new marker for allostatic load.

**PSYCHOSOCIAL INFLUENCES ON PARASYMPATHEtic REGULATION**

In general, ecological conditions that induce stress or erode social support alter cardiovascular activity in everyday contexts (James and Brown, 1997). Findings concerning RSA are consistent with other biomarkers in this regard. For example, stressful work conditions among adults are associated with elevated blood pressure, higher heart rate, and lower vagal tone, with crossover effects when assessed at home (Vrijikotter et al., 2000). Other contextual effects on cardiovascular and autonomic reactivity include attenuated responses when participants receive social support (Christenfeld and Gerin, 2000), and lower reactivity at home compared to laboratory conditions (Alkon et al., 2003). Acute psychologically stressful conditions are associated with parasympathetic withdrawal and consequently reduced RSA (Alkon et al., 2003; Doussard-Roosevelt et al., 2003; Porges et al., 1996). Yet, although vagal regulation plays a role in the capacity to adapt to social challenges, research regarding how social context influences vagal regulation largely has been limited to the immediate circumstances of measurement (Alkon et al., 2003).

**LINKING CULTURAL MODELS AND FAMILY STRUCTURE TO CHILD OUTCOMES**

One avenue of approach to the cultural patterning of cardiovascular activity is through the concept of a cultural model, a shared framework of beliefs in some specific domain that motivates behavior and contributes toward the appraisal of experience (D’Andrade and Strauss, 1986; Shore, 1996). For instance, adults whose lifestyles do not match a cultural ideal regarding what is needed to live well, or whose social support networks do not operate according to community ideals, display higher blood pressure across multiple cultural settings (Dressler et al., 1998, 2005). Such analyses provide less guidance on what to expect among young children, whose socialization into community ideals is incomplete. However, parents’ cultural models regarding childrearing and consequent care-giving practices should be important predictors of child outcomes.

Links between parents’ cultural beliefs and children’s biological outcomes are complicated by the dual paradox that cultural actors may not do what they say they do, and that culturally driven care-giving behaviors may have unintended consequences. Although peripheral to cardiovascular function, research regarding parent–infant bed-sharing and infant arousal illustrates this paradox. Many American parents fear that bedsharing will diminish infants’ capacity to self-regulate, whereas members of certain “counter-cultural” subgroups (e.g., social contract couples and commune residents) are more likely to believe that the practice will improve interpersonal expressiveness and reduce behavior problems (Okami et al., 2002). Neither is consistently true, but breastfeeding and co-sleeping together do protect against SIDS through improved nighttime arousal regulation (McKenna and McDade, 2005; Okami et al., 2002). Similarly, daily practices of parents likely influence parasympathetic arousal in early childhood, but not necessarily with parents’ intended effects.

Features of family structure such as parents’ marital status and maternal employment also are associated with children’s social adaptation and stress responses. These associations are mediated or moderated by other aspects of family ecology such as household economics, kin support, parenting styles, marital conflict, and maternal sensitivity (Belsky et al., 1991; Bronfenbrenner and Ceci, 1994; Flinn and England, 1995). The effect on child outcomes of parental “staffing” limitations presented by single parenthood or maternal employment depends in part on a household’s ability to compensate in culturally appropriate ways, such as by scheduling specific planned activities with the child, reducing housework or allocating it to weekends, relying on kin, or scheduling family time on the weekends (Bianchi et al., 2000; Coltrane and Adams, 2001; DeCaro and Worthman, 2007; Flinn and England, 1995; Yarrow et al., 1962; Zuzanek and Smale, 1992). Conversely, child outcomes linked to family or household functioning depend to some degree on family structure. In a recent study, youths in single parent households created by divorce were more vulnerable than dual-parent peers to the depressive effects of financial stress, but less vul-
nerable to family turmoil (Aseltine, 1996). Hence, potentially challenging features of family structure such as single parenthood, rather than simply being one among many forms of stress, often shape child outcomes primarily through interactions with the broader social and cultural ecology of the household.

THE PARADOX OF THE “SIMPLICITY/PROTECTION” MODEL HELD BY AMERICAN MIDDLE-CLASS PARENTS

The present analysis was part of a study on how American middle-class parents’ cultural beliefs regarding preschool children’s developmental needs shape child well-being. In the early stages of this study, we identified an apparent contradiction in parents’ attempts to protect their children from stress. DeCaro and Worthman (2007) identified a cultural model of simplicity/protection, positing that young children must be shielded from the adverse effects of hectic middle-class lifestyles. The simplicity/protection model was spontaneously invoked in open-ended interviews by 63% of the parents participating in this study, based on unprompted references to elements of the cultural model (intercoder reliability: κ = 0.84). This cultural model is linked to popular conceptions of stress from overscheduling (DeCaro and Worthman, 2007; Mahoney et al., 2006). Ethnographic interviews and diaries of daily activities showed that mothers were primarily responsible for keeping children’s weekday schedules within an implicit target zone of daily activity lower than their own, and that children should be protected from scheduling stress even at a personal cost to the parents (DeCaro and Worthman, 2007).

Yet for adults, busyness has become a marker of economic and social success (Roxburgh, 2002). Further, in tension with the model of simplicity/protection, mothers also claim that positive child development is fostered by active stimulation of children and enrichment of their experience (DeCaro and Worthman, 2007). The simplicity/protection model and middle-class valorization of busyness together encourage mothers to increase their own density of activity while buffering their children. If parents achieve their aims through such behaviors, we would expect less “overscheduled” and hence less stress-burdened children to show improved arousal regulation, including greater parasympathetic engagement at rest in a nonthreatening social context, regardless of maternal busyness.

Yet, parents’ minimization of the importance of their own well-being contrasts with an extensive literature showing that child outcomes are driven broadly by family functioning, not narrowly by direct child experience, and especially by maternal well-being. In US samples, maternal depression predicts children’s depression/anxiety, academic achievement, behavior problems and social competence (Goodman and Gotlib, 1999), and parent tension originating in marital conflict or at work readily spills over to create stress for children (Almeida et al., 1999). Parenting stress is associated with parent psychological symptoms and predicts the development of child behavior problems (Benzies et al., 2004; Reitman et al., 2002). Paternal involvement and frequent family dinners predict reduced behavior problems, substance use, school performance, depressive symptomatology, and suicide attempts (Amato, 1994; Eisenberg et al., 2004), whereas family aggression and conflict increase children’s mental and physical health risk (Repetti et al., 2002). By contrast, a recent review found scant evidence that heavy scheduling of children’s activities by itself poses any significant prospective health risk (Mahoney et al., 2006).

Hence, parents’ emphasis on buffering children from overscheduling while minimizing the importance of their own experience is inconsistent with the literature. If the arrangement of everyday life is an important marker of maternal and family functioning, then characteristics of the mother’s at least as much as the child’s schedule should moderate child arousal regulation. Moreover, as noted above, American mothers frequently treat their own busyness as a desirable indicator of successful middle-class parenting. Hence, in predicting the direction of the effect of maternal schedules on children’s adaptation, we question the assumption that “busyness” is experienced by parents or children as stressful (DeCaro et al., 2004). As alternative hypotheses, we propose that high functioning middle class mothers have busy schedules, and busy maternal schedules predict better child adaptation.

SCHOOL TRANSITION AS A NATURAL EXPERIMENT AND NORMATIVE CHALLENGE

In the present study, we set out first to confirm that parents were putting the cultural model of childhood “simplicity” into practice, by generating for their children relatively simplified daily routines observable in activity diaries. As noted above, we found ethnographic evidence in the affirmative, described in detail elsewhere (DeCaro and Worthman, 2007). Then, we used the school entry paradigm, borrowed from developmental psychology and social epidemiology (Ellis et al., 2005; Gunnar et al., 1997), as a natural experiment to evaluate whether these culturally driven practices were having their intended effects of reducing child stress and improving adaptation to ambient cultural demands.

Cardiovascular responses to psychosocial stress do not occur in a vacuum; they are part of the allostatic response following perceived threats to homeostasis or to social well-being. The best way to understand stress responsive systems often is to observe how they operate “in the wild,” during naturalistic social challenges (Adam et al., 2007; DeCaro and Worthman, 2008; Flinn and England, 1997; James and Brown, 1997; Pollard, 1997). School entry is a potentially stressful social challenge that US children normatively experience around ages 4–6. Although robust physiological arousal immediately following school entry is unproblematic and may even signal high functioning, high arousal beyond the first 2–3 weeks of the new school year is likely a marker for the psychological strain of poor social adaptation (Davis et al., 1999; Gunnar et al., 1997). Hence, measuring vagal regulation several months before and again several weeks after the transition into a new school year can help evaluate individual differences in how US children adjust to a sustained social challenge.

We measured everyday scheduling practices prior to the transition from Pre-K into kindergarten or its equivalent, followed by RSA after school entry, during a nonthreatening social engagement task that standardizes the immediate context of measurement but is not itself predicted to generate high arousal. To the extent that scheduling characteristics (such as maternal or child busyness) improve socio-emotional regulation and diminish the impact of
Contrary to the cultural model of simplicity/protection, we expect that maternal factors will be key determinants of child parasympathetic activity. However, consistent with the cultural model of simplicity/protection, mothers able to do so should maximize the busyness of their own schedule. Hence, we hypothesized as follows:

Hypothesis 1. Maternal busyness in year 1 will predict child RSA in year 2.

Hypothesis 2. Maternal busyness will be associated with high maternal and family functioning, judged through maternal mood, parenting stress, and family dinner frequency.

Hypothesis 3. Maternal mood, parenting stress, and family dinner frequency also will predict RSA in year 2, and mediate any association between maternal busyness and RSA.

Finally, we anticipate that these associations may be subject to interactions involving family structure, because marital and employment status affect the parental “staffing” that can be brought to bear in support of a logistically complex household schedule. Nevertheless, we hypothesized generally similar effects, because high functioning mothers in this cultural context should work to maximize their activity levels regardless of marital and employment status.

METHODS
Participants

Thirty-eight families in metropolitan Atlanta, Georgia, US were recruited through letters sent home at area preschools, and 32 (84%) completed both years of data collection. However, two additional families are omitted from this analysis: one due to asthma treatments that may interfere with accurate analysis of heart rate variability (Anthracopoulos et al., 2005), and one where the child was home schooled and did not experience a school transition. Of the 30 remaining families, 22 (73%) were headed by married heterosexual couples and 8 (27%) by a single mother. In both years among married families, 12 of 22 (54.5%) mothers were in school or employed for pay at least 20 h per week, and therefore are defined for the purposes of this study as “employed,” as were all fathers. In year 1 all single mothers were employed/in school, whereas six of eight (75%) were employed/in school in year 2.

All children attended Pre-K programs (regular Pre-K or Montessori) in the first year, and kindergarden or Primary Montessori classrooms in year 2. Median child age in year 1 was 60.1 months, range 53.7–67.3, and in year 2, Mdn = 67.2 months, range 61.6–73.2. Twenty-three of 30 mothers (76.7%) and 18 of 22 fathers (81.8%) had a four-year college degree or higher. Median household income was $69,000, range $17,184–$175,000. Parents identified 22 children as non-Hispanic White (73.3%), 6 as African American (20%), 1 as Hispanic (3.3%), and 1 as other (3.3%). The children were 16 (53%) females and 14 (47%) males.

This study has been reviewed and approved by the Institutional Review Boards of Emory University and the University of Alabama. Informed consent was obtained from all parents, and assent from all child participants.

General procedure

Each family was visited in the home four times across 9 or 10 days in the focal child’s Pre-K school year. During an initial 2-h visit, interviewers trained participants on study procedures and collected demographic data including household income, child birthdate, maternal education, and employment status. Then, interviewers visited three times to retrieve detailed self-collected daily schedule data for quantification of maternal and child busyness, and family dinner frequency as a marker of family functioning. At each visit, ethnographic interviews with parents were conducted that formed the basis for describing cultural models of parenting as described at the beginning of this article (DeCaro and Worthman, 2007). To provide a baseline of physiological data prior to the school transition, at the final visit children were continuously monitored using a ECG100C electrocardiogram (EKG) amplifier connected to an MP150 digitizer/acquisition unit and UIM100C universal interface module from Biopac Systems (Goleta, CA). During this monitoring, they interacted in a nonthreatening context with two puppets, according to the protocols of the Berkeley Puppet Interview (BPI) (Measelle et al., 1998). At this final visit, mothers completed a depression inventory [the Mood and Feelings Questionnaire (MFQ)] (Angold and Costello, 1987) and a parenting stress inventory [the Parenting Stress Index, Short Form (PSI/SF)] (Abidin, 1995) for additional data on maternal and family functioning.

Each family was visited a second time between 3 and 11 weeks following the start of the new school year (M = 51 days, range = 22–83 days). Daily schedule data were again collected, but are not used in this analysis. The EKG monitoring protocol was repeated in the same manner as in year 1 at the final visit of a four-visit sequence.

Daily activity

The daily life architecture (DLA) approach for collecting continuous daily activity data is described elsewhere (DeCaro and Worthman, 2007). Briefly, following one hour of training on day 1, both parents (if two were present) recorded 7 days of data on their activities for every 15-min increment across 24 h, through thrice-daily recall. Parents jointly completed records for the focal child, reconstructing schedules based on the reports of other caretakers when the child was with neither parent. Interviewers re-visited families on one each of days 2–4, 4–6, and 9–11, and reviewed each 15-min increment with participants for completeness and consistency (e.g., father–mother–child schedule agreement). DLA is a structured recall method: participants categorized each 15-min increment according to a limited range of pre-determined choices, by selecting icons representing specific activities (see Table 1), settings (home/work/out), companions (mother, father, spouse, siblings, other family, friends, peers, strangers) and moods using PROUST software on a Palm Pilot hand computer (DeCaro and Worthman, 2007). The task accommodated multiple overlapping activities. Activity data from a total of 480 fifteen-minute blocks per participant contribute toward the calculation of DLA-based measures, representing a complete 24 h, 5-day
TABLE 1. Categories of activities recorded in daily schedule diaries

<table>
<thead>
<tr>
<th>Icon name</th>
<th>Brief summary</th>
</tr>
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<tbody>
<tr>
<td>Solo: family</td>
<td>Solo leisure time, not work related</td>
</tr>
<tr>
<td>Social: peers</td>
<td>Social time with family members</td>
</tr>
<tr>
<td>Social: formal</td>
<td>Social time with non-family members</td>
</tr>
<tr>
<td>Work: paid or school</td>
<td>Paid work, whether working inside or outside the home, or school work</td>
</tr>
<tr>
<td>Work: domestic</td>
<td>Unpaid work performed for family, including child care activities</td>
</tr>
<tr>
<td>Work: volunteer</td>
<td>Unpaid work performed for those who are not family</td>
</tr>
<tr>
<td>Transit</td>
<td>Any form of transit, including walking</td>
</tr>
<tr>
<td>Sleep</td>
<td>Any sleep periods, including naps</td>
</tr>
<tr>
<td>Food</td>
<td>Ingestion of anything other than water</td>
</tr>
<tr>
<td>Spiritual</td>
<td>Self-defined spiritual or religious activity, alone or with others</td>
</tr>
<tr>
<td>Telecom</td>
<td>Telephone, e-mail, letter writing, and other “distance communication”</td>
</tr>
<tr>
<td>TV</td>
<td>Television watching</td>
</tr>
<tr>
<td>Personal</td>
<td>Maintenance of personal well-being; grooming, doctor visit, etc.</td>
</tr>
</tbody>
</table>

Although all these activities were recorded by participants in their diaries, only three are used in the present analysis: transit to identify transitions between physical settings, sleep to identify waking hours, and food to identify family dinners (together with separate diary records regarding companions).

weekday schedule and enhancing these measures’ validity. Data entry took 30–45 min per participant, per day.

Schedule density. The frequency of transitions between different physical settings was chosen as the index of “busyness” for this analysis because transitions could reliably be quantified using DLA data, and because of ethnographic evidence that parents considered such transitions a major logistical hurdle and potential family stressor (DeCaro and Worthman, 2007). Child waking schedule density is the weekday hourly frequency of transitions between all physical settings while awake (e.g., school to home; grocery store to mall). Maternal discretionary transitions (hereafter MDTs or maternal busyness) are the mean number of transitions per weekday between physical settings, eliminating those obligatory transitions related to transport to or from work or mother’s/child’s school (DeCaro and Worthman, 2007). Hence, the transition by mother and child from home to the child’s school is included in the calculation of the child’s waking density, but is not considered an MDT.

These two different approaches to calculating child and maternal busyness are necessitated by the unique role maternal busyness plays in the present analysis. MDTs reflect the mother’s greater capacity to schedule elective activities that serve personal goals or goals for child developmental needs, and/or allow her to conduct the logistical work of running a household (e.g., including grocery shopping and other activities that are non-optional but discretionary in their timing and organization; DeCaro and Worthman, 2007). MDTs as a measure of the mother’s capacity to schedule elective activities help disentangle what actually promotes positive family function from the complex cultural rhetoric of busyness and stress.

Because a transition may occur between two locations defined as “out” (that is, not home or work), the “transit” activity is used to identify transitions between physical settings in general, whereas the “home/work/out” settings are used to exclude work or school-related transitions from the MDT measure. Missing data were imputed from the average number of transitions per 15-min block within the same 3-hr time band across all other weekdays. Only 2.7% of 15-min blocks were missing across the total pool of participants who completed DLA data collection in year 1 (mothers, fathers, and children).

Evening meals. The frequency of child weekday evening meals eaten together with the mother and/or the father was also determined from DLA data. Evening meals, instances of the “food” icon after 4 pm, were identified as “with father” or “with mother” when that parent was eating at the same time as the child, the parent and child were in the same physical setting (home/work/out), and the parent reported the child as physically present. The proportion of dinners eaten together is scaled from 0 to 1.

Mother variables

Maternal mood. Maternal mood was assessed using the adult self-report form of the Short Mood and Feelings Questionnaire (SMFQ). Chosen for its brevity, the SMFQ is a 13-item, unidimensional instrument for rapid evaluation of core depressive symptomatology in epidemiological studies that correlates well with the Beck Depression Inventory (Angold and Costello, 1987; Angold et al., 1995). Items comprise descriptions of how the respondent has been feeling or acting “recently” (e.g., “I felt miserable or unhappy,” “I felt lonely”), rated as 0 (not true), 1 (sometimes true), or 2 (true). Item scores are added to generate an aggregate score; hence, higher scores indicate more severe depressive symptomatology. No threshold value was used in this analysis, because the continuous range of severity in depressive symptomatology was of interest rather than screening for clinical depression. Raw scores are used.

Parenting stress. Maternal parenting stress was assessed using the PSI/SF. The PSI/SF gauges the level of parental distress related to the experience of parenting, and is a 36-item subset of the full parenting stress index generated through exploratory factor analysis and separately validated in diverse samples (Abidin, 1995; Reitman et al., 2002; Whiteside-Mansell et al., 2007). Items are rated on a 5-point scale, either 1 (strongly disagree) through 5 (strongly agree), or item specific. The PSI/SF comprises three 12-item scales concerning child difficulty, parent distress, and dysfunctional interactions between parents and children. Total stress and parent–child dysfunctional interaction scores, converted to percentiles using published norms (Abidin, 1995), are used in this analysis. The Parent–Child Dysfunctional Interaction scale, used separately in this analysis because it most closely reflects relationship functioning within the family, concerns the parent’s perceptions of non-reinforcing interactions and unmet expectations (e.g., “My child smiles at me much less than I expected”).

Psychophysiology

EKG measurement. EKG data were collected during the first five continuous minutes of the BPI, comprising the introductory material and questions about school or preschool (Measelle et al., 1998). The BPI is a semistructured psychobehavioral interview, designed to assess 4 1/2- to 7 1/2-year-old children's self-perceptions through an

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exchange with two identical dog puppets selected to appear friendly and nonthreatening. Children respond to puppets’ queries in whatever verbal or nonverbal manner they prefer, and were familiar with the interviewer. Children were seated in a comfortable location in the home with parents not visible in an adjacent room, except for two cases in year 1 (none in year 2) where a parent was invited into the room to calm an anxious child. Before spot electrodes were affixed, the interviewer demonstrated the EKG monitoring equipment for the child. In the present analysis, BPI responses are not considered: the BPI is used only to standardize the immediate social context for RSA measurement. The interview is minimally challenging, and designed as peer-like social interaction (Measelle et al., 1998). Therefore, it is treated in this study as a test of the child’s physiological response to nonthreatening social engagement, of the type that should yield parasympathetic engagement (low arousal/high RSA) (Porges, 2007).

EKG data reduction. EKG data, digitized at 1,000 Hz, were recorded and analyzed using Biopac AcqKnowledge v3.7.3. An interbeat interval (IBI) time series was generated automatically using offline R-wave peak detection in AcqKnowledge, with all peaks manually checked and artifacts removed. The IBI time series was subjected to spectral analysis, transformed with a Hamming window and detrended (Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology, 1996). High frequency heart period variation (HF-HPV) in milliseconds squared was estimated as the power from 0.24 to 1.04 Hz, the frequency range of spontaneous respiration commonly accepted for determination of parasympathetic activity in young children (Alkon et al., 2003). The natural logarithm of HF-HPV is utilized as an index of RSA (Alkon et al., 2003).

Analytic strategy and statistical procedures

Hypothesis 1. Family schedules and vagal regulation. To test whether maternal or child busyness was associated with improved vagal regulation following the transition into a new school year, each was first evaluated using a zero-order Pearson correlation with year 2 RSA in all families, and separately in married families only. Significant bivariate predictors identified in either subsample were tested for interactions with maternal employment or single parent status using multiple linear regression. Hierarchical multiple regression was then completed using all significant predictors of year 2 RSA. Year 1 RSA and year 2 age in months were entered in the first step, and all significant bivariate predictors and interactions in the second step. In regression models, busyness was centered and categorical variables contrast coded to minimize collinearity problems when testing interactions (Aiken and West, 1991). Marital status was coded as −1 = “married,” 1 = “single,” and maternal employment as −1 = “not employed,” 1 = “employed.”

Each step 2 model was tested for confounding by year 1 maternal employment and single parent status (if not already included), maternal education, household income, and time lapsed from the first day of school to the date of measurement. However, these variables were included in a third regression step (and therefore incorporated into the final model) only if they eliminated or substantially modified some other effect, or had an independent, significant bivariate association with year 2 RSA. In this regard, the modeling strategy is conservative, recognizing the risk for small samples of generating statistical artifacts through the inclusion of too many covariates and thereby overfitting multivariate models.

Child age was included in the first regression step, even if not significant, because of the normative increase of RSA with age (Bar-Haim et al., 2000) and the nearly 12-month range of child ages represented in year 2 data. Year 1 RSA was entered in the first step in recognition of RSA’s stable trait-like properties (Doussard-Roosevelt et al., 2003), to control for stable associations between family ecology and child physiology, and to permit a determination of how much additional variance in year 2 RSA could be explained by the scheduling variables alone. However, to increase confidence that any significant associations were not artifacts from overfitting, a multiple linear regression model was also constructed outside of the hierarchical regression that did not include year 1 RSA and child age as controls, confirming that the other independent variables retained their significant association with year 2 RSA.

Hypothesis 2. Maternal busyness and family function. To test whether maternal busyness was associated with improved maternal and family function, zero-order Pearson correlations and first-order partial Pearson correlations controlling for maternal employment were calculated for year 1 MDTs and each of the following year 1 variables: mother’s total parenting stress, stress from dysfunctional parent–child interactions, maternal mood, frequency of dinners with mother, and frequency of dinners with father (in married families only). The decision to control for maternal employment was based on the expectation that eliminating work- and school-related transitions from the measure of busyness would have a larger effect for employed mothers than for homemakers. All variables that had significant zero- or first-order correlations with MDTs were entered in a single step into a multiple linear regression model to evaluate whether their effects were independent. These analyses were performed once for all families, and again separately for married families only.

Hypothesis 3. Family function and vagal regulation. To test whether maternal or family function predicted year 2 RSA, and hence could mediate any associations between RSA and maternal or child busyness, the same analytic strategy was performed as for hypothesis 1. Maternal mood, total and dysfunction-related parenting stress, and frequency of dinners with mother or father were substituted for maternal busyness and child schedule density.

All analyses were completed using Intercooled Stata 9.2. For all models, scatterplots of residuals and normal probability plots confirmed linearity, normality, the lack of influential outliers, and homoscedasticity, following methods described in Cohen and Cohen (1983).

RESULTS

Descriptive statistics and intercorrelations

Descriptive statistics for RSA and each of the ecological variables are shown in Table 2. Raw values for high frequency power were predictably right skewed, justifying normalization by log transformation to produce RSA (Alkon et al., 2003). Although RSA during the BPI
increased on average from year 1 to year 2, it expectably manifested trait-like properties, with moderate reliability (r = 0.72, P < 0.001). The mean child waking schedule density of 0.40 equates to a transition between physical settings every 2.5 h on average. The mean maternal busyness is 3.23 maternal discretionary transitions per day. The mean scores for SMFQ, PSI/SF total stress, and PSI/SF dysfunctional interactions are each at or below averages typically seen in nonclinical populations (Abidin, 1995; Angold et al., 1995; Reitman et al., 2002). In the full sample Cronbach’s α = 0.74 for the SMFQ. For PSI/SF total stress α = 0.83, and for PSI/SF dysfunctional interactions α = 0.93. This suggests adequate internal consistency for all scales. A correlation matrix incorporating all ecological variables is displayed in Table 3.

In the full sample, no difference in maternal discretionary transitions was found by single parent status, but employed mothers (single or married) had 1/3 fewer MDTs (M = 2.77, SD = 1.29) than nonemployed mothers (M = 4.17, SD = 1.89, t = 2.40, P < 0.05). The same pattern held for employed married parents, who reported fewer MDTs (employed: M = 2.58, SD = 1.30; nonemployed: M = 4.17, SD = 1.89, t = 2.33, P < 0.05).

**Daily schedules and vagal regulation**

First, we tested the hypothesis that maternal busyness would predict child parasympathetic activity at the start of the new school year, set against the parents’ cultural expectations that child schedules would predict child adaptation.

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Daily activity variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child waking schedule density</td>
<td>0.40</td>
<td>0.06</td>
<td>0.23–0.52</td>
</tr>
<tr>
<td>Maternal busyness (MDTs)</td>
<td>3.23</td>
<td>1.63</td>
<td>0.45–6.6</td>
</tr>
<tr>
<td>Mother–child dinner frequency</td>
<td>0.64</td>
<td>0.33</td>
<td>0–1</td>
</tr>
<tr>
<td>Father–child dinner frequency (married parents only)</td>
<td>0.61</td>
<td>0.29</td>
<td>0–1</td>
</tr>
<tr>
<td><strong>Mother variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SMFQ</td>
<td>3.22</td>
<td>2.98</td>
<td>0–12</td>
</tr>
<tr>
<td>PSI/SF total stressb</td>
<td>66.56</td>
<td>18.36</td>
<td>38–108</td>
</tr>
<tr>
<td>PSI/SF dysfunctional interactionsb</td>
<td>16.57</td>
<td>4.47</td>
<td>12–31</td>
</tr>
<tr>
<td><strong>Child psychophysiology variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 1 RSA</td>
<td>4.75</td>
<td>1.49</td>
<td>1.53–7.85</td>
</tr>
<tr>
<td>Year 2 RSA</td>
<td>5.20</td>
<td>1.24</td>
<td>3.19–8.12</td>
</tr>
</tbody>
</table>

*N = 30, except father–child dinner frequency (N = 22) and SMFQ (N = 29). Measures were taken in year 1 unless noted.

Hierarchical regression: married families. In married families, hierarchical regression confirmed a positive association between maternal busyness and year 2 RSA (see Table 4). In this subsample, in the first step, year 1 RSA explained 69% of the variance in year 2 RSA (F = 21.57, P < 0.001). After including maternal busyness, the model accounted for 81% of the variance, a significant 11% increase (F = 10.32, P < 0.01). As before, post hoc analyses removing year 1 RSA and year 2 child age demonstrates that this was not an artifact due including those

**TABLE 2. Descriptive statistics for psychophysiology and ecological variables**

**TABLE 3. Zero-order correlations among family variables**

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Child waking schedule density</td>
<td>–</td>
<td>0.29</td>
<td>–0.02</td>
<td>–0.14</td>
<td>–0.24</td>
<td>–0.28</td>
<td>–0.47***</td>
</tr>
<tr>
<td>2. Maternal busyness (MDTs)</td>
<td>–</td>
<td>0.11</td>
<td>0.43*</td>
<td>–0.48**</td>
<td>–0.35</td>
<td>–0.37*</td>
<td></td>
</tr>
<tr>
<td>3. Mother–child dinner frequency</td>
<td>–</td>
<td>–</td>
<td>0.29</td>
<td>0.05</td>
<td>0.26</td>
<td>0.24</td>
<td></td>
</tr>
<tr>
<td>4. Father–child dinner frequency (married parents only)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–3.2</td>
<td>0.09</td>
<td>0.17</td>
<td></td>
</tr>
<tr>
<td>5. SMFQb</td>
<td>–</td>
<td>0.66***</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>6. PSI/SF total stressb</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>7. PSI/SF dysfunctional interactionsb</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

*P < 0.05, **P < 0.01, ***P < 0.001.

*30, except correlations involving father–child dinner frequency (N = 22) and SMFQ (N = 29).

**Correlations are with raw scores.**
variables as controls ($B = 0.44$, SE $B = 0.13$, $R^2 = 0.38$, $F = 12.24, P < 0.01$).

There were no significant interactions. Maternal education and year 2 days since the start of school were neither significant nor confounders. Household income was not a confounder, and again had an independent association with lower year 2 RSA in the model also including maternal busyness, but with no zero-order correlation ($r = -0.38$, ns), nor a first-order partial correlation controlling for year 2 RSA (partial $r = -0.27$, ns).

Maternal employment was not a confounder but did independently predict lower year 2 RSA when added to the model in a third step, explaining an additional significant 6% of the variance ($F = 8.08, P < 0.05$). Regression diagnostics were satisfactory. The effect of maternal employment disappeared if year 1 RSA was removed as a covariate. However, in families with married parents, children whose mothers were employed did have lower RSA ($M = 4.61, SD = 0.79$) than children whose mothers were not employed ($M = 5.70, SD = 1.50, t = 2.19, P < 0.05$). Thus, while this finding is less robust than the association between maternal busyness and year 2 child RSA, it appears unlikely to be simply an artifact, and is retained in the final model.

Maternal busyness and functioning

Next we tested the hypothesis that maternal discretionary transitions are a marker of high functioning. Because the considerable and expectable effect of employment status on maternal busyness makes confounding a concern, the following zero-order Pearson correlations ($r$) are each reported together with a first-order partial Pearson correlation coefficient (partial $r$) that controls for maternal employment.

In the full sample, maternal busyness was not correlated with dinners with mother, but was correlated with lower maternal depression scores ($r = -0.48, P < 0.01$; partial $r = -0.51, P < 0.01$), and lower parent–child dysfunctional interactions ($r = -0.37, P < 0.05$; partial $r = -0.46, P < 0.05$). There was also a correlation with lower total parenting stress, but only when controlling for maternal employment ($r = -0.35, ns$; partial $r = -0.38, P < 0.05$).

In the subsample of children with married parents only, maternal busyness was correlated with more frequent child–father dinners ($r = 0.43, P < 0.05$; partial $r = 0.50, P < 0.05$). The correlation with lower maternal depression was replicated in this subsample ($r = -0.47, P < 0.05$; partial $r = -0.63, P < 0.01$), but there were no correlations with maternal total parenting stress or mother–child dysfunctional interactions.

Multivariate linear modeling was attempted using all proposed markers of maternal or family function that had significant associations with maternal busyness. In the full sample, maternal employment ($B = -0.68, P < 0.05$) and maternal depression ($B = -0.26, P < 0.01$) remained significant predictors in the final model ($R^2 = 0.38, F = 8.09, P < 0.01$). In married families, maternal employment ($B = -0.94, P < 0.01$), maternal depression ($B = -0.37, P < 0.05$), and dinner frequency with fathers ($B = 1.83, P < 0.10$) remained significant or marginally significant in the final model ($R^2 = 0.61, F = 8.68, P < 0.01$). There were no significant interactions, and regression diagnostics were satisfactory.

Maternal or family function and child autonomic regulation

Finally, we tested the hypothesis that mother or family dinner variables mediate relations between daily schedules and year 2 RSA. In the full sample or married families only, there was no association between year 2 RSA

\[ \text{Maternal busyness and functioning} \]

<table>
<thead>
<tr>
<th>Step</th>
<th>Variable</th>
<th>Full sample ($N = 30$)</th>
<th>Married mothers only ($N = 22$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Y1 RSA</td>
<td>$0.58 \pm 0.12$</td>
<td>$0.67 \pm 0.10$</td>
</tr>
<tr>
<td></td>
<td>Child age</td>
<td>$-0.02 \pm 0.05$</td>
<td>$-0.04 \pm 0.05$</td>
</tr>
<tr>
<td>2</td>
<td>Y1 RSA</td>
<td>$0.49 \pm 0.09$</td>
<td>$0.56 \pm 0.09$</td>
</tr>
<tr>
<td></td>
<td>Child age</td>
<td>$-0.02 \pm 0.05$</td>
<td>$-0.04 \pm 0.05$</td>
</tr>
<tr>
<td></td>
<td>Busyness centered</td>
<td>$0.05 \pm 0.04$</td>
<td>$0.09 \pm 0.04$</td>
</tr>
<tr>
<td></td>
<td>Single parent</td>
<td>$-0.31 \pm 0.10$</td>
<td>$-0.29 \pm 0.09$</td>
</tr>
<tr>
<td></td>
<td>Employment</td>
<td>$0.07 \pm 0.13$</td>
<td>$0.29 \pm 0.09$</td>
</tr>
<tr>
<td>3</td>
<td>Y1 RSA</td>
<td>$-0.59 \pm 0.10$</td>
<td>$-0.58 \pm 0.08$</td>
</tr>
<tr>
<td></td>
<td>Child age</td>
<td>$-0.31 \pm 0.10$</td>
<td>$-0.40**$</td>
</tr>
<tr>
<td></td>
<td>Busyness centered</td>
<td>$0.07 \pm 0.13$</td>
<td>$0.05$</td>
</tr>
<tr>
<td></td>
<td>Employment</td>
<td>$-0.29 \pm 0.10$</td>
<td>$-0.28$</td>
</tr>
</tbody>
</table>

\[ ^a P < 0.05, ^{**} P < 0.01, ^{***} P < 0.001. \]
and year 1 maternal depression, parenting stress (total or parent–child dysfunctional interactions), or dinners with mother or father. Because this excludes these ecological variables as mediators, we performed no further tests.

**DISCUSSION**

This study explores connections between American middle class cultural models regarding the arrangement of everyday family life, parents’ and children’s actual daily practices, and children’s subsequent vagal regulation during a nonthreatening social engagement task shortly after the start of a new school year. The object is to identify proximal family dynamics through which culture influences the socialization of cardiovascular functioning. Our mixed methods approach, incorporating ethnographic, activity diary, and physiological data, allows us to distinguish cultural intentions from outcomes and delineate relations between them. Cultural beliefs regarding what behaviors or activities are protective for children are not always reliable (e.g., McKenna and McDade, 2005; Okami et al., 2002). Our central finding is a systematic disconnect between expectations based on parents’ cultural beliefs and the actual predictors of child parasympathetic regulation, wherein maternal rather than child daily schedules predict child adaptation. Moreover, our findings suggest that structural and cultural-cognitive factors interact in socializing the child’s parasympathetic response: maternal schedules predict child outcomes differently depending on marital status.

Consistent with our first hypothesis, maternal busyness, but not child schedules, predicted children’s parasympathetic regulation several months later during the start of a new school year. Consistent with our second hypothesis, more frequent maternal discretionary transi- tions, a measure of the busyness of the mother’s schedule that focuses on activities other than the inflexible demands of commuting, was associated with more positive maternal mood and less parenting stress. Further, in married families, greater maternal busyness also was associated with more frequent child–father dinners. However, contrary to our third hypothesis, the association between maternal busyness and child RSA was not mediated by measured components of maternal and family function, because maternal mood, parenting stress, and family dinners were unrelated to children’s vagal regulation.

**Contrary to the cultural model, maternal factors predict child vagal regulation**

Other researchers have reported that the capacity to put cultural models into practice is associated with adults’ well being. For example, independent of other risk factors, lower arterial blood pressure is associated with the ability to draw social support from parents, friends, and others in a culturally appropriate manner, and with consumer lifestyles that match a cultural model of good living (Dressler et al., 2005). High functioning caregivers effectively enact cultural ideals of family life and parenthood. Hence, it is not surprising that mothers who exemplify the middle class culture of busyness in the present study are least depressed, least stressed, and have involved husbands. Yet, the relations among family scheduling and child vagal regulation in the new school year contrast with parents’ cultural models regarding child well-being. As measured through children’s parasympathetic arousal, parents do not protect their children from stress by reducing the complexity of child schedules and absorbing burdens themselves, with their own schedules and daily experience being irrelevant.

Whether married or single, we find that mothers’ own daily experience matters for children’s adaptation to a normative stressor. These findings confirm the central hypotheses of the study. They also are consistent with a broader literature in human development, behavioral ecology, and epidemiology highlighting the importance of maternal psychosocial factors to young children’s arousal regulation and well being (Almeida et al., 1999; Benzies et al., 2004; Chisholm, 1996; Goodman and Gotlib, 1999; Repetti et al., 2002).

Although that is broadly consistent with our expectations, we had not predicted that the direction of the effect would differ depending upon family structure: busier married mothers, but less busy single mothers, have children with higher RSA. Nevertheless, the literature does provide precedent for structure/function interactions that predict child stress responses and social adaptation better than either factor alone (Aseltine, 1996; Bronfenbrenner and Ceci, 1994). Hence, logistical burden may be a useful gloss for the characteristic of family function underlying the interaction identified in this study. Attempting to enact middle class models of maternal busyness likely carries a cost in families without adequate support systems to maintain a logistically complex schedule.

For parents in this same sample, based on daily activity records we have previously reported that juggling activities and logistical responsibilities among parents is a key mechanism facilitating complex daily schedules (DeCaro and Worthman, 2007); similar findings have been reported elsewhere (e.g., Coltrane and Adams, 2001). In dual parent families, more frequent maternal discretionary transitions directly reflect the contributions of a spouse and consequent reduction in the burden on the mother, with higher MDTs obtaining when a husband participates in the dinnertime routine and the mother is not employed outside the home. By contrast, for single mothers where a spouse is not available for load sharing, the logistical burden involved in achieving the same level of discretionary busyness would be higher. Even discretionary activities may be challenging when total parent staffing is reduced, and maternal activity carries greater costs in terms of the daily hassles that are created.

Nonetheless, given the small sample size and novelty of the maternal busyness measure, caution is required when interpreting the interaction with family structure. Our specific proposals regarding logistical burden are provisional, and require replication in a larger study.

**Child RSA is socially regulated but mediators are unclear**

The mediators of the relationship between maternal scheduling factors and child outcomes nevertheless remain unclear. Because we found no relationship between child RSA in year 2 and maternal mood, parenting stress, or family dinners, alternative possible mediators include differences in parenting styles, marital relations, and/or quality of care. In contrast to adrenocortical regulation (Adam et al., 2007; Flinn and England, 1995, 1997; Pendry and Adam, 2007), there are few published studies regarding the role of the family environment in...
the socialization of vagal regulation, and those that exist are ambiguous. Marital discord has been linked to lower vagal tone in infants (Porter et al., 2003) but higher vagal tone in preschoolers (Gottman and Katz, 1989). Burgess et al. (2003) reported that avoidant attachment in infancy predicted high vagal tone for 4-year-old children, whereas Kennedy et al. (2004) reported that child vagal tone at age 2 predicted more restrictive and less supportive parenting at age four. In the hypothalamic-pituitary-adrenal axis, quality of care is a moderator of physiological activity during a challenge (Adam et al., 2007). Variance in quality of care may similarly explain our findings, but confirmation will have to await further investigation.

Challenges and benefits of distinguishing cultural intentions from outcomes

Cultural models have concrete presence in daily life, can be operationalized, are enacted in caregiver behavior, and shape child development (LeVine et al., 1994; Super and Harkness, 1986; Weisner, 2002). Testing how cultural models are enacted by caregivers requires detailed knowledge of both cultural beliefs and actual daily experience. Although we used a diary approach, daily experience could also be tracked using experience sampling (Csikszentmihalyi and Larson, 1987). Testing whether child outcomes, including cardiovascular functioning, are consistent with cultural expectations requires longitudinal quantitative assessments at the level of the individual child. The empirical paradigm we have described, while complex, is doable and fruitful.

The importance of understanding discords among caregiver beliefs, family practices, and cardiovascular functioning is evident when considering the sources of differential outcomes as well as in the design of interventions. Sustainable behavioral interventions need to be compatible with cultural goals and expectations (Weisner, 2002), because parents’ cultural models motivate and direct their behavior (D’Andrade and Straus, 1986). Our findings suggest that a heightened capacity to enact a cultural ideal of busy middle-class motherhood is protective for children, at least in some family settings. Yet within the range of normal family functioning elevated parental burden may yield adverse consequences for child adaptation in the face of a normative challenge, reflected in cardiovascular functioning. Because this is contrary to cultural models that emphasize parental self-sacrifice and place overriding emphasis on the arrangement of the child’s daily life, educating parents about the salutary effects of improved parent well-being for children’s responses to normative stressors may be a particularly effective way to benefit parents and children, both.

Limitations

Mixed method approaches detailing relations among culture, practices, and outcomes frequently are only possible with small samples incorporating ethnography (Weisner, 2002). Yet this research was limited by its small and self-selected sample, which reduces statistical power and representativeness and increases the likelihood of bias. Also unclear is whether associations between schedule characteristics and child outcomes are fleeting, or if consistencies in such features of family life have a canalizing influence on psychobiological regulation. The naturalistic, ecological mode of research makes it impossible to establish causality. Yet in the present study, maternal schedules predict the component of the variance in RSA that is not stable across several months. Such a pattern of association is expectable if family settings shape subsequent psychobiological responses, as the theory driving this research suggests.

The technical difficulty of reliably measuring ambulatory EKG in 4–6-year-old children necessitated a research design relying on two RSA measurements, one each before and after school entry, rather than ambulatory monitoring as is the gold standard in blood pressure research (James and Brown, 1997). Nevertheless, with appropriate standardization of the context of measurement, this design also carries advantages. RSA is an element of the cardiovascular response highly attuned to individual differences in adaptation to social engagement. Measurement during a nonthreatening social engagement task, yet within a naturalistic context (at home) and surrounding a naturalistic challenge (school entry), is intermediate between experimental and ambulatory monitoring approaches and serves here to illuminate a short-term developmental trend in children’s adaptive capacities.

Finally, conclusions drawn from these largely affluent, well-educated mothers and their children should not lightly be extended to families of substantially different social and material backgrounds. The present study identified differences in the pattern of association between maternal behavior and child physiology depending on marital status. Similarly, different factors are likely to drive the organization of everyday life and predict parent and child well-being within low income families and in different cultural contexts (Flinn and England, 1997; Tubbs et al., 2005; Worthman and Panter Brick, 2008). These findings point to the need for similar mixed methods research in multiple cultural and socioeconomic contexts, and provides a model to suggest for how such research may be designed.

CONCLUSIONS

The present study illustrates how culturally driven parenting practices may influence children’s cardiovascular functioning in ways that are not consistent with the cultural models parents carry. Our analysis revolves around a cultural model concerning a single aspect of experience—family busyness—and its enactment in parents’ and children’s daily schedules. However, daily life is pieced together by parents and children in the service of numerous, sometimes competing goals such as maximizing parents’ income or social status, promoting children’s future academic, economic, and social prospects, and maintaining both parents’ and children’s physical and psychological well being. Understanding cultural influences in the social development of cardiovascular regulation will require a new generation of research regarding the proxemics of culture, including under what circumstances cultural intentions and outcomes become discordant.

In contrast to fetal programming models (Adair et al., 2001; Kuzawa, 2005; Worthman and Kuzawa, 2005), our findings do not concern the identification of lasting physiologically mediated developmental effects. Rather, any persistent changes in cardiovascular autonomic regulation via socialization processes of the type we describe likely are cognitively mediated. That is, culture has ongoing influence on daily settings and how they are subjectively
appraised, with the potential for persistent effects on how individuals biologically respond to psychosocial stress. To identify medium- to long-term developmental trends, such findings must be extended through a longer longitudinal window. Yet given the importance to adult health of cardiovascular functioning, including parasympathetic regulation, research in this area has the potential to bear important fruit. Adding an enhanced developmental dimension to existing cognitive-cultural understandings of allostatic load in children and adults can help illuminate how acute adaptive physiological responses to daily psychosocial challenges contribute to health differences (Bindon, 2007; Dressler et al., 2005; McDade et al., 2000).

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