Effects of Socioeconomic Status on Maternal and Child Positive Behaviors in Daily Life Among Youth With Asthma

Ledina Imami,[1] BA, Erin T. Tobin,[1] MA, Heidi S. Kane,[2] PhD, Daniel J. Saleh,[1] BA, Toni H. Lupro,[1] BA, and Richard B. Slatcher,[1] PhD

[1]*Department of Psychology, Wayne State University and* [2]*School of Behavioral and Brain Sciences, The University of Texas at Dallas*

All correspondence concerning this article should be addressed to Ledina Imami, BA, Department of Psychology, Wayne State University, 5057 Woodward Avenue, Detroit, MI 48202, USA. E-mail: ledina.imami@wayne.edu

Received January 28, 2014; revisions received July 26, 2014; accepted July 28, 2014

Objective Socioeconomic disadvantage is associated with poorer behavioral and emotional outcomes in children with asthma. This study investigated the associations between maternal income and education and naturalistically observed behaviors and affect during everyday parent–child interactions. **Methods** 53 predominantly low-income youth with asthma, aged 10–17 years, wore a naturalistic event-sampling device, the Electronically Activated Recorder, for 4 days to assess mother and child positive behaviors and affect in daily life. **Results** Maternal education, but not income, was positively associated with child positive behaviors, displays of mother and child positive affect, and increased maternal responsiveness. Maternal positive affect and maternal responsiveness mediated the effect of maternal education on child positive affect. **Conclusions** Our findings suggest that maternal education has an important influence on the socioemotional adjustment of youth with asthma and point to the importance of investigating the independent influence of socioeconomic status components on everyday parent–child interactions.

Key words asthma; EAR; maternal responsiveness; positive affect; positive behaviors; SES.

Asthma is the most prevalent childhood chronic illness, affecting approximately 9.3% of youth in the United States, many of them being of minority and low socioeconomic status (SES; Bloom, Jones, & Freeman, 2013). Asthma can exert negative effects on developmental outcomes, placing youth at greater risk for emotional and behavioral difficulties (McQuaid, Kopel, & Nassau, 2001), which, in turn, are thought to further exacerbate asthma symptoms and increase functional impairment (McQuaid et al., 2008). Studies show that behavioral problems among youth with asthma are exacerbated in the context of socioeconomic adversity (Blackman & Gurka, 2007; Gillaspy, Hoff, Mullins, Van Pelt, & Chaney, 2002). In general, low-SES youth display higher rates of disobedience, impulsivity (McLoyd, 1998), anxiety, and learned helplessness (Evans & English, 2002), particularly during middle childhood and adolescence (Appleyard, Egeland, van Dulmen, & Sroufe, 2005). Researchers have argued that economic hardship increases punitive inconsistent parenting behaviors while reducing parents' responsiveness to children's needs (Conger & Donnellan, 2007). These poor parenting practices are thought to mediate the relationship between low SES and youth's behavioral and emotional problems (Grant et al., 2003).

Parental behaviors among low-SES families of children with asthma may be further compromised because of the additional difficulties related to managing the disease. A recent meta-analysis showed that parenting stress was higher among parents of children with chronic illness (Cousino & Hazen, 2013), while children with asthma have been found to have higher rates of family stress relative to healthy children (Bussing, Burket, & Kelleher, 1996).

Maternal responsiveness—which refers to mothers' prompt, contingent, and appropriate reactions to their children—is one of the parental behaviors most closely linked to socioemotional adjustment in children (Blair & Raver, 2012) and one that we propose is a likely key mediator of

Journal of Pediatric Psychology 40(1) pp. 55–65, 2015
doi:10.1093/jpepsy/jsu066
Advance Access publication August 22, 2014

the effects of SES on behaviors and emotions among youth with asthma. Research in healthy youth has shown that nurturing and attentive maternal behaviors relate to fewer externalizing problems among low-SES adolescents (Doan, Fuller-Rowell, & Evans, 2012). For children and adolescents with asthma, reports of greater relational security toward mothers (characterized by increased feelings of positive affect in the presence of mothers) have been related to fewer symptoms of depression, which in turn, were related to asthma severity (Wood et al., 2008). Surprisingly, no studies to our knowledge have investigated the association between parental SES, maternal responsiveness, and youth *positive* behaviors (e.g., cooperation, problem-solving) or displays of positive affect (e.g., happiness, interest). In the context of asthma, youth positive behaviors in daily life may lead to increased positive mother–child interactions, which may facilitate a coordinated response to asthma symptoms (McQuaid et al., 2008). Positive affect may also lead to long-term positive health outcomes such as better immune functioning (Cohen & Pressman, 2006). A recent study among low-income youth with asthma showed that maternal responsiveness was associated with better immune functioning by increasing youth positive affect (Tobin, Kane, Saleh, Wildman et al., 2014).

While many studies have investigated the influence of SES on developmental outcomes, less is known about how specific components of SES (e.g., income, education) influence outcomes in childhood and adolescence, even though recent studies suggest that each may predict distinct aspects of cognitive and socioemotional development (Farah et al., 2008; Shapero & Steinberg, 2013). For instance, previous research has found that parental education is associated not only with fewer child behavioral problems (Bradley & Corwyn, 2002), but also with increased maternal responsiveness during observed mother–child interactions (Huston & Aronson, 2005). Results from a national study showed that while both income and maternal education were significantly related to maternal responsiveness during short observations of mother–child interactions among 2-year-olds, maternal education was related to lower negative parent–child interactions independently of income (Belsky, Bell, Bradley, Stallard, & Stewart-Brown, 2006). Notably, maternal education often is included in studies as a component of SES, or used as a proxy for assessing SES (Evans, Li, & Whipple, 2013). Understanding the unique contribution of maternal education (vs. other SES components) to maternal responsiveness and children's developmental outcomes may prove particularly important for youth with asthma, since low parental education has been associated with more severe asthma symptoms among children of 0–17 years of age (Blackman & Gurka, 2007).

It is important to note that links between SES and youth socioemotional adjustment commonly are assessed through parental and teacher reports of youth's experiences (Doan et al., 2012). No study to our knowledge has investigated how everyday displays of affect and behaviors among youth with asthma vary across SES contexts and whether SES relates to these outcomes across assessments methods.

In this study, we investigated the effects of maternal SES, assessed through income and education, on naturalistically observed maternal responsiveness, youth positive behaviors, and mother and youth displays of positive affect. Our sample included older children and adolescents with asthma from a predominantly low-income population. We assessed maternal and child positive behaviors with the Electronically Activated Recorder (EAR; Mehl, Pennebaker, Crow, Dabbs, & Price, 2001), a novel naturalistic observation sampling methodology that allowed us to assess maternal and child behaviors as they emerged spontaneously in everyday life. We hypothesized that higher maternal education would be associated with greater displays of children's naturalistically observed positive behaviors and positive affect. Because better educated mothers display increased maternal sensitivity and because better educated individuals are less vulnerable to stress in general (Grzywacz, Almeida, Neupert, & Ettner, 2004), we also expected that higher maternal education would associate with greater maternal responsiveness and greater displays of maternal positive affect in daily life. Further, we investigated whether maternal responsiveness in daily life would mediate the effects of maternal education on children's positive behaviors and expressions of positive affect; we expected that children of more educated mothers would display more positive behaviors and affect in daily life as a function of their mother's higher levels of responsiveness. Finally, we also assessed maternal and child displays of negative affect in daily life and maternal reports of child internalizing and externalizing symptoms.

Method

Participants

Participants were recruited from the Detroit, MI metropolitan area, into a pilot study (data collected December 2010–September 2012) of a larger project that examines the effects of family environments on childhood asthma.[1] Our study

[1] Other papers from the same project have examined naturalistically observed conflict and asthma symptoms (Tobin, Kane, Saleh, Naar-King et al., in press) and youth-expressed positive affect and inflammation (Tobin, Kane, Saleh, Wildman et al., 2014), but the present analyses do not overlap with analyses from those other papers.

focused on EAR assessments of mother and child expressed affect and behaviors. Participants were recruited through the Allergy, Immunology, and Rheumatology Clinic at Children's Hospital of Michigan, local area hospitals, and Metro-Detroit area schools. Families were eligible for the study if their child was between the ages of 10 and 17 years with a diagnosis of mild to severe asthma confirmed by medical report. Families were excluded if their child was currently using oral steroid medication(s), diagnosed with a chronic condition other than asthma (e.g., endocrine disorders, cardiovascular disease), or diagnosed with a medical condition that may interfere with immune system function (e.g., pregnancy, chemotherapy, or radiotherapy in the past year). The sample included 25 female (Mean age = 12.88, *SD* = 1.83) and 28 male (Mean age = 13.00, *SD* = 1.78) youth, ranging in age from 10 to 17 years.[2] Asthma severity diagnosis ranged from mild intermittent to severe, with 41.5% of the youth having moderate asthma. Primary caregivers, defined as the parent or legal guardian, included 51 mothers, one aunt, and one grandmother. Age ranged from 32 to 75 years with an average of 42.34 years (*SD* = 7.76). Thirty-one reported being African American/Black, 19 White, 2 Hispanics and 1 Asian.[3] Twenty-five mothers reported that they were married or living in a marriage-like relationship (Mean relationship length = 15.68 years, *SD* = 6.69), 16 were never married, 6 were divorced, 4 were separated, and 2 were widowed.

Procedure

Participants visited the lab to complete a series of baseline questionnaires. Following this visit each child wore the EAR for 4 days, Thursday through Sunday or Saturday through Tuesday (details on the EAR follow below). Written assent and consent were obtained from the participating youth and their parent, respectively. Children and their mothers were paid up to $200 for their participation. This study was approved by the institutional review board at Wayne State University.

[2] This sample was taken from a larger pilot sample of 81 participants. The current sample is composed of those 53 families for whom we have EAR data. Families with EAR data did not differ from those without EAR data on age, parent age, income, education, or relationship status. Furthermore, participants did not differ on parental reports of externalizing and internalizing symptoms.

[3] Female caregivers will be referred to as mothers throughout the rest of this article. Only one family had a male primary caregiver. Because the focus of this article is on maternal education and behavior, the family with the male primary caregiver was excluded from analyses. However, all of the results reported in this article remain significant when the male caregiver family is included in the analyses.

Measures

Socioeconomic Status

We assessed two components of SES: Annual maternal income and maternal education. For income, mothers selected one of six tax bracket categories ranging from $0 to $7,825 per year to over $174,850 per year. Annual maternal income ranged from the $0 to $7,825 tax bracket to the $97,926–$174,850 tax bracket, with a median range of $7,826–$31,850. For education, mothers indicated the highest grade of school they had completed. Maternal education ranged from the *no schooling completed* category to *doctoral degree*, with a median range of some college credit but less than a year, corresponding to 12 years of education.

Maternal Reports of Child Internalizing and Externalizing Symptoms

Mothers completed the Child Behavior Checklist (CBCL 4-18; Achenbach, 1991) to report children's behavioral and emotional problems over the past 6 months. Responses ranged from 0 (*not true*) to 2 (*very true or often true)*, with higher scores indicating more problematic behavior. The CBCL includes two broad subscales: Internalizing Behavior (consisting of Withdrawn, Somatic Complaints, and Anxious/Depressed) and Externalizing Behavior (consisting of Aggressive Behavior and Delinquent Behavior). Descriptive statistics are displayed in Table I.

Naturalistic Observations of Mother and Child Behaviors

Everyday mother and child behaviors and expressions of affect were assessed naturalistically through the EAR (Mehl et al., 2001). The EAR is a portable audio-recorder that monitors participants' behaviors and interactions by capturing sounds from their surrounding environments. The EAR has been used to investigate a variety of psychological outcomes, from happiness and relationship satisfaction to depression and pain (Mehl, Robbins, & Deters, 2012). In the developmental literature, EAR-assessed parental depressive symptoms have been related to objective assessments of children's negative behaviors in daily life (Slatcher & Trentacosta, 2012).

Prior research shows that participants habituate to wearing the EAR quickly, report minimal interference in their daily activities, and display generally high compliance (Mehl et al., 2012). Test-retest reliability on college students' behaviors assessed 4 weeks apart ranges from 0.64 for how much time participants spend alone to 0.63 for how much they talk to others and 0.77 for how much amusement they express (Mehl & Pennebaker, 2003).

Table I. *Descriptive Statistics*

Variable	*M* (*SD*)	Range	Internal consistency (α)	Inter-coder agreement (intra-class correlations)
Maternal reports of child behaviors				
Internalizing symptoms	7.12 (6.76)	0–35	0.84	
Externalizing symptoms	6.03 (7.39)	0–32	0.82	
Electronically Activated Recorder behaviors				
Maternal responsiveness	3.19 (0.34)		0.78	
Warmth	1.12 (0.20)	1.00–1.91		0.95
Emotional support	1.04 (0.10)	1.00–1.50		0.95
Proud of child	1.03 (0.07)	1.00–1.33		0.96
Maternal positive affect	4.64 (1.05)		0.70	
Happy	1.37 (0.35)	1.00–2.12		0.96
Interested	2.15 (0.68)	1.00–3.47		0.95
Excited	1.16 (0.21)	1.00–1.75		0.95
Maternal negative affect	5.67 (0.53)		0.50	
Sad	1.01 (0.03)	1.00–1.13		0.96
Angry	1.03 (0.29)	1.00–2.17		0.96
Upset	1.12 (0.14)	1.00–1.55		0.96
Worried	1.14 (0.19)	1.00–1.79		0.96
Distressed	1.09 (0.17)	1.00–1.83		0.95
Child positive behaviors	17% (0.13)		0.70	
Agrees with parent	1.8% (0.02)	0–11%		0.84
Complies to parent command	3.5% (0.03)	0–13%		0.88
Cooperative	5.4% (0.06)	0–23%		0.77
Planning permission	1.6% (0.02)	0–8%		0.77
Problem solving solution	2.4% (0.02)	0–9%		0.73
Genuine humor	0.9% (0.01)	0–5%		0.91
Positive evaluations of self	0.4% (0.01)	0–3%		0.70
Positive evaluations of others	0.4% (0.01)	0–7%		0.44
General positive comments	0.9% (0.02)	0–8%		0.71
Child positive affect	6.24 (1.37)		0.85	
Happy	1.61 (0.40)	1.08–2.43		0.95
Interested	2.12 (0.59)	1.02–3.42		0.95
Excited	1.40 (0.36)	1.00–2.45		0.94
Proud	1.11 (0.19)	1.00–2.24		0.93
Child negative affect	5.43 (0.22)		0.43	
Sad	1.01 (0.02)	1.00–1.11		0.93
Angry	1.17 (0.12)	1.02–1.48		0.95
Upset	1.11 (0.09)	1.00–1.34		0.94
Worried	1.08 (0.07)	1.00–1.37		0.92
Distressed	1.05 (0.06)	1.00–1.30		0.92

Parallel-test reliability obtained on subsamples based on 50% of the data is high (test-half correlation: median = 0.97, minimum = 0.66, maximum = 1.00; Mehl et al., 2012).

This study used two versions of the EAR. The first version (HP iPAQ 110) was 4.59 × 2.71 × 0.54 inches and weighs 4.08 ounces. The second version (Apple iPod touch, 8 GB) is 4.4 × 2.3 × 0.28 inches and weighs 3.56 ounces. Recordings captured 50 s of sound every 9 min, from wake-up until bedtime. Participants had an average of 218.43 (*SD* = 82.03) waking audio files and an average of 96.35 (*SD* = 43.40) talking files. These values did not differ based on participants' age or gender. On average, mother–child interactions were present on 35.96 of the files (*SD* = 27.34), with girls showing a greater number of interactions, $F(1, 46) = 5.64$, $p = .02$ (M*girls* = 45.64, *SD* = 35.84; M*boys* = 27.15, *SD* = 15.80). The data were independently coded by 12 trained psychology student

research assistants, using the Everyday Child Home Observation coding system (Slatcher & Tobin, 2012) adapted, in part, from the Social Environment Coding of Sound Inventory (Mehl & Pennebaker, 2003). Each sound file was coded for participants' location, mood, and various behaviors expressed across parent–child interactions. EAR-assessed behaviors were coded as being present or not, while expressions of affect were rated for their intensity. Inter-coder reliability for each coded behavior was determined from a set of 512 training recordings, a standard approach across EAR studies (Mehl et al., 2012). Intraclass correlations (ICCs) were calculated based on a two-way random effects model.

To assess displays of mother and child affect and behaviors, we computed six composite measures based on EAR data collected across the four observation days. Scores for each composite (described in detail below) represent a sum of the individual behaviors or affective expression ratings coded in each talking file for each respective measure. For example, the total number of positive behavior displays per child was summed across the 4 days and converted into a percentage. Table I displays alpha reliabilities for each scale and inter-coder agreement ICCs of each analyzed behavior.

Child Positive Behaviors. To assess child positive behaviors during mother–child interactions, we aggregated nine EAR-observed behaviors assessing agreement with mother, compliance to commands, cooperation during mother–child activities, asking for permission, offering solutions to problems or questions raised by mother, displays of genuine humor, expressions of positive evaluative comments about self and others, and expressions of general positive comments not necessarily directed to a specific target (e.g., ''I love downtown at Christmas time; it is so beautiful!''). These behaviors were assessed by raters as being present or not (coded 1 or 0, respectively). The score for each behavior displayed in Table I reflects the percentage of total talking EAR files in which that particular behavior occurred.

Maternal Responsiveness. Maternal responsiveness during mother–child interactions was defined as displays of pride, warmth, and emotional support toward the child. These expressions were rated for their intensity on a scale of 1–5, including half-point ratings. For example, when assessing maternal emotional support, extremely supportive and empathetic expressions (e.g., ''We can work through this together and we will get through it'') were rated as 5.

Maternal and Child Affect. We defined child positive affect as expressions of happiness, interest, excitement, and pride that emerged naturally throughout the day. Maternal positive affect included assessments of the same emotions with the exception of pride. The child negative affect measure included ratings of expressions in which youth participants appeared sad, upset, angry, worried, and distressed. Maternal negative affect included ratings of the same expressions. All affective variables were rated on a scale of 1–5, with half-point increments. For example, interactions in which participants showed mild distress (i.e., ''I don't know if I can do this'') were rated as 2, while interactions in which extreme distress was observed (i.e., ''I really need help, I can't do this and I will never be able to'') were rated as 5.

Child behaviors and affect were rated in all talking files, while maternal outcomes were rated only in files where the mother was present. Because some of the EAR-observed affect and behaviors were positively skewed, we log-transformed all values before statistical analyses.

Results

SES, Child Affect, and Positive Behaviors Across Mother–Child Interactions

First, we investigated associations between SES components, child affect, and child positive behaviors. These associations are shown in Table II. As expected, higher maternal education was associated with more frequent displays of child positive behavior across mother–child interactions. Maternal education also was associated with increased expressions of child positive affect, but was not associated with expressions of child negative affect. We examined associations between maternal education and maternal reports of child externalizing and internalizing behaviors and found that maternal education was negatively associated with externalizing symptoms, but was not significantly associated with internalizing symptoms. Maternal annual income was not associated with any of the child affect variables, child positive behaviors, or maternal reports of externalizing and internalizing behaviors, even though education and income were positively correlated with each other, $r = .45$, $p < .01$.

SES, Maternal Responsiveness, and Maternal Affect

Next, as shown in Table II, we examined the relationship between SES components, maternal responsiveness, and maternal affect observed in daily life. As hypothesized, higher maternal education was associated with increased maternal responsiveness and more frequent displays of

Table II. *Correlations Between Education, Income, Electronically Activated Recorder-Observed Behaviors and Affect, and Mother-Reported Child Internalizing and Externalizing Symptoms*

	2	3	4	5	6	7	8	9	10	11
1. Education	.45**	−.25	.41**	.28*	.05	.27*	.28*	−.03	−.18	−.29*
2. Annual income		.02	−.06	−.03	−.15	.24	−.02	−.16	−.10	−.22
3. Child age			−.02	−.33*	−.38**	−.12	−.24	−.39**	.08	.003
4. Child positive behavior				.02	.21	.16	.09	−.04	.19	−.08
5. Child positive affect					.43**	.47**	.84**	.53**	−.16	−.11
6. Child negative affect						.14	.32*	.53**	.01	−.02
7. Maternal responsiveness							.23	.22	.09	−.08
8. Maternal positive affect								.42**	−.16	−.13
9. Maternal negative affect									.07	.03
10. Child Behavior Checklist internalizing symptoms										.53**
11. Child Behavior Checklist externalizing symptoms										

Note. *$p < .05$, **$p < .01$.

maternal positive affect across mother–child interactions. Maternal negative affect, on the other hand, was not associated with maternal education. Notably, we did not find significant associations between maternal annual income and maternal responsiveness or affect.[4]

Maternal Responsiveness and Maternal Affect as Mediators

Since income did not emerge as a significant predictor of any of the EAR or maternal-reported outcomes, we focused on testing if maternal responsiveness and affect accounted for the effects of education on child positive affect and behaviors. To test mediation, we ran three separate models: (1) the total effect model, modeled by regressing child positive affect on education, (2) maternal responsiveness regressed on education, and (3) child positive affect regressed on maternal responsiveness and education. As expected, when education and maternal responsiveness were entered as predictors of child positive affect in the same model, the effect of education was non-significant (see Figure 1). Mediation analyses using a bootstrapping macro in SPSS to estimate indirect effects (Preacher & Hayes, 2004) indicated that maternal responsiveness mediated the effect of education on child positive affect, $b = .0042$, $SE = .0027$, 95% CI [.0003, .0106]. When maternal responsiveness was tested as a mediator for the effects of education on child positive behaviors, results

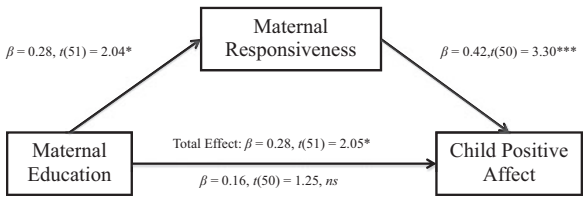

Figure 1. Mediation of the effect of maternal education on child positive affect by maternal responsiveness.
Note. *$p < .05$, ***$p < .005$.

indicated that maternal responsiveness did not contribute significantly to the model, $\beta = .07$, $t(50) = .54$, $p = ns$.

In addition to testing the mediating effects of maternal responsiveness, we also explored whether maternal positive affect expressed in daily life might partially mediate the effects of maternal education on child positive affect, above and beyond the mediating effect of maternal responsiveness. When entered together with maternal responsiveness and education, maternal positive affect significantly predicted child positive affect, $\beta = .77$, $t(49) = 10.61$, $p < .001$, while maternal responsiveness continued to uniquely predict child positive affect, $\beta = .27$, $t(49) = 3.77$, $p < .001$; maternal education was not significantly associated with child positive affect in this model, $\beta = -.01$, $t(49) = -.25$, $p =$ ns, suggesting that maternal responsiveness and maternal positive affect each uniquely mediated the effect of education on child positive affect. We then used the PROCESS macro in SPSS (Hayes, 2013) to simultaneously estimate the indirect effects of maternal education through maternal positive affect and maternal responsiveness. We found that the indirect effect of

[4] Asthma severity diagnosis and caregiver relationship status (single vs. married/cohabitating) did not differ across SES measures. Also, EAR-assessed behaviors and affect did not differ based on asthma severity diagnosis and caregiver relationship status.

education through maternal positive affect on child positive affect was significant, $b = .008$, $SE = .0038$, 95% CI [.0009, .0162], as was the indirect effect of education through maternal responsiveness, $b = .0027$, $SE = .0014$, 95% CI [.0008, .0065]. This double mediation suggests that maternal education exerts an influence on youths' everyday expressions of positive affect through multiple mechanisms, such that mothers with higher education levels display both greater positive affect and greater responsiveness with their children.

Finally, we assessed whether the effects of maternal education on maternal responsiveness, maternal positive affect and child positive affect differed based on youth age. Youth were categorized in two groups: younger group (10–12 years old; $n = 26$) and older group (13–17 years old; $n = 27$). Separate regression analyses with education, maternal responsiveness, and maternal positive affect as predictors of child positive affect were run for each group. Results indicated that maternal responsiveness (younger group: $\beta = .28$, $t(22) = 2.79$, $p = .01$; older group: $\beta = .39$, $t(23) = 3.11$, $p < .01$) and maternal positive affect (younger group: $\beta = .84$, $t(22) = 8.46$, $p < .001$; older group: $\beta = .56$, $t(23) = 4.56$, $p < .001$) uniquely predicted child positive affect in both age groups. The effects of maternal education, however, were significant only for the older age group, $\beta = .52$, $t(25) = 3.08$, $p < .01$. When entered together with maternal responsiveness and maternal positive affect, maternal education was no longer a significant predictor of child positive affect in this model, $\beta = .06$, $t(23) = .52$, $p =$ ns. When estimating the indirect effects of maternal education through maternal positive affect and responsiveness for the older age group, we found that the indirect effect of education through maternal positive affect on child positive affect was significant, $b = .0082$, $SE = .0058$, 95% CI [.0023, .0251], as was the indirect effect of education through maternal responsiveness, $b = .0067$, $SE = .0055$, 95% CI [.0011, .0226].[5]

Discussion

The current findings indicate that increased maternal education is associated with more frequent displays of child positive behaviors and displays of mother and child positive affect in youth aged 13–17 years. Maternal education was also associated with increased maternal responsiveness, which, along with maternal positive affect, accounted for the relationship between maternal education and child displays of positive affect. Neither maternal responsiveness nor maternal positive affect, however, explained the effects of education on child positive behaviors. Replicating prior work, we also found maternal education to be associated with lower levels of mother-reported child externalizing behaviors. We did not find any associations between maternal education and displays of mother and child negative affect. In contrast to prior research, we also did not find significant associations between maternal income and these outcomes.

Our study replicates—using a different methodological approach—recent research findings that highlight the impact of SES on maternal responsiveness (Doan et al., 2012). However, while previous studies have primarily investigated the deleterious effects of low SES on maternal responsiveness, our study extends this line of work by showing that improvements in at least one specific component of SES, education, may lead to improvements in both maternal responsiveness and children's emotional adjustment. Because youth emotional adjustment is closely related to asthma morbidity (McQuaid et al., 2008), our findings suggest that improvements in maternal education may be particularly relevant to low-income youth with asthma.

Our findings also point to the importance of evaluating the influence of each SES component independently of others (Duncan & Manguson, 2003). While there is evidence that assessing multiple risk factors may be a more powerful approach in predicting adverse outcomes (Evans, Li, & Whipple, 2013), other perspectives argue that distinct sociodemographic variables may be related to different types of risk exposure, and, as a result, to distinct developmental consequences (Duncan & Mangunson, 2003). Our findings raise the possibility that maternal education in particular may have a key influence on everyday mother–child interactions in the risky family environments that characterize economically distressed cities such as Detroit. Future studies should continue to assess if distinct SES components differentially predict specific aspects of mother–child relationships.

One notable strength of this study is the innovative use of the EAR methodology, which allowed us to naturalistically assess multiple aspects of family relationships as they unfold in everyday life. Although previous studies have relied on parents' and teachers' reports to assess the link between SES and youths' behavioral and affective outcomes, our naturalistic observations may be more suitable for exploring the extent to which particular SES components relate to specific aspects of the parent–child relationship. For example, our results extend previous

[5] We also tested number of talking files and number of waking files as potential covariates, but did not find any significant associations between these variables and the EAR-assessed behaviors and affect.

findings on the unique contributions of maternal education to maternal responsiveness and positive mother–child interactions (Belsky et al., 2006; Huston & Aronson, 2005) and discourage interpretations that better educated parents simply are more likely to positively bias their reports on family dynamics and children's behaviors.

Future investigations will need to further examine the relationship between maternal education, maternal responsiveness, and youth expressed positive affect across different age groups. Interestingly, we found that maternal education was significantly related to maternal responsiveness, maternal positive affect, and youth positive affect among older (13–17-year-old) but not younger (10–12-year-old) youth. These findings contradict previous research showing that parental education is significantly related to maternal responsiveness toward 6- and 7-year-old children (Tamis-LeMonda, Briggs, McClowry, & Snow, 2009); therefore, attempts to replicate these findings are needed, particularly given the small sample sizes in the age subgroups in our sample. Alternatively, these findings may reflect different effects of maternal education across developmental stages. Adolescents' relationships with parents become less warm and cohesive (Smetana, Campione-Barr, & Metzger, 2006), while their friendship ties and drive for autonomy increase (Steinberg, 2005). Furthermore, adolescents tend to experience more negative emotions on a day-to-day basis, along with frequent disagreements and conflict with parents (Smetana et al., 2006). In youth with asthma, this period is marked by increased responsibilities in disease management (Duncan et al., 2012), which also bring difficulties and conflict related to the shared responsibility of asthma care in the family (Bitsko, Everhart, & Rubin, 2014; Duncan et al., 2012). Increased maternal education may lead to a greater understanding of the developmental challenges faced by adolescents and may facilitate responsive attention of mothers toward their children during this phase.

Surprisingly, we did not find an association between maternal responsiveness and child positive behaviors. Perhaps this is due to the fact that many of our behavioral indicators for child positive behaviors refer to compliance, cooperation, and agreement with parents, which occur not only in the context of positive parent–child interactions but also in those occasions when parents may use harsh disciplinary practices to regulate children's behaviors. Therefore, maternal responsiveness may not always be necessary for increased manifestations of child positive behaviors.

We also did not find significant associations between maternal education and mother and child negative affect expressed in daily life. Because the internal consistency of the composite measures for negative affect was quite low, we also investigated the effects of SES on individual negative affect codes (for both mothers and children) but found no significant effects with those individual codes either (statistics not reported). Therefore, it remains unclear why there were not significant associations between maternal education and negative affect. Perhaps, displays of negative affect include additional behaviors that our coding system failed to capture, which might be more relevant to maternal education.

While our study offers important contributions in improving ecological validity in the assessment of parent–child interactions, there are some limitations worth noting. An important limitation is our fairly small sample size (particularly for the age group subsamples) with limited statistical power and the cross-sectional nature of our data, which limits the interpretation of the causal direction of our findings. Because children have an active role in influencing the nature of mother–child interactions (Sameroff & MacKenzie, 2003), it is possible that children's expressed affect and behaviors may also influence expressions of maternal responsiveness, especially in the context of chronic illness (Wallander & Varni, 1998). Additionally, our data capture family interactions only through a 4-day period, which may limit our ability to observe family dynamics as they evolve through longer periods. In terms of our sample, the majority of our participants were African American and Caucasian, which may limit the extension of our results to other minority groups with high rates of asthma, such as Hispanics (Bloom et al., 2013). The restricted income range may have obscured possible effects of income on mother and child behaviors in daily life. Also, both income and education were assessed through self-report. Future replications of this work using larger samples with a wider range of income and alternative ways of assessing income (i.e., annual income adjusted for the number of children/individuals in the home), as well as studies that examine fathers' SES and parenting behaviors, will be important in continuing to disentangle the effects of SES on child development among youth with asthma.

Taken together, our findings support theoretical models that emphasize that positive and supportive family interactions may promote social competency and well-being in children (e.g., Repetti, Taylor, & Seeman, 2002). Our data point to possible mechanisms, such as displays of positive affect and positive behaviors in daily life, through which parental education can lead to positive outcomes in youth with asthma from low-SES environments. From a social support perspective, it is plausible that these types of positive behaviors and displays of

positive affect could help to attract greater social support or increase positive interactions with peers that could, in turn, reduce social anxiety and depressive symptoms (Bitsko et al., 2014) and help improve asthma-related outcomes. Increased positive affect may also relate to greater asthma control through several more direct biobehavioral pathways. For example, adolescents who experience increased rates of positive affect may be at lower risk for engaging in self-soothing risk behaviors, such as smoking and substance abuse, which increase chronic inflammation and promote nonadherence (Bender, 2006).

Greater maternal responsiveness could also help improve mother–child interactions among older teenagers, facilitating the family management of asthma symptoms. Positive mother–child interactions may foster higher levels of family connectedness, which has been associated with lower levels of asthma-related functional limitation (Koinis-Mitchell et al., 2012). Better educated mothers may also have a greater understanding of the disease management challenges faced by youth and, as a result, they may respond with greater sensitivity to these challenges. For example, highly sensitive mothers may be better able to provide adherence feedback to their children in a way that is not perceived intrusive or unwelcomed. This may be particularly important among low-SES parents whose parenting styles tend to emphasize strict disciplinary practices, undermining adolescents' increased need for autonomy (Conger & Donnellan, 2007).

Our findings, therefore, point not only to the importance of maternal education for immediate socioemotional outcomes in youth with asthma, but also could potentially have farther-reaching implications by helping to answer the question of how SES early in life is associated with health and well-being later in life.

Acknowledgments

The authors thank all the research assistants in the Close Relationships Laboratory for their help with data collection.

Funding

This work was supported by funding from the National Institutes of Health Grant (RO1HL114097) and a Wayne State University Junior Faculty Grant in the Social and Behavioral Sciences (to R.B.S.).

Conflicts of interest: None declared.

References

Achenbach, T. M. (1991). *Manual for the child behavior checklist/4-18 and 1991 profile*. Burlington, VT: University of Vermont, Department of Psychiatry.

Appleyard, L., England, B., van Dulment, M., & Sroufe, L. A. (2005). When more is not better: The role of cumulative risk in child behavior outcomes. *Journal of Child Psychology and Psychiatry, 46*, 235–245.

Belsky, J., Bell, B., Bradley, R. H., Stallard, N., & Stewart-Brown, S. L. (2006). Socioeconomic risk, parenting during the preschool years and child health at age six years. *The European Journal of Public Health, 17*, 508–513.

Bender, B. G. (2006). Risk taking, depression, adherence, and symptom control in adolescents and young adults with asthma. *American Journal of Respiratory and Critical Care Medicine, 173*, 953–957.

Bitsko, M. J., Everhart, R. S., & Rubin, B. K. (2014). The adolescent with asthma. *Pediatric Respiratory Reviews, 15*, 146–153.

Blair, C., & Raver, C. C. (2012). Child development in the context of adversity. *American Psychologist, 67*, 309–318.

Blackman, J. A., & Gurka, M. J. (2007). Developmental and behavioral comorbidities of asthma in children. *Journal of Developmental Behavioral Pediatrics, 28*, 92–99.

Bloom, B., Jones, L. I., & Freeman, G. (2013). Summary health statistics for U.S. children: National Health Interview Survey, 2012. *Vital Health Statistics, 10*, 1–75.

Bradley, R. H., & Corwyn, R. F. (2002). Socioeconomic status and child development. *Annual Review of Psychology, 53*, 371–399.

Bussing, R., Burket, R. C., & Kelleher, E. T. (1996). Prevalence of anxiety disorders in a clinic-based sample of pediatric asthma patients. *Psychosomatics, 37*, 108–115.

Cohen, S., & Pressman, S. D. (2006). Positive affect and health. *Current Directions in Psychological Science, 15*, 122–125.

Conger, R. D., & Donnellan, M. B. (2007). An interactionist perspective on the socioeconomic context of human development. *Annual Review of Psychology, 58*, 175–199.

Cousino, M. K., & Hazen, R. A. (2013). Parenting stress among caregivers of children with Chronic illness: A systematic review. *Journal of Pediatric Psychology, 38*, 809–828.

Doan, S. N., Fuller-Rowell, T. E., & Evans, G. W. (2012). Cumulative risk and adolescents' internalizing and externalizing problems: The mediating roles of maternal responsiveness. *Developmental Psychology, 48*, 1529–1539.

Duncan, C. L., Beth Hogan, M., Tien, K. J., Graves, M. M., Chorney, J. M., Zettler, M. D., … Portnoy, J. (2012). Efficacy of a parent-youth teamwork intervention to promote adherence in pediatric asthma. *Journal of Pediatric Psychology, 38*, 617–628.

Duncan, G. J., & Mangunson, K. A. (2003). Off with Hollingshead: Socioeconomic resources, parenting, and child development. In M. H. Bornstein, & R. H. Bradley (Eds.), *Socioeconomic status, parenting, and child development* (pp. 83–106). Mahwah, NJ: Erlbaum.

Evans, G. W., & English, K. (2002). The environment of poverty: Multiple stressor exposure, psychological stress, and socioemotional adjustment. *Child Development, 73*, 1238–1248.

Evans, G. W., Li, D., & Whipple, S. S. (2013). Cumulative risk and child development. *Psychological Bulletin, 139*, 1342–1396.

Farah, M. J., Betancourt, L., Shera, D. M., Savage, J. H., Giannetta, J. M., Brodsky, N. L., … Hurt, H. (2008). Environmental stimulation, parental nurturance, and cognitive development in humans. *Developmental Science, 15*, 793–801.

Gillaspy, S. R., Hoff, A. L., Mullins, L. L., Van Pelt, J. C., & Chaney, J. M. (2002). Psychological distress in high-risk youth with asthma. *Journal of Pediatric Psychology, 27*, 363–371.

Grant, K. E., Compas, B. E., Stuhlmacher, A. F., Thurm, A. E., McMahon, S. D., & Halpert, J. A. (2003). Stressors and child and adolescent psychopathology: Moving from markers to mechanisms of risk. *Psychological Bulletin, 129*, 447–466.

Grzywacz, J. G., Almeida, D. M., Neupert, S. D., & Ettner, S. L. (2004). Socioeconomic status and health: A micro-level analysis of exposure and vulnerability to daily stressors. *Journal of Health and Social Behavior, 45*, 1–16.

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression based approach*. New York, NY: Guilford Press.

Huston, A. C., & Aronson, S. R. (2005). Mother's time with infant and time in employment aspredictors of mother-child relationships and children's early development. *Child Development, 76*, 467–482.

Koinis-Mitchell, D., McQuaid, E. L., Jandasek, B., Kopel, S. J., Sifer, R., Klein, R. B., … Fritz, G. K. (2012). Identifying individual, cultural and asthma-related risk and protective factors associated with resilient asthma outcomes in urban children and families. *Journal of Pediatric Psychology, 37*, 424–437.

Tamis-LeMonda, C. S., Briggs, R. D., McClowry, S. G., & Snow, D. L. (2009). Maternal control and sensitivity, child gender, and maternal education in relation to children's behavioral outcomes in African American families. *Journal of Applied Developmental Psychology, 30*, 321–331.

McLoyd, V. C. (1998). Socioeconomic disadvantage and child development. *American Psychologist, 53*, 185–204.

McQuaid, E. L., Kopel, S. J., & Nassau, J. H. (2001). Behavioral adjustment in children with asthma. *Journal of Developmental and Behavioral Pediatrics, 22*, 430–439.

McQuaid, E. L., Weiss-Laexer, N., Kopel, S. J., Mitchell, D. K., Nassau, J. H., Wamboldt, M. Z., … Fritz, G. K. (2008). Pediatric asthma problems in attention, concentration, and impulsivity: Disruption of the family management system. *Families, Systems, and Health, 26*, 16–29.

Mehl, M. R., & Pennebaker, J. W. (2003). The sounds of social life: A psychometric analysisof students' daily social environments and natural conversations. *Journal of Personality and Social Psychology, 84*, 857–870.

Mehl, M. R., Pennebaker, J. W., Crow, M. D., Dabbs, J., & Price, J. H. (2001). The Electronically Activated Recorder (EAR): A device for sampling naturalistic daily activities and conversations. *Behavior Research Methods, Instruments, and Computers, 33*, 517–523.

Mehl, M. R., Robbins, M. L., & Detters, G. F. (2012). Naturalistic observation of health-relevant social processes: The Electronically Activated Recorder (EAR) methodology in psychosomatics. *Psychosomatic Medicine, 74*, 410–417.

Preacher, K. J., & Hayes, A. F. (2004). SPSS and SAS procedures for estimating direct effects in simple mediation models. *Behavior Research Methods, Instruments, and Computers, 36*, 717–731.

Repetti, R. L., Taylor, S. E., & Seeman, T. E. (2002). Risky families: Family social environments and the mental and physical health of offspring. *Psychological Bulletin, 128*, 330–366.

Sameroff, A. J., & MacKenzie, M. J. (2003). Research strategies for capturing transactional models of development: The limits of the possible. *Development Psychopathology, 15*, 613–640.

Shapero, B. G., & Steinber, L. (2013). Emotional reactivity and exposure to household stress in childhood predict psychological problems in adolescence. *Journal of Youth and Adolescence, 42*, 1573–1582.

Slatcher, R. B., & Tobin, E. T. (2012). *Everyday child home observation coding system*. Detroit: Wayne State University.

Slatcher, R. B., & Trentacosta, C. J. (2012). Influences of parent and child negative emotionality on young children's everyday behaviors. *Emotion, 12*, 932–942.

Smetana, J. G., Campione-Barr, N., & Metzger, A. (2006). Adolescent development in Interpersonal and societal contexts. *Annual Reviewes in Psyhcology, 57*, 255–284.

Steinberg, L. (2005). Cognitive and affective development in adolescence. *Trends in Cognitive Sciences, 9*, 69–74.

Tobin, E. T., Kane, H. S., Saleh, D. J., Naar-King, S., Poowuttikul, P., Secord, E., . . . Slatcher, R. B. (in press). Naturalistically-observed conflict in the family environment and youth asthma symptoms. *Health Psychology*.

Tobin, E. T., Kane, H. S., Saleh, D. J., Wildman, D. E., Crabb-Breen, E., Secord, E., & Slatcher, R. B. (2014). Youth expressions of positive affect in daily life mediate the associations between maternal responsiveness and improved inflammation status in youth with asthma. Manuscript submitted for publication.

Wallander, J. L., & Varni, J. W. (1998). Effects of pediatric chronic physical disorders on child and family adjustment. *Journal of Child Psychological Psychiatry, 39*, 29–46.

Wood, B. L., Lim, J., Miller, B. D., Cheah, P., Zwetsch, T., Ramesh, S., & Simmerns, S. (2008). Testing the biobehavioral family model in pediatric asthma: Pathways of effect. *Family Processes, 47*, 21–40.