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Naturalistically Observed Conflict and Youth Asthma Symptoms

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Objective: To investigate the links between naturalistically observed conflict, self-reported caregiver–youth conflict, and youth asthma symptoms. ***Method:*** Fifty-four youth with asthma (age range: 10–17 years) wore the Electronically Activated Recorder (EAR) for a 4-day period to assess interpersonal conflict and caregiver–youth conflict as they occur in daily life. Conflict also was assessed with baseline self-report questionnaires and daily diaries completed by youth participants and their caregivers. Asthma symptoms were assessed using daily diaries, baseline self-reports, and wheezing, as coded from the EAR. ***Results:*** EAR-observed measures of conflict were strongly associated with self-reported asthma symptoms (both baseline and daily diaries) and wheezing coded from the EAR. Further, when entered together in regression analyses, youth daily reports of negative caregiver–youth interactions and EAR-observed conflict uniquely predicted asthma symptoms; only EAR-observed conflict was associated with EAR-observed wheezing. ***Conclusion:*** These findings demonstrate the potential impact of daily conflict on youth asthma symptoms and the importance of assessing conflict as it occurs in everyday life. More broadly, they point to the importance of formulating a clear picture of family interactions outside of the lab, which is essential for understanding how family relationships "get under the skin" to affect youth health.

Keywords: parent–child relationship, conflict, Electronically Activated Recorder (EAR), asthma, health, ecological momentary assessment

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Multiple factors in family environments have been known to exacerbate childhood asthma morbidity, such as psychological stress (Marin, Chen, Munch, & Miller, 2009), marital conflict (Northey, Griffin, & Krainz, 1998), parental stress (Shalowitz, Berry, Quinn, & Wolf, 2001), and family conflict (Anda et al., 2006). Additional family characteristics, such as poor caregiver or youth mental health (Ortega, Goodwin, McQuaid, & Canino, 2004; Wood et al., 2007), family disorganization (Kaugars, Klinnert, & Bender, 2004), and minority ethnicity (Bauman et al., 2002), all are contributing components through which family environment and stress can negatively impact the asthma symptom profile. Research also has demonstrated that increased exposure to stress in adolescents with asthma is associated with greater eosinophil counts, increased lymphocyte proliferation, and increased production of proinflammatory cytokines, which may contribute to increased asthma symptom expression (Chen et al., 2006; Kang et al., 1997). Given the accumulating evidence for a biopsychosocial model of asthma, it is important for researchers to identify aspects of relationships that can contribute to the exacerbation and persistence of asthma symptoms. Furthermore, the research to date has largely focused on the extent to which very general family characteristics, such as family-related stress, impact asthma morbidity during youth using parent and youth accounts of the family environment. No investigations to our knowledge have examined the direct effect of daily conflict in everyday life on youth health.

Frequent conflict in the home has been theorized to create vulnerabilities in youth by disrupting biological and psychological

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processes through interactions with genetic and environmental factors (Repetti, Taylor, & Seeman, 2002). Family conflict has been associated with a variety of poor health outcomes, including lower weight attainment in infancy (Stein, Woolley, Cooper, & Fairburn, 1994), slower growth in childhood (Montgomery, Bartley, & Wilkinson, 1997), and greater psychological distress during adolescence (Gunnlaugsson, Kristjánsson, Einarsdóttir, & Sigfúsdóttir, 2011). Research also has demonstrated that youth growing up in environments with increased conflict and anger have amplified emotional responses to stressors and more often use maladaptive coping strategies, which negatively impact physical health (Cummings, Zahn-Waxler, & Radke-Yarrow, 1981; Repetti, Robles, & Reynolds, 2011; Valiente, Fabes, Eisenberg, & Spinrad, 2004). Surprisingly, very little is known about the direct impact of conflict at home on serious physical health problems, such as asthma during childhood and adolescence. Moreover, there has been a recent call for research focusing on the adversities youth face on a routine basis, such as family conflict, to clarify links between stress during development and chronic illness (G. E. Miller, Chen, & Parker, 2011).

Family conflict is a construct that typically is measured using brief questionnaire reports or laboratory interactions. However, questionnaire reports of family conflict include potential sources of bias, aspects of social desirability, and shared method variance (Campbell & Fiske, 1959; Mehl, Robbins, & Deters, 2012). Additionally, assessing family conflict from short laboratory interactions can raise questions about the generalizability of these interactions, because research has long documented variations in parental behaviors due to changes in the context in which they are measured (Belsky, 1980). Research has suggested that data should be collected from multiple informants (e.g., from both parents and children) due to contextual elements and situational determinants that may influence an individual's perceptions (Achenbach, McConaughy, & Howell, 1987; Kerr, Lunkenheimer, & Olson, 2007). Collecting questionnaire data from multiple informants can sometimes pose a challenge in family research. Alternatively, naturalistic observation can provide reasonably objective and detailed accounts of daily interactions in the home. The Electronically Activated Recorder (EAR; Mehl, Pennebaker, Crow, Dabbs, & Price, 2001) is a relatively new naturalistic observation method used to capture participant behaviors and interactions as they occur in daily life. The EAR unobtrusively takes brief recordings of ambient sounds and interactions as they occur in a participant's environment. By taking an observational approach, the EAR helps to address the potential issues of bias, shared method variance, and generalizability that can sometimes hinder questionnaire and laboratory measures of conflict.

Previous studies of families have documented the usefulness of the EAR in assessing everyday behaviors in the home. For example, parental negative emotionality (Slatcher & Trentacosta, 2012) and parental depressive symptoms (Slatcher & Trentacosta, 2011) have been linked with increased problem behaviors in young children. Increased observed conflict in the home of young children (age range: 3–5 years) was associated with an altered diurnal cortisol profile, including flatter (less "healthy") cortisol slopes and lowered waking cortisol levels, whereas maternal questionnaire reports of daily parent–child conflict were unrelated to cortisol patterns (Slatcher & Robles, 2012). To our knowledge, no studies to date have addressed how naturalistically observed everyday family interactions are associated with youth asthma symptoms. This study addressed that gap by using the EAR to assess the links between observed conflict in the home and the health of youth with asthma.

The Present Study

The goal of the present study was to determine the relationship between naturalistically observed conflict—both broad interpersonal conflict and caregiver–youth conflict in daily life—and youth asthma symptoms. Based on existing findings, we expected that greater levels of naturalistically observed interpersonal conflict and caregiver–youth conflict would be associated with increased asthma symptoms, including self- and daily-reported asthma symptoms and naturalistically observed wheezing, beyond that accounted for by youth and caregiver reports of conflict.

Method

Participants

A total of 54 children and adolescents, aged 10−17 years with asthma, and their primary caregivers took part in the study as part of a pilot for a larger longitudinal study investigating the effect of risky family environments on child health, the Asthma in the Lives of Families Today Study. This sample was taken from a larger pilot sample of 81 participants. Due to technological problems early in the data collection process, only 54 of these 81 participants had a sufficient number of EAR files to analyze. Of the 27 not included in the analyses, 18 were returned to the lab with no files due to a program malfunction, six were returned with an insufficient number of codeable files (fewer than 30 valid talking files—a minimum number of files needed to capture fairly low-base rate behaviors such as yelling), two EARs were damaged, and one was stolen. Participants with and without coded EAR files did not differ based on youth age, caregiver age, youth gender, ethnicity, caregiver income, or severity of asthma diagnosis.

The sample consisted of 25 girls (M_{age} = 12.96 years, SD = 1.81) and 29 boys (M_{age} = 13.00 years, SD = 1.73). Asthma severity diagnosis ranged from mild intermittent to severe persistent, as determined by medical record report. Primary caregivers included 51 mothers, one father, one aunt, and one grandmother. Primary caregivers will be referred to as caregivers in the remainder of the article for clarification purposes. Annual household income ranged from the \$0−7,825 tax bracket to the \$97,926−174,850 tax bracket, with a median range of \$7,826−31,850. Of the caregivers, 31 identified themselves as African American or Black, 20 as White, two as Hispanic, and one as Asian. Twenty-six caregivers indicated that they were married or living in a marriage-like relationship, 16 were never married, six were divorced, four were separated, and two were widowed. The average relationship duration for couples who reported being married or in a marriage-like relationship was 15.84 years (SD = 6.61).

Procedure

This project was approved by the university institutional review board. Participants were recruited through the Allergy, Immunol-

ogy, and Rheumatology Clinic at Children's Hospital of Michigan, local area hospitals, and Metro-Detroit area schools using posted flyers or a staff research nurse. Families then called the laboratory and were informed that the purpose of the study was to better understand the links between daily life and asthma. The caregiver completed a telephone screening interview to determine eligibility in the study. Families were eligible for the study if their child was between the ages of 10 and 17 and had a diagnosis of mild intermittent to severe persistent asthma confirmed by their medical record report. Families were excluded if the participating youth was diagnosed with a chronic condition other than asthma (e.g., endocrine disorders, immunodeficiency, cardiovascular disease), diagnosed with a medical condition that would impede immune system function (e.g., pregnancy, chemotherapy, radiotherapy in the past year), or currently using oral steroid medications. Written assent and consent were obtained from the participating youth and their caregiver, respectively.

The participating youth and caregiver visited the laboratory for their first visit, where they completed a number of background questionnaires on a computer and individual interviews assessing conflict and stress from the youth's and caregiver's perspectives. During this time, the youth and caregiver also reported the number of medications taken by the youth and signed a release of information for the medical records of the youth to confirm the medication report and asthma diagnosis. Also at this visit, the youth and caregiver were given detailed instructions on wearing the EAR and completing the daily diaries. The laboratory visit lasted approximately two hours. They then completed 4 days of daily diaries, which included daily ratings of asthma symptoms from the youth participant as well as youth and caregiver reports of conflict, and wore the EAR on each of those days (detailed information about the EAR is provided in the EAR conflict section). Participants returned study materials and the EAR to the lab or during a home visit. The current analyses focus on the laboratory questionnaires, daily diaries, EAR conflict, and asthma data. Youth and caregivers were compensated and reimbursed for their time.

Measures

See Table 1 for descriptive and reliability statistics for all measures used in the present study.

Family conflict. Youth and caregivers completed the 12-item Parent–Child Conflict subscale of the Parental Environment Questionnaire (PEQ; P. A. Miller & Hauser, 1989). This scale has been extensively validated in family samples with both children and adolescents (Burt, Krueger, McGue, & Iacono, 2003; Elkins, McGue, & Iacono, 1997). Items were rated on a 4-point scale (1 = *definitely false* and 4 = *definitely true*). Reliability in the present study was strong for both youth and caregiver reports.

Daily diaries. The youth and caregiver completed daily diaries during the 4-day period when the youth wore the EAR.

Caregiver–reported negative caregiver–youth interactions. The caregiver daily diary was adapted from the Parent Child Home Data Questionnaire (Margolin, 1990). The caregiver–reported *negative caregiver–youth interactions* composite consisted of nine items rated on a 5-point scale (1 = *not at all* and 5 = *a lot*).

Table 1
Descriptive Statistics

Descriptive variables	*M* (*SD*) or %	Range	Internal consistency	Interrater reliability, ICC(2, *k*)	Interrater reliability, ICC(2, 1)
Youth age	12.93				
Youth gender, % male	53.7				
Caregiver age, years	42.42 (7.85)				
% β-agonist use	79				
% inhaled corticosteroid use	72				
Median income range	$7,826–$31,850				
Measures of conflict					
Y-PEQ	1.52 (.50)		.89		
C-PEQ	1.56 (.57)		.88		
Y-NG	1.20 (.27)		.82		
C-NG	1.36 (.36)		.83		
EAR-observed interpersonal conflict	4.59 (4.74)	0–19	.39		
Composite					
Conflict	3.33% (3.66)			.91	.48
Youth yelling	0.66% (1.23)			.83	.30
Mother yelling	0.50% (0.77%)			.89	.43
Father yelling	0.11% (5.62%)			.92	.51
EAR-observed conflict with caregiver	2.13% (2.48)	0–11	.39		
Composite					
Mother−youth conflict	0.97% (1.56)			.97	.73
Youth yelling	0.66% (1.23)			.83	.30
Mother yelling	0.50% (0.77%)			.89	.43
Asthma symptom assessment					
Baseline self-reported asthma symptoms	2.11 (2.53)		.79		
Daily diary asthma symptom composite	1.28 (0.31)		.83		
EAR-observed wheezing	0.72% (1.60%)			.75	.34

Note. C = caregiver reported; EAR = Electronically Activated Recorder; ICC = intraclass correlation coefficient; NG = daily negative caregiver−youth interactions; PEQ = Parental Environment Questionnaire; Y = youth reported.

Sample items included *today I punished my child*, *today I yelled at my child*, and *today I was angry with my child*. Daily negative caregiver–youth interactions assessments were averaged across the 4-day period. Two participants' scores were missing and imputed using mean replacement.

Youth–reported negative caregiver–youth interactions. The youth daily diary consisted of items adapted from the Youth Everyday Social Interactions and Mood Scales (YES-I-AM; Repetti, 1996; Repetti & Polina, 1994) and the Child Home Data Questionnaire (Margolin, 1990). The youth-reported *negative caregiver–youth interactions* composite consisted of three items rated on a 3-point scale (1 = *not at all* and 3 = *a lot*). Items included: *my mom got mad at me today*, *I was angry with my mom today*, and *my mom punished me today*. Daily negative caregiver–youth interactions assessments were averaged across the 4-day period. Three participants' scores were missing and imputed using mean replacement.

EAR conflict. To observe conflict during daily interactions and specific behaviors associated with conflict (i.e., yelling), each child/adolescent wore the EAR (Mehl et al., 2001) using a belt clip or carried the EAR in their front pant pocket from the time they woke up until bedtime as they went about their daily lives. This study used two versions of the EAR.[1] Following the laboratory session, the EAR was worn for 4 days, beginning on a Thursday morning and ending on a Sunday evening or beginning on a Saturday morning and ending on a Tuesday evening in order to capture 2 weekdays and 2 weekend days. Recordings captured 50 s of sound every 9 min. Participants were provided with a CD containing their recordings, if requested, and were given the opportunity to delete files prior to coding. No participants chose to delete audio files.

Previous research with the EAR has suggested good psychometric properties, such that the sampling patterns are generalizable to an individual's daily behavior and satisfactory test–retest reliability has been established (Mehl et al., 2012). Through implementing a specific coding strategy using carefully defined behaviors to evaluate the presence or absence of a particular behavior with a training set of EAR recordings, high interrater reliability can be established (Mehl et al., 2012). Further, research has demonstrated that, within a brief time of wearing the EAR, participants habituate to the device (Mehl et al., 2012). In the present sample, EAR obtrusiveness was measured by counting the number of sound files that participants mentioned the EAR in daily life. The EAR was discussed in 1.24% of all valid waking files.

EAR data were coded using the Everyday Child Home Observation (ECHO; Slatcher & Tobin, 2012) coding system that specified the youth's current location, activity, mood, and behaviors related to specific types of caregiver–youth interactions. Only the behaviors of the youth and caregiver, who both provided consent for the study, were coded. EAR coders listened to all participant files before beginning coding and identified the youth participant and caregiver based on the frequency in which the speaker was found in sound files and a small snippet of spoken language recorded during the laboratory visit. Family members, neighbors, and other individuals in the youth participant environment were identified by contextual cues in the recording files (e.g., location, topic of conversation) and use of a daily activity log completed by the youth participant.

Intercoder reliability was determined by a set of training recordings (512 50-s recordings) independently coded by the 11 research assistants who transcribed and coded these data. Intraclass correlation coefficients (ICCs) based on a two-way random effects model were calculated for each coded behavior. Note that prior EAR studies (Mehl, Gosling, & Pennebaker, 2006; Mehl, Vazire, Holleran, & Clark, 2010; Tenney, Vazire, & Mehl, 2013) reported ICCs using the 2, *k* method, reflecting two-way random average ICCs across raters. These reliabilities tended to be high because one estimated the reliability for an average measure consisting of *k* codings, akin to a questionnaire with *x* items. However, because actual EAR codings (in this study and in prior EAR research conducted in other labs) were only coded by single raters, this led to an inflated estimate of interrater reliability. A more appropriate and conservative approach was to use the 2, 1 method (two-way random single measure) of computing ICCs, which represents the reliability for single raters.[2] We included estimates of ICCs using both approaches in Table 1 to allow for comparison with the typical magnitude of previous EAR study interrater reliabilities (2, *k*, to which our estimates compared very favorably) and to provide estimates of the "true" reliability of these EAR codes using the 2, 1 method. As would be expected, the reliability estimates using the 2, 1 method were substantially lower than when using the 2, *k* method.

Scores for each EAR-observed behavior reflect the percentage of total recordings that the behavior was observed during waking hours. Participants had an average of 219.54 (SD = 81.66) waking audio files, which is equivalent to 183.95 min of valid audio files. Participants had an average of 96.65 (SD = 43.05) talking files. Conflict in this coding scheme was defined as an interpersonal argument, conflict, or fight between the participating youth and individuals in their environment. Examples of dialogue from files with conflict coded between youth and caregiver found in the EAR files include "Leave it here please, can you turn that down a bit for me? Turn it down. Turn it down please. Turn it down now," "I don't want to, no, no. I like it this way," "Hold on a second, I'm coming. God," and "Why are you making such a big deal out of this, geez?" Yelling was defined as very loud speech or scream. Given the low base rates of the conflict and yelling found in the EAR files, two composite measures were computed to capture interpersonal and caregiver–youth–related conflict. Composite measures were computed by summing the individual EAR-observed behaviors.

The first composite, *interpersonal conflict*, captured all conflict in the youth environment, including conflict, yelling by the mother/female caregiver, yelling by the father/male caregiver, and yelling by the youth codes. The conflict code included conflict in the environment experienced or witnessed by the child, including conflict with a caregiver, peers, and siblings and conflict between other family members, (e.g., between a caregiver and another child in the family). This composite reflected the experience of conflict in participants' daily lives.

[1] The first version used in this study (HP iPAQ 110) was 4.59 × 2.71 × 0.54 in. and weighed 4.08 ounces. The second version used in this study (Apple iPod touch, 8GB) was 4.4 × 2.3 × 0.28 in. and weighed 3.56 ounces.

[2] We thank an anonymous reviewer for suggesting this alternative approach to computing intraclass correlation coefficients.

The second composite was limited to *caregiver–youth conflict*, including coded conflict specifically between mother/female caregiver and participating youth, yelling by the mother/female caregiver, and yelling by the youth. Although one caregiver–youth dyad enrolled in the study included a father, this youth also had a mother who participated in his caregiving at home and was included in this composite. This composite was limited to the experience of conflict between the youth and their caregiver.

Although the interrater reliabilities of the specific EAR conflict codes all were acceptable—based on comparisons with ICCs (2, *k*) reported in prior EAR studies)—the alpha levels for the caregiver–youth conflict and interpersonal conflict composites were quite low due to small correlations between youth yelling and the more general EAR conflict codes (*r* range: .15−.21). However, the youth yelling codes (both the code assessing yelling in the presence of the mother and the more general youth yelling code) correlated significantly with youth daily reports of negative caregiver–youth interactions (*r* range: .28−.39) and with maternal daily reports of the youth being angry that day (*r* range: .30−.32). Thus, on both theoretical grounds and for parsimony of conducting analyses, we retained the youth yelling codes in the conflict composites rather than analyzing yelling separately.

Asthma symptoms. Severity of youth asthma symptoms was assessed with a self-report questionnaire in the laboratory, daily diary questionnaire, and with the EAR. The Self-Reported Asthma Symptom Questionnaire completed during the baseline laboratory session by the youth participant has been validated in an interview format for youth with asthma (Chen, Chim, Strunk, & Miller, 2007) and these items were chosen based on the National Asthma Education and Prevention Program, Expert Panel Report 2 (National Asthma Education and Prevention Program, 1997). Youth participants were asked the number of days in the past 2 weeks during which they experienced any asthma symptoms; this included wheezing, shortness of breath, coughing, tightness in their chest, and the number of nights awoken due to asthma symptoms. The mean for this scale was 2.11 ($SD = 2.53$; $\alpha = .79$.). One participant's scores were missing and imputed using mean replacement.

Self-reported asthma symptoms also were included in the youth daily diary. Youth were asked to rate asthma symptoms experienced that day on a 5-point scale, with high scores indicating more severe symptoms. Symptoms included wheezing, chest pain, chest tightness, and shortness of breath ($M = 1.28$, $SD = 0.31$; $\alpha = .83$). Two participants' scores were missing and imputed using mean replacement.

From the ECHO coding system, we used the wheeze code as an EAR-observed measure of asthma symptoms in the analyses. Wheezing was chosen as an observational measure of asthma symptoms due to the strong relationship demonstrated in previous research between asthma and wheezing (Arshad, Kurukulaaratchy, Fenn, & Matthews, 2005; Baughman & Loudon, 1984). Wheezing was defined as any audible signs of shortness of breath, including coarse or continuous whistling sounds (Shim & Williams, 1983).

Medications. Current inhaled steroid medication prescriptions and β-agonist medications were abstracted from medical records. Two dummy codes were created for each inhaled steroid and β-agonist use, 0 (*no medication prescribed*) and 1 (*medication prescribed*). Four medical records did not mention medication prescription and those records were coded as 0.

Analysis Plan

Outliers in all measures and EAR codes were winsorized to 2.5 *SD* from the mean to limit the influence of extreme values (Barnett & Lewis, 1994; McIntosh et al., 2014; Wilcox, 1998). Winsorizing is a common strategy used to reduce the influence of possible spurious outliers, particularly in a relatively small sample like this one (Hansen, Vaughan, Cavanaugh, Connell, & Sikkema, 2009; Madlensky et al., 2008). Due to positive skew, independent and dependent variables were base-10 log transformed with an added constant to prevent zeros and negative numbers.[3] After winsorizing and log-transforming the data, normality was substantially improved and skewness was reduced to between −1 and +1 for all variables. Bivariate correlations initially were conducted to examine the relationships between study variables and to discern any age- or gender-related differences. Hierarchical multiple regression analyses were conducted to assess which measures of conflict (EAR, daily reports) were independently associated with baseline and daily measures of asthma symptoms. EAR-conflict composites were entered first into the regression equation, then daily self-reports of conflict were entered in Step 2 to determine if the relationship between EAR composites and asthma symptoms were still significant when adding daily self-reported conflict measures. Covariates were included in regression analyses if they correlated with the asthma outcome measures ($p < .10$; e.g., youth ethnicity). In the regression models, 0 was coded for African American or Black and 1 was coded for the White/Caucasian, Hispanic, and Asian. Previous research has controlled for youth age, gender, inhaled steroid medication, β-agonist medications, and income (Marin et al., 2009; G. E. Miller, Gaudin, Zysk, & Chen, 2009); however, these variables did not correlate with asthma outcomes in this study ($p > .10$); thus, they were not included as covariates in the analyses. As mentioned earlier, due to technological problems early in this pilot study, 33% of the EAR data was missing. Thus, we also ran multiple imputation for the complete sample of 81 families to account for this large percentage of missing data (as well as any missing data for other variables); the results of those analyses can be found in the online supplemental materials.

Results

Naturalistically Observed and Self-Reported Conflict

We first examined bivariate correlations between caregiver–reported, youth–reported, and EAR-observed measures of conflict. Table 2 presents bivariate correlations between all study measures. Notably, there were no associations between EAR-observed conflict composites and the baseline self-reported measures of conflict (e.g., caregiver and youth PEQ conflict). However, daily diary reports of negative interactions from the caregiver correlated significantly with baseline caregiver–reported conflict (e.g., caregiver PEQ), youth daily reports of negative interactions, EAR-observed interpersonal conflict, and EAR-observed caregiver–youth conflict. Additionally, youth daily diary reports of negative interactions correlated significantly with baseline youth-reported conflict

[3] For the data transformations, .51 was added to caregiver–reported daily negative interactions, .01 was added to the Self-Reported Asthma Symptom Questionnaire. For the remaining variables, .001 was added.

Table 2
Bivariate Correlations Between Study Variables

	2	3	4	5	6	7	8	9	10	11
1. Y-age	−.05	.25†	.05	.13	−.06	−.14	−.01	−.05	.03	−.03
2. Y-ethnicity		−.04	−.18	−.04	−.01	.03	−.09	.12	−.05	−.25†
3. Y-PEQ			.26†	.33**	.05	−.10	−.05	.14	.13	−.22
4. C-PEQ				.19	.35**	.07	.05	−.13	−.12	−.10
5. Y-NG					.43**	.25†	.26†	.19	.40**	.00
6. C-NG						.46**	.48**	.02	.16	.11
7. EAR-observed interpersonal conflict							.82**	.27*	.32*	.36**
8. EAR-observed caregiver-youth conflict								.25†	.23†	.39**
9. Baseline self-reported asthma symptoms									.48**	.17
10. Daily diary asthma symptom composite										.01
11. EAR-observed wheezing										

Note. C = caregiver reported; EAR = Electronically Activated Recorder; NG = daily negative caregiver−youth interactions; PEQ = Parental Environment Questionnaire; Y = youth reported.
† $p < .10$. * $p < .05$. ** $p < .01$.

(e.g., youth PEQ) and marginally with EAR-observed measures of interpersonal conflict and caregiver–youth conflict. Further, EAR-observed interpersonal conflict and EAR-observed caregiver–youth conflict were strongly associated, as would be expected given the composite codes share overlap (e.g., yelling by the mother and yelling by the youth).

Conflict and Asthma Symptoms

We next explored the associations between the measures of conflict and asthma symptoms (see Table 2). Notably, there were no significant relationships between caregiver or youth baseline self-reported conflict and asthma symptoms or EAR-observed wheezing. However, with the daily diaries and EAR-observed measures, various relationships emerged. Daily youth reports of negative caregiver–youth interactions were significantly associated with greater daily asthma symptoms. EAR-observed interpersonal conflict was significantly associated with greater baseline self-reported asthma symptoms and daily asthma symptoms, whereas EAR-observed caregiver–youth conflict was only marginally associated with both asthma measures. Both EAR-observed interpersonal conflict and EAR-observed caregiver–youth conflict were significantly associated with greater EAR-observed wheezing.

Interpersonal Conflict and Asthma Symptoms

We next conducted several hierarchical multiple regression analyses to examine the independent effects of EAR-observed interpersonal conflict and daily diary measures of conflict on asthma symptoms. As displayed in Table 3, EAR-observed interpersonal conflict and the daily diary indices of conflict (e.g., youth-reported negative caregiver–youth interactions, caregiver-reported negative interactions) were entered as predictors. EAR-observed interpersonal conflict predicted increased baseline self-reported asthma symptoms and, when daily reports of conflict where added to the regression, remained a significant predictor.

EAR-observed interpersonal conflict also predicted increased asthma symptoms reported using daily diary and, when daily reports of conflict where added to the regression equation, the relationship remained significant. Notably, when entering daily reports of conflict, youth daily ratings of caregiver–youth conflict also significantly predicted daily-reported asthma symptoms, along with EAR-observed interpersonal conflict.

Table 3
Multiple Regression Analyses With EAR Interpersonal Conflict and Daily Caregiver and Youth Reports Predicting Asthma Symptoms

Predictor variables	Self-Reported Asthma Symptom Questionnaire β	Daily diary reported asthma symptoms β	EAR-observed wheezing β
Step 1	$R^2 = .07$, $F(1, 52) = 4.09^*$	$R^2 = .11$, $F(1, 52) = 6.08^*$	$R^2 = .13$, $F(1, 52) = 7.81^{**}$
EAR-observed interpersonal conflict	.27*	.32*	.36**
Step 2	$\Delta R^2 = .05$, $F(3, 50) = 2.27^\dagger$	$\Delta R^2 = .12$, $F(3, 50) = 4.79^{**}$	$\Delta R^2 = .01$, $F(3, 50) = 2.72^\dagger$
EAR-observed interpersonal conflict	.32*	.29*	.40**
Y-NG	.20	.38**	−.08
C-NG	−.21	−.14	−.04
Step 3			$\Delta R^2 = .05$, $F(4, 49) = 2.99^*$
EAR-observed interpersonal conflict			.39*
Y-NG			−.07
C-NG			−.04
Y-ethnicity			.24†

Note. C = caregiver reported; EAR = Electronically Activated Recorder; NG = daily negative caregiver−youth interactions; Y = youth reported.
† $p < .10$. * $p < .05$. ** $p < .01$.

Table 4
Multiple Regression Analyses With EAR Caregiver−Youth Conflict and Daily Caregiver and Youth Reports Predicting Asthma Symptoms

Predictor variables	Self-Reported Asthma Symptom Questionnaire β	Daily diary reported asthma symptoms β	EAR-observed wheezing β
Step 1	$R^2 = .06$, $F(1, 52) = 3.43^{\dagger}$	$R^2 = .05$, $F(1, 52) = 2.93^{\dagger}$	$R^2 = .15$, $F(1, 52) = 9.33^{**}$
EAR-observed caregiver−youth conflict	$.25^{\dagger}$	$.23^{\dagger}$	$.39^{**}$
Step 2	$\Delta R^2 = .05$, $F(3, 50) = 2.00$	$\Delta R^2 = .13$, $F(3, 50) = 3.62^{*}$	$\Delta R^2 = .01$, $F(3, 50) = 3.33^{*}$
EAR-observed caregiver−youth conflict	$.30^{*}$	.17	$.45^{**}$
Y-NG	.20	$.39^{*}$	−.09
C-NG	−.21	−.09	−.07
Step 3			$\Delta R^2 = .04$, $F(4, 49) = 3.25^{*}$
EAR-observed caregiver−youth conflict			$.42^{**}$
Y-NG			−.08
C-NG			−.06
Y-ethnicity			.21

Note. C = caregiver reported; EAR = Electronically Activated Recorder; NG = daily negative caregiver−youth interactions; Y = youth reported.
$^{\dagger} p < .10$. $^{*} p < .05$. $^{**} p < .01$.

EAR-observed interpersonal conflict significantly predicted EAR-observed wheezing. When including daily reports of caregiver–youth conflict in the regression, EAR-observed interpersonal conflict remained significant. After the addition of youth ethnicity, the relationship between EAR-interpersonal conflict and EAR-observed wheezing remained significant. Youth ethnicity had a marginally significant relationship with EAR-observed wheezing.

Caregiver–Youth Conflict and Asthma Symptoms

We then conducted several hierarchical multiple regression analyses to examine the independent effects of EAR-observed caregiver–youth conflict and daily diary measures of conflict on asthma symptoms. As displayed in Table 4, EAR-observed caregiver–youth conflict and the daily diary indices of conflict (e.g., youth-reported negative caregiver–youth interactions, caregiver–reported negative interactions) were entered as predictors. EAR-observed caregiver–youth conflict was marginally associated with increased baseline self-reported asthma symptoms. When adding daily measures of conflict into the regression equation, EAR-observed caregiver–youth conflict significantly predicted increased baseline self-reported asthma symptoms.

EAR-observed caregiver–youth conflict was marginally associated with daily reported asthma symptoms. When including daily diary reports of conflict, youth reports of negative interactions emerged as a significant predictor of daily-reported asthma symptoms and not EAR-observed caregiver–youth conflict.

Finally, EAR-observed caregiver–youth conflict significantly predicted EAR-observed wheezing. When including daily reports of caregiver–youth conflict in the regression, EAR-observed caregiver–youth conflict remained significant. After the addition of youth ethnicity, the relationship between EAR-observed caregiver–youth conflict and EAR-observed wheezing remained significant.[4]

Discussion

This study investigated the relationship between different assessments of conflict in the lives of youth with asthma and the links between measures of conflict in the social environment of youth and measures of asthma morbidity. The findings indicate that the EAR-observed measures of conflict are more strongly related to daily measures of conflict than traditional laboratory measures assessing family conflict in this study. Furthermore, the findings of this study suggest that daily interpersonal conflict and caregiver–youth conflict are associated with youth asthma symptoms across multiple methods of asthma symptom assessment, including traditional self-reported symptoms, daily reports, and wheezing observed in everyday life. The significant associations between conflict in the home and increased asthma symptoms in youth are consistent with previous findings that demonstrated the impact of more general family factors and relationships on asthma (Chen, 2007; G. E. Miller & Chen, 2010; Northey et al., 1998; Shalowitz et al., 2001) and with previous EAR research that highlighted the specific deleterious effects of conflict in the home on the stress−response pathways of young children (Slatcher & Robles, 2012).

Although we found positive associations between naturalistically observed measures of interpersonal and caregiver–youth conflict with asthma symptoms, we found no associations between baseline questionnaire reports of conflict and asthma symptoms. Few associations between daily conflict reports and asthma symptoms were found, which could be partly related to the fact that both reports were provided by the same rater—the youth participant—whereas the parent-reported conflict was unrelated to asthma symptoms. The multimethod approach used here allowed for direct comparison of naturalistically observed family interactions with traditional self-report questionnaires and daily diary reports of family relationships. These data provide compelling evidence for the addition of naturalistic observation and daily diary methods when assessing specific behaviors within the social environment of children and adolescents, especially given the magnitude of the

[4] We also conducted these analyses using multiple imputation to examine the complete sample of 81 caregiver–youth dyads and found similar patterns of relationships between EAR-assessed conflict and self-reported, daily, and EAR-observed asthma symptoms. These analyses are described in the online supplemental materials.

effect sizes of the relationships between conflict and asthma symptoms. Similar patterns were observed with general interpersonal conflict and caregiver–youth conflict, such that both conflict measures significantly predicting increased self-reported asthma symptoms and EAR-observed wheezing, providing important evidence that both types of conflict are important to asthma symptom expression.

The effects of conflict on youth asthma symptoms reported here could be explained by a number of possible mechanisms. It is possible, for instance, that youth are unable to sufficiently cope with the stress of frequent family conflicts or lack adaptive coping strategies impacting biological processes through inflammatory pathways and/or hypothalamic−pituitary−adrenocortical dysregulation, mechanisms theorized to underlie links between childhood adversity and health (G. E. Miller et al., 2011). In the adult literature, exposure of individuals with asthma to stressors is associated with greater eosinophil counts, greater lymphocyte proliferation, and higher levels of proinflammatory cytokines (Segerstrom & Miller, 2004). Other research has demonstrated that greater levels of family stress (Marin et al., 2009) and low socioeconomic status (Chen et al., 2006) are associated with a greater inflammatory response in youth with asthma (e.g., interleukin [IL]-4, IL-5, and IL-13). Another possible mechanism for this relationship between conflict and asthma symptoms is through health behaviors; youth who do not have sufficient coping strategies or resources to manage daily conflict may be less likely to engage in positive health behaviors important to asthma management (e.g., medication adherence, healthy diet, exercise). Future longitudinal studies examining these potential mediators and others are needed to provide a more complete picture of how family social relationships "get under the skin" to affect youth health and well-being.

The study has several limitations. The main limitation is the cross-sectional design, which prevented us from drawing firm conclusions about causal effects of interpersonal and caregiver–youth conflict on asthma symptoms. It is possible that these effects are bidirectional or that other factors not assessed here are leading to both greater conflict and increased asthma symptoms. Additionally, it is possible that social desirability may have influenced youth and caregiver reports of the caregiver–youth relationship or tempered the amount of conflict displayed in the EAR recordings, but, if anything, self-monitoring—which tends to be very low in EAR studies (Mehl et al., 2012)—would be expected to underestimate rather than overestimate the effects of observed conflict on asthma symptoms. There also are limitations inherent with our naturalistic event-sampling approach; given the low base rates of conflict behaviors picked up by the EAR, it is possible that more frequent or longer sampling periods and/or more days of sampling would capture conflict behaviors with greater precision. Additionally, given EAR-observed interpersonal conflict and EAR-observed caregiver–youth conflict are composite measures created using overlapping EAR-observed variables (e.g., yelling by the mother/female caregiver, yelling by the youth), it is possible that the findings displayed here are due to this similar overlap and thus this should be further investigated in future EAR studies. Furthermore, although naturalistically observed wheeze is a novel frequency-based measure of asthma symptoms, the fair interrater reliability, and small correlation with the Self-Reported Asthma Symptom Questionnaire may limit the validity of the measure; future work should examine the associations between EAR-observed wheezing and peak expiratory flow, an important measure in management of asthma symptoms. Lastly, in using an electronic sampling device, we encountered problems during data collection that resulted in a sizable percentage of missing data and thus a small sample size. Supplementary analyses were conducted with multiple imputation to account for the missing data and to improve statistical power.

These findings demonstrate a link between daily conflict and youth health. The associations between naturalistically observed conflict and asthma symptoms have important implications for clinical practice and research. Given the relationship between caregiver–youth conflict and interpersonal conflict and the health of youth with asthma, interventions aimed at the family, rather than the caregiver or youth individually, may prove most beneficial. Future research will benefit from including naturalistic observations and daily reports of behaviors coupled with biological assessments (e.g., inflammatory biomarkers, genetic markers) and a prospective approach to determine mediators and moderators of these relationships; prospective data we are currently collecting will, we anticipate, help to identify mediators and moderators. Additionally, using daily reports and naturalistic observation strategies will allow for intense, short-term, longitudinal follow-up that can help to identify patterns of change within the social environment and asthma symptoms. Further, future research might assess aspects of resilience and contributing factors in daily life for children and adolescents, because previous research has identified protective qualities (e.g., positively reappraising stress, persisting with future goals) for health in adults who grew up in low socioeconomic households (Chen, Miller, Lachman, Gruenewald, & Seeman, 2012). Extending this research to more diverse samples, including families with individuals diagnosed with other chronic illnesses and/or psychological problems, may help to identify additional targets of interventions. To better generalize these findings, samples are needed with greater diversity in culture, socioeconomic status, family relationship status, and physical health status.

Conclusion

This study provides evidence for the importance of daily family interactions, specifically caregiver–youth interactions, on the health of developing youth. Observing family behaviors as they naturally unfold in daily life is a noteworthy strength of the study, in that it provides direct measurement of daily interactions and behaviors as they occur. The study is first to our knowledge to identify everyday behaviors within the social environment of youth that are linked to increased asthma symptoms in childhood and adolescence and it adds to the literature pointing to the importance of social interactions on youth health. These results can help medical professionals and researchers better understand the impact of daily and family interactions on health and inform intervention programs aimed at reducing the impact of negative family relationships on youth health.

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