

Family Obligations and Asthma in Youth: The Moderating Role of Socioeconomic Status

Phoebe H. Lam, Cynthia S. Levine,
and Jessica J. Chiang
Northwestern University

Madeleine U. Shalowitz and Rachel E. Story
NorthShore University HealthSystem, Evanston, Illinois

Robin Hayen, Rebecca N. Sinard, and Edith Chen
Northwestern University

Objective: Fulfilling family obligations—providing instrumental help to and spending time with family—is a common aspect of family relationships. However, whether fulfilling these obligations links with physical health remains unclear. In this study, we investigated whether fulfilling family obligations was associated with asthma outcomes among youth, and whether these associations differed depending on family socioeconomic status (SES). **Method:** Participants were 172 youth, 8 to 17 years of age ($M_{\text{age}} = 12.1$; 54% boys) who had been physician-diagnosed with asthma and reported on family-obligation frequency; completed the Asthma Control Test (ACT; Nathan et al., 2004), a clinical measure of asthma control; and completed a measure of airway inflammation (i.e., fractional exhaled nitric oxide). Parents also completed the ACT in reference to their asthmatic children and reported on family income. **Results:** Fulfilling family obligations was not associated with asthma outcomes ($\beta s < .14$, $p s > .075$). However, SES (family income) interacted with family obligations, such that fulfilling family obligations was associated with greater airway inflammation (interaction term $\beta = -.17$, $p = .023$) and poorer parent-reported asthma control (interaction term $\beta = .15$, $p = .039$), only among youth from lower SES backgrounds. Exploratory analyses suggest that these interactions were robust against covariates and were largely consistent across age and the two dimensions of family-obligation behaviors. **Conclusion:** Findings from this study suggest that among youth from lower SES backgrounds, engaging in more frequent family-obligation behaviors may have negative repercussions in terms of their asthma.

Keywords: socioeconomic status, family obligations, asthma, youth

Asthma, a chronic lung disease that involves inflammation of the airways, is one of the most common chronic illnesses among youth (Zahran, Bailey, Damon, Garbe, & Breyse, 2018). According to recent *Morbidity and Mortality Weekly Reports* by the United States Department of Health and Human Services, Center for Disease Control and Prevention, asthma affects the lives of

approximately 6 million American youth, accounting for about 13.8 million missed school days per year (Zahran et al., 2018) and 14% of all hospital emergency visits among youth aged 5 to 17 years (Ashman, Rui, & DeFrances, 2018). Health-care use is high among youth with asthma: 71% make routine-care visits, 5% were hospitalized, and 54% reported at least one asthma attack in the past year that resulted in 17% having to visit an emergency department or urgent care (Zahran et al., 2018). In addition, asthma disproportionately affects youth from different demographic groups: Youth from families with lower income, as well as African American and Latin American youth (vs. European American youth) were more likely to be diagnosed with asthma (Zahran et al., 2018). Important to note, empirical evidence suggests that the social environment in which many youth are situated is linked to asthma (Chen, Chim, Strunk, & Miller, 2007; Chen et al., 2017; Klinnert et al., 2001). In this paper, we focused on the links between family social environment and asthma.

Research has long shown that youth interactions and relationships with their families are important for their health (Amato & Keith, 1991; Chen, Brody, & Miller, 2017; Repetti, Taylor, & Seeman, 2002; Wegman & Stetler, 2009). For instance, family environments marked by conflict, lack of parental support, and chaos have been linked with worse physical health-related out-

Phoebe H. Lam, Department of Psychology, Northwestern University; Cynthia S. Levine and Jessica J. Chiang, Department of Psychology and Institute for Policy Research, Northwestern University; Madeleine U. Shalowitz, Research Institute, NorthShore University HealthSystem, Evanston, Illinois; Rachel E. Story, Department of Medicine, NorthShore University HealthSystem; Robin Hayen, Department of Psychology and Institute for Policy Research, Northwestern University; Rebecca N. Sinard, Department of Psychology, Northwestern University; Edith Chen, Department of Psychology and Institute for Policy Research, Northwestern University.

This research was supported by United States Department of Health and Human Services, National Institutes of Health Grant R01 HL108723.

Correspondence concerning this article should be addressed to Phoebe H. Lam, Department of Psychology, Northwestern University, 1801 Maple Avenue, Suite 2450, Evanston, IL 60201. E-mail: phobelam@u.northwestern.edu

comes, such as heightened inflammation, among youth (Miller & Chen, 2010; Repetti et al., 2002; Schreier, Roy, Frimer, & Chen, 2014; Troxel & Matthews, 2004). Furthermore, family functioning and interactions also have clinical relevance in the context of asthma; for example, conflicts with family (Chen, Bloomberg, Fisher Jr., & Strunk, 2003; Chen et al., 2006), lack of family support (Chen et al., 2007), poorer parent-child relationships in the form of insecure child attachment (Bleil, Ramesh, Miller, & Wood, 2000), parenting difficulties (Klennert et al., 2001), and low parental support (Miller, Gaudin, Zysk, & Chen, 2009b) have been linked with worse asthma outcomes. As such, it is not surprising that many current asthma-practice recommendations are aimed at the family (and not just the individual with asthma), such as keeping a clean house, and thus asthma management becomes a part of family life (Drotar & Bonner, 2009; Fiese, Wamboldt, & Anbar, 2005; Rosales, McQuaid, & Koinis-Mitchell, 2017). In sum, the different ways youth interact with their families have implications for their physical health, not only among healthy populations, but also among clinical populations such as asthma patients.

One normative but understudied way in which youth interact with their families day to day is through fulfilling family obligations. Family obligations refer to the behaviors youth engage in to provide tangible help to their families (e.g., cooking, cleaning home, and caring for siblings) and to spend time with them (e.g., visiting extended family members; Fuligni, Tseng, & Lam, 1999; Hardway & Fuligni, 2006). These behaviors can be normative components of youth's everyday interactions with their families (Bianchi & Robinson, 1997; Cogle, Tasker, & Morton, 1982; Fuligni et al., 1999; Gager, Sanchez, & Demaris, 2009; Hoffert & Sandberg, 2001), with daily-diary estimates indicating that youth can spend approximately 7 hours a week fulfilling family obligations (Fuligni, Yip, & Tseng, 2002; Gager et al., 2009; Hardway & Fuligni, 2006; Larson & Verma, 1999). This amount of family-obligation time was shown to be comparable to other activities significant to youth, such as studying or socializing with peers (Hardway & Fuligni, 2006), and has been linked with psychological well-being. In the present study, we examined whether these normative obligatory behaviors have implications for physical health, specifically in youth with asthma, and investigated whether the health correlates of family obligations may be different depending on whether youth come from low or high socioeconomic status (SES) family backgrounds.

Family Obligations and Psychological Well-Being

The majority of studies that have examined the link between engaging in family-obligation behaviors and health have focused on psychological well-being. In some studies, engaging in family-obligation behaviors has been linked with positive psychosocial outcomes, such as greater positive mood, greater satisfaction with life, and better interpersonal outcomes (East, Weisner, & Reyes, 2006; Kuperminc, Wilkins, Jurkovic, & Perilla, 2013; Telzer & Fuligni, 2009). However, in other studies, engaging in family-obligation behaviors has been linked with negative psychosocial outcomes, such as greater feelings of demand and burden, more stress, and poorer academic achievement (Early, Cushway, & Cassidy, 2006; East et al., 2006; Kuperminc et al., 2013; Telzer & Fuligni, 2009; Tseng, 2004; Vasquez-Salgado, Greenfield, &

Burgos-Cienfuegos, 2015). These seemingly contradictory patterns may be explained by the meaning youth derive from fulfilling family obligations (East, 2010; Goodnow & Lawrence, 2001; Kuperminc et al., 2013; Telzer & Fuligni, 2009; Weisner, 2001). For example, in one study, helping the family provided youth with a sense of role fulfillment (i.e., the sense of being a good child or a good sibling), which in turn was associated with greater positive mood, despite experiencing greater demands from family (Telzer & Fuligni, 2009). Thus, although fulfilling family obligations can be stressful and demanding for youth, it may also be associated with greater psychological well-being when it provides opportunities for role fulfillment in the family.

Family Obligations and Physical Health

The existing theory and empirical research on the link between family obligations and physical health is relatively limited and, to some extent, inconclusive about whether such a link exists. Some researchers have theorized that, because engaging in more family-obligation behaviors can increase feelings of stress and demand (East et al., 2006; Kuperminc et al., 2013; Telzer & Fuligni, 2009) and because these psychological states have been linked with worse physical health (McEwen, 2000; Miller, Chen, & Cole, 2009a; Miller, Cohen, & Ritchey, 2002), engaging in family-obligation behaviors may be linked with *worse* physical health. Indeed, one study found that youth who spent more time providing help for the family had higher levels of systemic inflammation, as measured by C-reactive protein and soluble interleukin-6 receptor (Fuligni et al., 2009). However, empirical support for this hypothesis that family obligations is linked to worse health does not emerge consistently. The one other study that has explored the relationship between family obligations and physiological outcomes showed that doing household chores was not associated with youth's cortisol profiles (McHale et al., 2012). Thus, previous literature on the link between family obligations and physical health is scarce and findings are inconclusive among the emerging studies.

The Role of Context: SES

The mixed findings for the link between family obligations and health suggests that there may be contextual moderators influencing the relationship, such that the health implications of family obligations may depend on the family context in which these behaviors take place. One context variable that may be relevant is SES. The family environments associated with low SES are very different from those associated with high SES (Chen & Miller, 2013). For example, families from lower (vs. higher) SES backgrounds are often characterized as having less stability in daily family routines (Jensen, James, Boyce, & Hartnett, 1983), more frequent conflicts (Conger & Elder, 1994), and higher parental demands for youth (Conger & Elder, 1994; McLoyd, 1990). These SES-related differences in family environments may have differential implications for the experience and meaning of fulfilling family obligations (Lehman, Taylor, Kiefe, & Seeman, 2005). For example, in low SES families, family members may be more dependent on youth helping out, thereby increasing their demands (Burton, 2007; Tseng, 2004). Moreover, in low SES households, family obligations may be perceived as mandatory, making the

experience more stressful and burdensome (Burton, 2007; Evans, Gonnella, Marcynyszyn, Gentile, & Salpekar, 2005). For instance, knowing that there is no one else to take care of younger children, youth from lower SES families may experience this task as particularly demanding. As such, fulfilling family obligations may be associated with worse health among youth from lower (vs. higher) SES backgrounds. Consistent with this hypothesis, one study of healthy youth found higher levels of inflammation (i.e., higher levels of inflammation and higher proinflammatory cytokine production in response to bacterial stimulation) among youth who both provided a lot of help to their families and perceived their families as making a lot of demands on them, as compared with youth who provided more help, but experienced less demand (Levine, Hoffer, & Chen, 2017). Further, low SES families may have more conflict and difficulties communicating with one another (Conger & Elder, 1994). Having to fulfill family obligations in high-conflict contexts may make the experience even more stressful. Following this reasoning, one study found that providing help for family was associated with cigarette and alcohol use only among adolescents from households with high levels of conflict, but not among adolescents from households with low levels of conflict (Telzer, Gonzales, & Fuligni, 2014). Taken together, we similarly hypothesized that engaging in family obligations may be more strongly associated with worse health outcomes among youth from lower (vs. higher) SES backgrounds (McEwen, 2012; Miller et al., 2009a).

Current Investigation

The present study was an investigation of the relationships among SES, family obligations, and physical health in youth. Because of the high prevalence and impact of asthma in youth and because of the significant role of the family around asthma, it provided a useful model for studying the interplay between SES and family obligations in a disease context in children. In a sample of youth who were physician-diagnosed with asthma, we tested whether SES would interact with family obligations to predict multiple asthma outcomes, including clinical measures of asthma control and a noninvasive measure of airway inflammation (fractional exhaled nitric oxide; FeNO). We hypothesized that family-obligation behaviors carried out in low-SES environments would be associated with worse asthma outcomes, whereas family-obligation behaviors in higher-SES environments would not be associated with asthma outcomes. Additional exploratory analyses examined whether the SES \times Family Obligation interactions were robust against additional potential confounds (such as medical, environmental, and family-structure covariates) and whether the interactions were consistent across age and across the two dimensions of family-obligation behaviors (i.e., helping the family vs. spending time with the family).

Method

Participants

Participants were 172 youth (59% European American), 8 to 17 years of age, who had been physician-diagnosed with asthma. They were recruited to be part of a larger research project aimed to investigate the neighborhood, family, and individual contributors

to asthma disparities. This paper focused on a family factor and its links with clinical measures of asthma and airway inflammation. The youth were recruited from the Chicago metropolitan area (i.e., nonrural regions) through one health-care system, NorthShore University HealthSystem, and one federally qualified health center, Erie Family Health Center. Families were fluent in English, participants had no current or history of any chronic physical illnesses (except for asthma), had no acute respiratory illness and were not on oral steroids at the time of visit. Youth visited the research lab with a parent (88% mothers) and completed all assessments in a single visit. Because our sample included younger youth, a reading assessment prior to administering questionnaires was conducted for youth under the age of 12. If they had difficulty with the reading screener, a research assistant read all questions out loud and helped explain terms. In addition, for all participants, the research assistant remained available for questions throughout the questionnaire period. Youth gave written assent, and parents provided written consent. This study was approved by Northwestern, NorthShore, and Erie institutional review boards (See Table 1 for a summary of sample characteristics).

Measures

Family obligation. Youth completed an adapted version of the current assistance measure (Fuligni et al., 1999) to report how often they typically engaged in family obligation activities. This scale includes 11 items describing two dimensions of family obligation: Providing Tangible Help for the Family (e.g., run errands that the family needs done, help out around the house) and Spending Time With Family members (e.g., spend time at home with family, spend time with extended family members). Items were rated on a 1 (*almost never*) to 5 (*almost always*) scale and averaged to create a family-obligation score, such that a higher score indicates more frequent engagement of family-obligation activities, $\alpha = .81$. The current assistance measure has demonstrated good internal consistency (Fuligni et al., 1999) and has been linked with more positive family relationships (Fuligni & Pedersen, 2002; Fuligni et al., 1999).

Airway inflammation. The concentration of nitric oxide in the airways has been shown to reflect the amount of inflammation (Kharitonov, O'Connor, Evans, & Barnes, 1995; Van Den Toorn et al., 2001). The concentration of nitric oxide in exhaled breath, or FeNO, was measured using an electrochemical analyzer (the NIOX system; Aerocrine AB, Solna, Sweden) following the American Thoracic Society Guidelines. Specifically, after one inhalation and one exhalation, youth inserted a mouthpiece, inhaled to total lung capacity, and then exhaled at a pressure of 10–20-cm H₂O for 10 s to maintain a constant flow rate of 50 ± 5 mL/s. Youth performed this test while standing and were presented with computer-based visual cues that facilitated maintenance of a constant flow rate. To ensure accuracy of the assessment, participants were not allowed to exercise or consume any food or caffeine one hour prior to the test. Because there were two extreme outliers (i.e., >3 SDs above the mean), FeNO was Winsorized such that the values of the two outliers were replaced with the next highest value.

Asthma control. Asthma control was reported by both the parent and the youth using the Asthma Control Test (ACT), a scale commonly used in clinical settings (Nathan et al., 2004). This scale

Table 1
Demographic Features and Descriptive Statistics (N = 172)

Variable	Mean (SD)	Percent (Frequency)
Age	12.06 (2.47)	
Sex—Male		41.3 (71)
Race/Ethnicity		
European American		58.7 (101)
African American		23.3 (40)
Asian American		5.8 (10)
Latino/Hispanic American		7.6 (13)
Other ethnicities		4.7 (8)
Family income		
Less than \$,5000		1 (1)
\$5,000–\$19,999		6.4 (11)
\$20,000–\$34,999		6.4 (11)
\$35,000–\$49,999		10.5 (18)
\$50,000–\$74,999		12.2 (21)
\$74,999–\$99,999		12.8 (22)
\$100,000–\$149,999		22.1 (38)
\$149,999–\$199,999		10.5 (18)
Higher than \$199,999		18.6 (32)
Asthma severity ^a	2.45 (.87)	
Use of inhaled corticosteroids ^b	2.61 (3.08)	
Use of beta agonists ^b	1.71 (2.30)	
Home-environment control ^c	3.85 (2.97)	
Exposure to second-hand smoke ^d	.54 (1.28)	
Family size	4.14 (1.24)	
Birth order—first born		43.0 (74)
Family obligation ^e	3.48 (.72)	
Airway inflammation (ppb) ^f	29.09 (25.23)	
Parent-reported asthma control ^g	20.62 (3.51)	
Youth-reported asthma control ^g	19.20 (3.59)	

^a Asthma severity ranged from 1 to 4, higher score indicated more severe asthma. ^b Use of medications refers to the number of times in the past week. ^c Home-environment control ranged from 1 to 9, higher score indicated better home-environment control. ^d Exposure to second-hand smoke refers to the average number of days per week. ^e Family obligation was rated from 1 to 5, with higher scores indicating more engagement of family-obligation behaviors. ^f For youth 12 or older, airway inflammation lower than 25 parts per billion (ppb) is considered low, between 25 to 50 ppb is considered intermediate, and higher than 50 ppb is considered high. ^g Parent-reported and youth-reported asthma control ranged from 8 to 25, with higher scores reflecting greater asthma control. Asthma control scores greater than 19 indicate well-controlled asthma.

has been shown to have good test–retest reliability (Schatz et al., 2006), as well as convergent and discriminant validity (Nathan et al., 2004; Schatz et al., 2006) among asthma patients 12 years and older. For youth reports, we chose to administer only one version of the ACT (the one intended for those 12 years and older) for all youth across all ages so that statistical analyses for the same measure could be conducted on the entire sample. For parent reports, similar to other studies (duRivage et al., 2017), the same ACT items completed by youth were adapted for parents to report on their children’s asthma condition (e.g., “During the past 4 weeks, how often has your child had shortness of breath?”). The ACT includes five items assessing asthma symptoms, use of rescue medications, the effects of asthma on daily functioning, and perceived asthma control over the past 4 weeks, rated on a 5-point scale and summed, such that higher scores indicated better asthma control ($\alpha_{\text{youth report}} = .72$; $\alpha_{\text{parent report}} = .80$). Consistent with previous literature (duRivage et al., 2017), parent- and youth-reported asthma control were moderately correlated, $r = .49$, $p < .001$.

SES. SES was measured by interviewing parents about their family income. Specifically, parents reported the total family income received from all members living in the household and from all sources of income (e.g., wages, government assistance, alimony) over the past 12 months. Family income is an established measure of SES (Oakes & Rossi, 2003), and consistent with measures of SES in our previous studies (Chen, McLean, & Miller, 2015; Schreier & Chen, 2010; Schreier et al., 2014).

Covariate variables. Demographic, medical, environmental, and family-structure variables were assessed as covariates. Demographic variables included youth age, sex (male vs. female), and race/ethnicity (European American vs. non-European American). Medical covariates included asthma severity and use of medications. Asthma severity was determined through a combination of symptoms and medications, as recommended by the National Asthma Education and Prevention Program/Expert Panel Report 2 guidelines (Bacharier et al., 2004) and ranged from 1 (*mild intermittent*) to 4 (*severe*). Use of medications referred to use of inhaled corticosteroids and use of β agonists (number of times in the past week). Environmental variables include exposure to second-hand smoke (average number of days per week) and home-environment control (a 9-point interviewer rating of environment control based on the Family Asthma Management System Survey (McQuaid, Walders, Kopel, Fritz, & Klinnert, 2005), a semistructured interview with youth and parents that probed exposures to environmental triggers, such as pets, and efforts to improve environment, such as use of air filters. Family-structure variables included family size (number of people living in the family home) and youth’s birth order.

Statistical Analyses

To test whether SES moderated the association between family obligation and asthma outcomes, a series of hierarchical regression analyses were conducted following the recommendations of Aiken, West, and Reno (1991). Specifically, asthma outcomes (i.e., airway inflammation, parent-reported asthma control, and youth-reported asthma control) were predicted from (a) demographic variables, (b) SES and family obligation, and (c) the interaction between SES and family obligation. Demographic variables, including race/ethnicity (given the substantial overlap between SES and race/ethnicity in the United States), gender, and age were included as covariates in all models. All continuous predictors were mean-centered, and dichotomous predictors were effect-coded. Significant interaction effects were followed up with tests of simple slopes between family obligation and asthma outcomes at ± 1 SD from the mean of SES. Secondary analyses tested the robustness of results by additionally controlling for medical (asthma severity and medication use), environmental (home-environment control and exposure to second-hand smoke), and family-structure (family size and birth order) covariates. Secondary analyses also tested whether results were consistent across dimensions of family-obligation behaviors by separately testing the Time Spent With Family \times SES interaction and the Family Assistance \times SES interaction. Finally, to test whether results were consistent across age, we tested the three-way interaction of Age \times SES \times Family Obligations.

Results

Preliminary Analyses

Simple correlations among study variables are presented in Table 2. Older age was associated with greater airway inflammation, boys (vs. girls) reported better asthma control, and European American (vs. non-European American) youth had less airway inflammation and better parent-reported asthma control.

SES, Family Obligations, and Asthma Outcomes

Results from all regression models are displayed in Table 3.

Airway inflammation. There was a significant interaction between SES and family obligation predicting airway inflammation, $\beta = -.17, p = .02$, with no main effects of either SES or family obligation. Specifically, greater family obligation was linked with greater airway inflammation only among youth from lower SES backgrounds, $\beta = .26, p = .010$, but not among youth from higher SES backgrounds, $\beta = -.08, p = .482$ (see Figure 1, Panel A).

Parent-reported asthma control. There was a significant interaction between SES and family obligation predicting parent-reported asthma control, with a main effect of SES, but no main effect of family obligation. The main effect of SES was such that higher SES was linked with greater parent-reported asthma control. The interaction effect, $\beta = .15, p = .04$, was such that, among youth from lower SES backgrounds, the association between family obligation and parent-reported asthma control was, $\beta = -.19, p = .055$, whereas among youth from higher SES backgrounds, the association between family obligation and parent-reported asthma control was $\beta = .11, p = .310$ (see Figure 1, Panel B).

Youth-reported asthma control. There was no significant interaction between SES and family obligation predicting youth-reported asthma control. There were no main effects for SES and for family obligation. Although the interaction was not statistically significant, tests of simple slopes indicated that, similar to the above outcomes, greater family obligation was linked with worse

youth-reported asthma control among youth from lower SES backgrounds, $\beta = -.21, p = .041$, but not among youth from higher SES backgrounds, $\beta = -.05, p = .693$.

Secondary Analyses

Were results robust when controlling for potential confounds?

Medical covariates. Because airway inflammation (FeNO) may be affected by medical covariates (Rodway, Choi, Hoffman, & Sethi, 2009; Taylor, Pijnenburg, Smith, & Jongste, 2006), we tested whether the SES \times Family Obligation interaction on airway inflammation was robust when controlling for asthma severity and medication use in addition to demographic variables. Results remained the same, interaction $\beta = -.17, p = .020$, suggesting that the SES \times Family Obligation on airway inflammation was independent of these medical covariates. We did not include asthma severity and medication use in analyses of asthma control because of the overlap in these variables—that is, medication use is part of the assessment of asthma control. In addition, because this was a sample of youth with preexisting asthma, asthma severity was determined through a combination of symptoms and medications, as recommended by the National Asthma Education and Prevention Program/Expert Panel Report 2 guidelines (Bacharier et al., 2004), which has overlap with the asthma-control variable.

Environmental covariates. We further tested whether the SES \times Family Obligation interactions were robust when controlling for home-environment control and exposure to second-hand smoke in addition to the demographic variables. Results remained the same, interaction $\beta s > .15, ps < .043$, suggesting that the SES \times Family Obligation interactions were not driven by environmental covariates.

Family-structure covariates. Because the oldest child of a household may have more family obligations and youth from larger families may have more family obligations than others, we tested whether the SES \times Family Obligation interactions were robust when controlling for birth order and family size, in addition to the demographic variables. Results remained the same, interac-

Table 2
Simple Correlations Among Study Variables ($N = 172$)

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Age	—													
2. Gender	.13	—												
3. Race/ethnicity	-.06	-.01	—											
4. Asthma severity	-.07	-.05	-.09	—										
5. Use of inhaled corticosteroids	-.15	.05	-.01	.27*	—									
6. Use of beta agonists	-.03	.13	-.15	.28*	.23*	—								
7. Home-environment control	-.14	-.07	-.07	-.08	.04	-.03	—							
8. Exposure to second-hand smoke	.16*	.02	-.02	-.14	-.04	.01	-.18*	—						
9. Family size	-.18*	-.04	.13	.01	.14	.14	-.06	-.02	—					
10. Birth order	-.08	-.02	.01	-.16*	-.03	-.14	.13	.19*	-.18*	—				
11. SES	.03	.05	.45*	-.12	.00	-.29*	.02	-.05	.24*	-.03	—			
12. Family obligation	-.25*	.16*	-.03	-.03	.07	.05	.09	-.06	.21*	.10	-.05	—		
13. Airway inflammation	.17*	.02	-.20*	-.10	-.12	.08	.03	-.02	-.12	-.03	-.17	.07	—	
14. Parent-reported asthma control	.11	-.08	.30*	-.37*	-.19*	-.54*	.06	-.06	.00	.18*	.31*	-.13	-.06	—
15. Youth-reported asthma control	.05	-.19*	.03	-.16	-.09	-.43	.10	-.07	-.11	.09	.12	-.18	.02	.49

Note. Gender was effect-coded such that male was coded -1 and female was coded 1. Race/ethnicity was effect-coded such that European American was coded 1 and non-European American was coded -1. Birth order was effect-coded such that first born was coded 1 and later born was coded -1.
* $p < .05$.

Table 3
Hierarchical Regression Analyses of SES and Family Obligation Predicting Asthma Outcomes ($N = 172$)

Variable	Airway inflammation	Parent-reported asthma control	Youth-reported asthma control
Step 1			
Age	$\beta = .16, p = .03$	$\beta = .14, p = .07$	$\beta = .08, p = .28$
Gender	$\beta = .00, p = .98$	$\beta = -.10, p = .18$	$\beta = -.20, p = .01$
Race/ethnicity	$\beta = -.19, p = .01$	$\beta = .31, p < .001$	$\beta = .03, p = .70$
Step 2			
SES	$\beta = -.11, p = .20$	$\beta = .22, p = .01$	$\beta = .14, p = .10$
Family obligation	$\beta = .12, p = .14$	$\beta = -.06, p = .43$	$\beta = -.14, p = .08$
Step 3			
SES \times Family Obligation	$\beta = -.17, p = .02$	$\beta = .15, p = .04$	$\beta = .08, p = .29$

Note. SES = socioeconomic status. Gender was effect-coded such that male was coded -1 and female was coded 1 . Race/ethnicity was effect-coded such that European American was coded 1 and non-European American was coded -1 .

tion β s $> .15$, p s $< .047$, suggesting that the SES \times Family Obligation interactions were independent of birth order and family size.

Were results consistent across different types of family-obligation behaviors? Family obligations theoretically encompass two dimensions: Helping the Family and Spending Time With Family members (Fuligni et al., 1999). It is possible that these two dimensions of family obligation may have differential correlates with health (e.g., regular engagement of helping the family may be more stressful and demanding than spending time with family members). Therefore, we tested whether similar interaction effects were apparent if family obligation was operationalized by focusing only on behaviors related to helping the family, $\alpha = .72$, or behaviors related to spending time with the family, $\alpha = .81$. Patterns of results largely remained the same, suggesting that the SES \times Family Obligation interactions were not driven by any one subscale: for Helping the Family, the interaction regression weight for airway inflammation was $\beta = -.17, p = .027$, the interaction regression weight for parent-reported asthma control was $\beta = .14, p = .061$; for Spending Time With Family, the interaction regression weight for parent-reported asthma control was $\beta = .15, p = .043$ and the interaction regression weight for airway inflammation was $\beta = -.10, p = .175$.

Were results consistent across different ages? Our sample allowed for examination of whether similar interaction effects were apparent across younger and older youth because it is possible that the interaction effects are different for youth of different ages (e.g., older youth may have more competing demands from school and work, making family-obligation behaviors more stressful for them than for younger youth). Therefore, we tested the three-way interaction, examining whether age moderated the SES \times Family Obligation interactions on asthma outcomes. There was no evidence that the SES \times Family Obligation interactions were different across ages (β s for three-way interaction terms $< .12$, p s $> .146$).

Discussion

Findings from the current study suggest that fulfilling family obligations in certain family contexts is associated with asthma outcomes in youth. Specifically, we found that engaging in family obligations was associated with greater airway inflammation and poorer parent-reported asthma control among youth from lower

SES backgrounds, but not among youth from higher SES backgrounds. This study builds on previous research documenting that family obligations can be detrimental to physical health (Fuligni et al., 2009) by examining this relationship in the context of a chronic illness and demonstrating that family obligations have relevance for disease outcomes. Our findings are consistent with previous research that found links between helping the family and worse health-related outcomes among youth who experienced more family conflicts (Telzer et al., 2014) and experienced greater demands from the family (Levine et al., 2017), both of which tend to be more common among youth from low-SES families.

A novel aspect of this study is that we examined an understudied type of family interaction that is typically performed to aid in family life (e.g., youth running errands for the family) and found that this type of aid may come with a cost for youth from low-SES backgrounds. One difference between this finding and other studies of family relationships and asthma is that the effect of family obligations was seen only in lower SES youth, whereas many studies of family relationships and asthma find main effects (Kaugars, Klinnert, & Bender, 2004; Wood, Miller, & Lehman, 2015), with a few exceptions (Mangan, Wittich, & Gerald, 2007). As such, this study's results highlight the importance of examining the context in which family behaviors take place.

Other researchers have suggested that because families from lower SES backgrounds often have fewer resources, youth may have to engage in family obligations more frequently than youth from high-SES families (Burton, 2007), which may negatively impact health. However, in this sample, SES was not associated with family-obligation frequency ($r = -.05$), suggesting that SES moderations were not because of SES-related differences in frequency, but instead may be because of differences in perceived meaning and experience of family obligations. For example, because alternative options for accomplishing the behaviors assessed in the obligation measure may not be readily available among lower SES families (Evans et al., 2005), youth may perceive family obligation tasks as mandatory duties that could lead to serious negative consequences if they fail to fulfill them, making the experience more burdensome and stressful (Gallant, Smale, & Arai, 2017).

In turn, more stressful psychological experiences have been linked with worse asthma outcomes among youth with asthma (Chen & Miller, 2007; Chen, Schreier, & Chan, 2012; Wright,

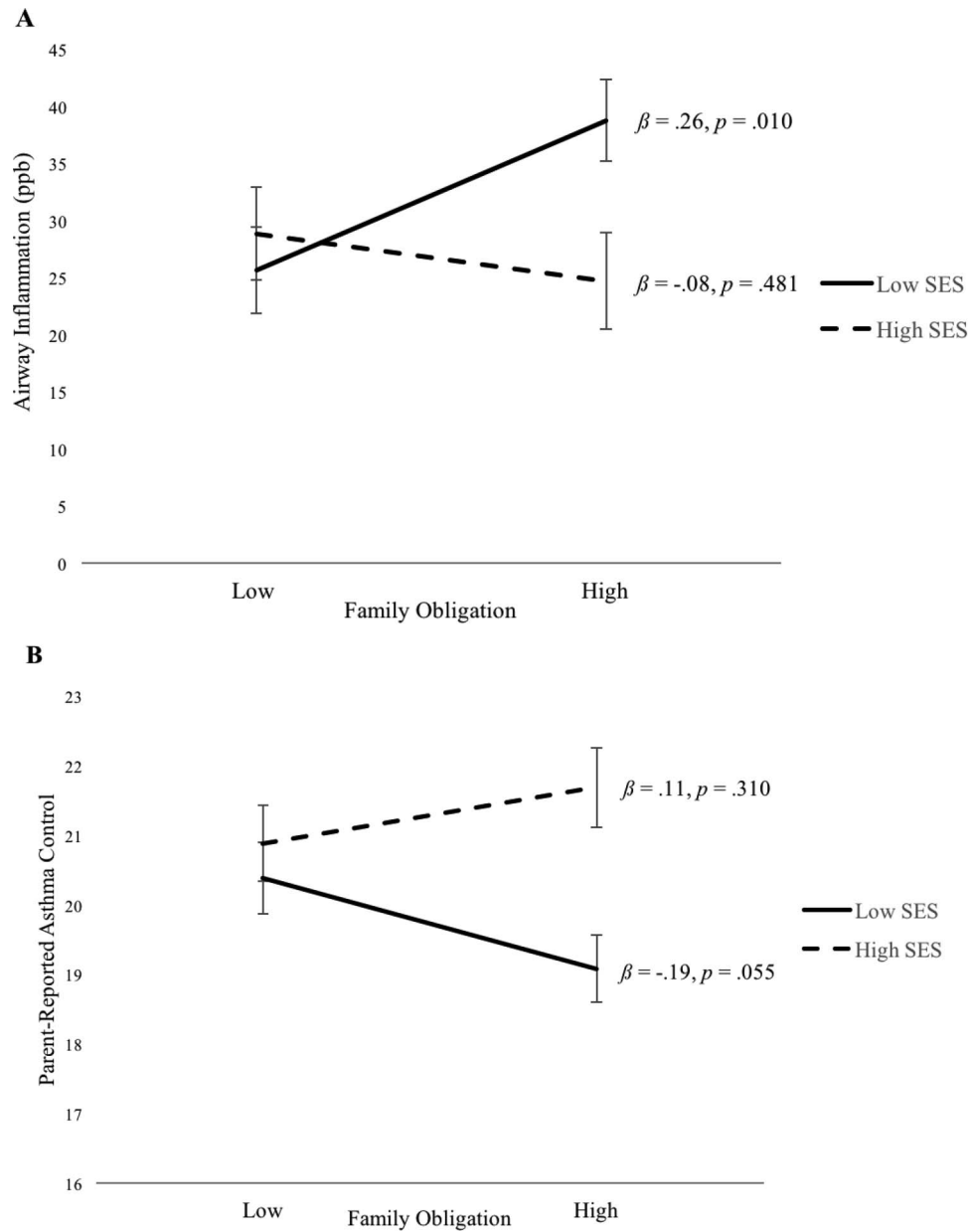


Figure 1. Interaction between SES and family obligation predicting airway inflammation (Panel A) and parent-reported asthma control (Panel B), controlling for demographic variables. Airway inflammation was measured with FeNO in parts per billion. The standardized regression coefficients (β s) and p -value notations refer to the estimated regression lines for the links between family obligation and asthma outcome at ± 1 SD of SES. Low and high family obligation also refers to ± 1 SD . Error bars reflect standard errors of asthma outcome scores at low SES (-1 SD) and low family obligation (-1 SD), at low SES and high family obligation, at high SES and low family obligation, as well as at high SES and high family obligation.

Rodriguez, & Cohen, 1998), which may be because psychological stress impacts asthma outcomes via biological pathways. For example, psychological stress is associated with greater production of cytokines in response to in vivo allergen challenges that are theorized to be instrumental in airway inflammation (Liu et al., 2002) and in vitro mitogen stimulation (Chen et al., 2006; Chen, Fisher, Bacharier, & Strunk, 2003). Second, psychological stress

may also impact asthma outcomes through behavioral pathways, such as self-management of asthma. For example, previous research has linked psychological stress with difficulty in managing asthma (Shalowitz, Berry, Quinn, & Wolf, 2001), as well as with lower adherence to medical treatments (Cluley & Cochrane, 2001).

Although there was a significant interaction between SES and family obligations for parent-reported asthma control, there was no

such interaction for youth-reported asthma control. The correlation between parent-reported and youth-reported asthma control was moderate ($r = .49$). Perhaps the parent reports captured a different perspective than the youth reports. Because youth age was as low as 8 years old, the youth reports may have had more errors or inaccuracies in reporting frequencies, such as missed school days because of asthma, compared to parent reports.

Exploratory analyses revealed no strong evidence that the SES \times Family Obligation interactions were driven more by helping the family versus by spending time with family. Helping behaviors are more physically demanding; however, spending time with family may take away time from other important activities for youth, such as socializing with friends and schoolwork, and thus both may be associated with negative asthma outcomes in lower SES youth. Exploratory analyses also revealed no evidence that age moderated the SES \times Family Obligation interactions, suggesting that such interactions were relatively similar across younger and older youth. Whereas younger (vs. older) youth from low-SES families may find obligation tasks more demanding (e.g., it may be more difficult for a younger youth to perform housework), older (vs. younger) youth may be put in charge of more difficult tasks (e.g., babysitting younger siblings, cooking for family), and thus may find them equally demanding. However, results for the three-way interactions should be considered tentative and should be followed up with a larger sample.

This study highlights the role that socioeconomic context plays in the link between family obligations and health. However, another influential context that may also shape these associations is race/ethnicity. Studies have found established racial/ethnic differences in how much youth value familism and engage in family-obligation behaviors. For example, studies have found that because of cultural traditions and immigrant status, youth from Asian, Latino/Hispanic, and African American backgrounds, compared with youth from a European background, typically place stronger importance on the idea of familism and communalism (Fuligni et al., 1999; Landale, Oropesa, & Bradatan, 2006) and spend more time fulfilling family obligations (Fuligni et al., 1999; Hooper, Wallace, Doehler, & Dantzler, 2012; Khafi, Yates, & Luthar, 2014; Telzer & Fuligni, 2009). Furthermore, the concept of family may be different across different races/ethnicities. Supporting this notion, some studies have shown that extended family integration, such as living with and having close contact with extended family, is more common among Latino/Hispanic American and African American families than European American families (Brown, Cohon, & Wheeler, 2002; Landale et al., 2006; Sarkisian, Gerena, & Gerstel, 2006). As such, because of differences in the value of familism, family-obligation behaviors, and conceptions of what constitutes a family, the SES by family obligation interactions may be different within different racial/ethnic groups. For example, because of stronger values on familism, Asian, Latino/Hispanic, or African American youth from lower SES background may reap more meaning and purpose through engaging in family-obligation behaviors, which may in turn be associated with better health outcomes and buffer against the effects of low SES. Furthermore, although these racial/ethnic minority groups may have similar emphasis on familism, it is important to acknowledge that each racial/ethnic group has unique practices, values, ideals that may further nuance the SES \times Family Obligation interactions. Unfortunately, because of our small sample sizes of Asian Americans

($n = 10$), Latino/Hispanic Americans ($n = 13$), and African Americans ($n = 40$), this study was unable to test the interactions within each racial/ethnic group. However, these analyses are important future directions, as they may provide a more refined understanding of how family relationships situated within the broader socioeconomic and racial/ethnic contexts contribute to childhood-asthma disparities.

The present study has several limitations. First, we relied on cross-sectional data; thus, although we propose that engaging in family obligation could negatively influence asthma outcomes among youth from low-SES backgrounds, neither causality nor directionality can be determined from these correlational results. Future research will benefit from applying longitudinal designs to test the prospective links between family obligation and asthma outcomes in youth from low- and high-SES backgrounds. Second, although there are racial/ethnic differences in family-obligation norms between youth from European backgrounds and those from Asian, Latin American, and African backgrounds (Fuligni et al., 1999; Hooper et al., 2012), unfortunately, we were not able to examine the specific roles of race/ethnicity. Our non-European American sample sizes (i.e., 10 Asian Americans, 13 Latino/Hispanic Americans, and 40 African Americans) were not large enough to have adequate statistical power to examine the SES \times Family Obligation interactions within any of these racial/ethnic backgrounds. We recognize that findings might be different within certain ethnic groups, thus, our results might be limited in their generalizability. Our findings represent results across a diverse sample of youth (youth of European, Asian, Latino/Hispanic, and African backgrounds), but it is possible that these results mask other interesting patterns that may emerge only within certain ethnic groups. Furthermore, because race/ethnicity has substantial overlap with SES in the United States, the SES \times Family Obligation findings may be confounded by race/ethnicity. Future research will benefit from recruiting a large sample of youth from specific racial/ethnic backgrounds, with varying degrees of SES within each, and examining the relationships among SES, family obligations, and health within specific racial/ethnic groups.

Third, although the ACT is an established clinical measure of asthma control (Nathan et al., 2004), it is still based on subjective perceptions. As indicated by the moderate correlation between the parent- and youth-reported asthma-control scores, multiple factors likely contributed to how both parents and youth perceived and reported on asthma control. It is possible that parents' perceptions of their children's asthma control influenced their expectations about the amount of family-obligation behaviors youth could engage in, or that youth's symptom-reporting tendencies affected the amount of obligatory family behaviors they take on. It is also possible that parents' knowledge about children's symptoms and reporting of control may be systematically different by SES (e.g., parents from low SES families may not have as much knowledge about their children's symptoms). These possibilities cannot be ruled out in a cross-sectional study, but the consistency in patterns across both biological and symptom measures lends credibility to our proposed explanations for the study findings. Fourth, we were unable to test potential mechanisms for the SES \times Family Obligation interactions. For example, the link between family obligation and asthma outcomes among youth from low-SES backgrounds may be explained by the increased demands (perceived or objective) or environmental hazards that often accompany daily

life in lower SES households. Future research will benefit from formal mediated moderation analyses of these and other psychological processes (e.g., feelings and meaning derived from fulfilling family-obligation behaviors) and behavioral processes (e.g., asthma-management strategies) that may account for the moderation.

Fifth, in this study, we used a single assessment of family obligation. Future research may consider a daily diary approach to measure the actual amount of time spent each day on family-obligation behaviors (Fuligni et al., 2009; Telzer & Fuligni, 2009). This would eliminate the need to recall obligation behaviors over time and eliminate potential scale-related inaccuracies in reporting (e.g., youth from lower, vs. higher, SES backgrounds may have different definitions for the scale anchors *almost never* or *almost always*). In addition, other potential mechanistic processes could be measured through diary formats. Finally, using a diary approach could also increase the ecological validity of the findings by targeting real-world processes as they happen in youth's everyday lives.

The present study has several implications. First, most previous research on family obligations has focused on psychosocial outcomes (East et al., 2006; Kuperminc et al., 2013; Telzer & Fuligni, 2009), thus, our research builds on these studies by suggesting implications of obligations for physical health as well. Second, we have added to the emerging literature that studies family-level, instead of individual-level, psychosocial factors in health disparities (Brody, Miller, Yu, Beach, & Chen, 2016; Chen, Cohen, & Miller, 2010; Repetti et al., 2002); we also expanded on previous research that has examined family relationships by specifically demonstrating that family time and family routines that come in the form of obligations can be detrimental for asthma among youth from low-SES backgrounds. Third, this study may help increase awareness that although engaging in family obligations is considered normative, certain youth may face health costs of these obligations as a result. For example, family therapies for asthma typically focus on changing dysfunctional family relationships (Panton & Barley, 2000), but our findings suggest that even the daily routines in families' lives may have implications for youth asthma, particularly among those from lower SES homes. Thus, it may be valuable for service providers to consider youth engagement in these day-to-day family experiences, particularly among low-SES youth with asthma.

Conclusion

Providing help to and spending time with one's family are common components of youth family life. The present study adds to nascent research on how these common behaviors may be related to physical health among youth with asthma from families of lower (vs. higher) SES backgrounds. These findings demonstrate that, among youth with asthma, greater engagement of family-obligation behaviors is linked to poorer asthma outcomes among lower SES youth. Findings from this research build onto health-disparities research by considering a novel, family-level psychosocial factor that may have implications for our understanding of how family relationships contribute to childhood-asthma disparities.

References

- Aiken, L. S., West, S. G., & Reno, R. R. (1991). *Multiple regression: Testing and interpreting interactions*. Newbury Park, California: Sage.
- Amato, P. R., & Keith, B. (1991). *Parental divorce and the well-being of children: A meta-analysis*. Washington, DC: American Psychological Association.
- Ashman, J. J., Rui, P., & DeFrances, C. J. (2018, February 9). *QuickStats: Percentage of all emergency department (ED) visits made by patients with asthma, by sex and age group. National Hospital Ambulatory Medical Care Survey, United States 2014–2015. Morbidity and Mortality Weekly Report, 67, 167.* <http://dx.doi.org/10.15585/mmwr.mm6705a5>
- Bacharier, L. B., Strunk, R. C., Mauger, D., White, D., Lemanske, R. F., Jr., & Sorkness, C. A. (2004). Classifying asthma severity in children: Mismatch between symptoms, medication use, and lung function. *American Journal of Respiratory and Critical Care Medicine, 170*, 426–432. <http://dx.doi.org/10.1164/rccm.200308-1178OC>
- Bianchi, S. M., & Robinson, J. (1997). What did you do today? Children's use of time, family composition, and the acquisition of social capital. *Journal of Marriage and Family, 332*–344.
- Bleil, M. E., Ramesh, S., Miller, B. D., & Wood, B. L. (2000). The influence of parent-child relatedness on depressive symptoms in children with asthma: Tests of moderator and mediator models. *Journal of Pediatric Psychology, 25*, 481–491.
- Brody, G. H., Miller, G. E., Yu, T., Beach, S. R., & Chen, E. (2016). Supportive family environments ameliorate the link between racial discrimination and epigenetic aging: A replication across two longitudinal cohorts. *Psychological Science, 27*, 530–541. <http://dx.doi.org/10.1177/0956797615626703>
- Brown, S., Cohon, D., & Wheeler, R. (2002). African American extended families and kinship care: How relevant is the foster care model for kinship care? *Children and Youth Services Review, 24*, 53–77.
- Burton, L. (2007). Childhood adultification in economically disadvantaged families: A conceptual model. *Family Relations, 56*, 329–345.
- Chen, E., Bloomberg, G. R., Fisher, E. B., Jr., & Strunk, R. C. (2003). Predictors of repeat hospitalizations in children with asthma: The role of psychosocial and socioenvironmental factors. *Health Psychology, 22*, 12–18. <http://dx.doi.org/10.1037/0278-6133.22.1.12>
- Chen, E., Brody, G. H., & Miller, G. E. (2017). Childhood close family relationships and health. *American Psychologist, 72*, 555–566. <http://dx.doi.org/10.1037/amp0000067>
- Chen, E., Chim, L. S., Strunk, R. C., & Miller, G. E. (2007). The role of the social environment in children and adolescents with asthma. *American Journal of Respiratory and Critical Care Medicine, 176*, 644–649. <http://dx.doi.org/10.1164/rccm.200610-1473OC>
- Chen, E., Cohen, S., & Miller, G. E. (2010). How low socioeconomic status affects 2-year hormonal trajectories in children. *Psychological Science, 21*, 31–37. <http://dx.doi.org/10.1177/0956797609355566>
- Chen, E., Fisher, E. B., Bacharier, L. B., & Strunk, R. C. (2003). Socioeconomic status, stress, and immune markers in adolescents with asthma. *Psychosomatic Medicine, 65*, 984–992.
- Chen, E., Hanson, M. D., Paterson, L. Q., Griffin, M. J., Walker, H. A., & Miller, G. E. (2006). Socioeconomic status and inflammatory processes in childhood asthma: The role of psychological stress. *The Journal of Allergy and Clinical Immunology, 117*, 1014–1020. <http://dx.doi.org/10.1016/j.jaci.2006.01.036>
- Chen, E., McLean, K. C., & Miller, G. E. (2015). Shift-and-persist strategies: Associations with socioeconomic status and the regulation of inflammation among adolescents and their parents. *Psychosomatic Medicine, 77*, 371–382. <http://dx.doi.org/10.1097/PSY.0000000000000157>
- Chen, E., & Miller, G. E. (2007). Stress and inflammation in exacerbations of asthma. *Brain, Behavior, and Immunity, 21*, 993–999. <http://dx.doi.org/10.1016/j.bbi.2007.03.009>

- Chen, E., & Miller, G. E. (2013). Socioeconomic status and health: Mediating and moderating factors. *Annual Review of Clinical Psychology, 9*, 723–749. <http://dx.doi.org/10.1146/annurev-clinpsy-050212-185634>
- Chen, E., Miller, G. E., Shalowitz, M. U., Story, R. E., Levine, C. S., Hayen, R., . . . Brauer, M. (2017). Difficult family relationships, residential greenspace, and childhood asthma. *Pediatrics, 139*, Article e2016-3056. <http://dx.doi.org/10.1542/peds.2016-3056>
- Chen, E., Schreier, H. M. C., & Chan, M. (2012). Dissecting pathways for socioeconomic gradients in childhood asthma. In B. Wolf, W. Evans, & T. E. Seeman (Eds.), *The biological consequences of socioeconomic inequalities* (pp. 103–125). New York, NY: Russell Sage Foundation.
- Cluley, S., & Cochrane, G. M. (2001). Psychological disorder in asthma is associated with poor control and poor adherence to inhaled steroids. *Respiratory Medicine, 95*, 37–39. <http://dx.doi.org/10.1053/rmed.2000.0968>
- Cogle, F. L., Tasker, G. E., & Morton, D. G. (1982). Adolescent time use in household work. *Adolescence, 17*, 451–455.
- Conger, R. D., & Elder, G. H. (1994). Families in troubled times: The Iowa Youth And Families Project. In R. D. Conger & G. H. Elder (Eds.), *Families in troubled times: Adapting to change in rural America* (pp. 3–19). Berlin, Germany: de Gruyter.
- Drotar, D., & Bonner, M. S. (2009). Influences on adherence to pediatric asthma treatment: A review of correlates and predictors. *Journal of Developmental and Behavioral Pediatrics, 30*, 574–582.
- duRivage, N., Ross, M., Mayne, S. L., Suh, A., Weng, D., Grundmeier, R. W., & Fiks, A. G. (2017). Asthma Control Test: Comparing parent proxy with parent and child report for children 6 to 12 years. *Clinical Pediatrics, 56*, 341–347. <http://dx.doi.org/10.1177/0009922816675013>
- Early, L., Cushway, D., & Cassidy, T. (2006). Perceived stress in young carers: Development of a measure. *Journal of Child and Family Studies, 15*, 165–176.
- East, P. L. (2010). Children's provision of family caregiving: Benefit or burden? *Child Development Perspectives, 4*, 55–61.
- East, P. L., Weisner, T. S., & Reyes, B. T. (2006). Youth' caretaking of their adolescent sisters' children: Its costs and benefits for youth' development. *Applied Developmental Science, 10*, 86–95.
- Evans, G. W., Gonnella, C., Marcynyszyn, L. A., Gentile, L., & Salpekar, N. (2005). The role of chaos in poverty and children's socioemotional adjustment. *Psychological Science, 16*, 560–565.
- Fiese, B. H., Wamboldt, F. S., & Anbar, R. D. (2005). Family asthma management routines: Connections to medical adherence and quality of life. *The Journal of Pediatrics, 146*, 171–176. <http://dx.doi.org/10.1016/j.jpeds.2004.08.083>
- Fuligni, A. J., & Pedersen, S. (2002). Family obligation and the transition to young adulthood. *Developmental Psychology, 38*, 856–868. <http://dx.doi.org/10.1037/0012-1649.38.5.856>
- Fuligni, A. J., Telzer, E. H., Bower, J., Irwin, M. R., Kiang, L., & Cole, S. W. (2009). Daily family assistance and inflammation among adolescents from Latin American and European backgrounds. *Brain, Behavior, and Immunity, 23*, 803–809. <http://dx.doi.org/10.1016/j.bbi.2009.02.021>
- Fuligni, A. J., Tseng, V., & Lam, M. (1999). Attitudes toward family obligations among American adolescents with Asian, Latin American, and European backgrounds. *Child Development, 70*, 1030–1044. <http://dx.doi.org/10.1111/1467-8624.00075>
- Fuligni, A. J., Yip, T., & Tseng, V. (2002). The impact of family obligation on the daily activities and psychological well-being of Chinese American adolescents. *Child Development, 73*, 302–314. <http://dx.doi.org/10.1111/1467-8624.00407>
- Gager, C. T., Sanchez, L. A., & Demaris, A. (2009). Whose time is it? The effect of employment and work/family stress on children's housework. *Journal of Family Issues, 30*, 1459–1485.
- Gallant, K., Smale, B., & Arai, S. (2017). Measurement of feelings of obligation to volunteer: The Obligation to Volunteer as Commitment (OVC) and Obligation to Volunteer as Duty (OVD) scales. *Leisure Studies, 36*, 588–601.
- Goodnow, J. J., & Lawrence, J. A. (2001). Work contributions to the family: Developing a conceptual and research framework. *New Directions for Child and Adolescent Development, 2001*, 5–22. <http://dx.doi.org/10.1002/cd.28>
- Hardway, C., & Fuligni, A. J. (2006). Dimensions of family connectedness among adolescents with Mexican, Chinese, and European backgrounds. *Developmental Psychology, 42*, 1246–1258. <http://dx.doi.org/10.1037/0012-1649.42.6.1246>
- Hofferth, S. L., & Sandberg, J. F. (2001). How American children spend their time. *Journal of Marriage and Family, 63*, 295–308. <http://dx.doi.org/10.1111/j.1741-3737.2001.00295.x>
- Hooper, L. M., Wallace, S. A., Doehler, K., & Dantzer, J. (2012). Parentification, ethnic identity, and psychological health in Black and White American college students: Implications of family-of-origin and cultural factors. *Journal of Comparative Family Studies, 43*, 811–835. Retrieved from <https://www.researchgate.net/publication/281905018>
- Jensen, E. W., James, S. A., Boyce, W. T., & Hartnett, S. A. (1983). The family routines inventory: Development and validation. *Social Science & Medicine, 17*, 201–211. Retrieved from <http://www.psychwiki.com/dms/other/labgroup/Measufsd/sdbger345resWeek1/Elizabeth/Jensen1983.pdf>
- Kaugars, A. S., Klinnert, M. D., & Bender, B. G. (2004). Family influences on pediatric asthma. *Journal of Pediatric Psychology, 29*, 475–491. <http://dx.doi.org/10.1093/jpepsy/jsh051>
- Khafī, T. Y., Yates, T. M., & Luthar, S. S. (2014). Ethnic differences in the developmental significance of parentification. *Family process, 53*, 267–287.
- Kharitonov, S. A., O'Connor, B. J., Evans, D. J., & Barnes, P. J. (1995). Allergen-induced late asthmatic reactions are associated with elevation of exhaled nitric oxide. *American Journal of Respiratory and Critical Care Medicine, 151*, 1894–1899. <http://dx.doi.org/10.1164/ajrccm.151.6.7767537>
- Klinnert, M. D., Nelson, H. S., Price, M. R., Adinoff, A. D., Leung, D. Y. M., & Mrazek, D. A. (2001). Onset and persistence of childhood asthma: Predictors from infancy. *Pediatrics, 108*, e69. <http://dx.doi.org/10.1542/peds.108.4.e69>
- Kuperminc, G. P., Wilkins, N. J., Jurkovic, G. J., & Perilla, J. L. (2013). Filial responsibility, perceived fairness, and psychological functioning of Latino youth from immigrant families. *Journal of Family Psychology, 27*, 173–182. <http://dx.doi.org/10.1037/a0031880>
- Landale, N. S., Oropesa, R. S., & Bradatan, C. (2006). Hispanic families in the United States: Family structure and process in an era of family change. In M. Tienda & F. Mitchell (Eds.), *Hispanics and the future of America* (pp. 138–178). Washington, DC: National Academies Press.
- Larson, R. W., & Verma, S. (1999). How children and adolescents spend time across the world: Work, play, and developmental opportunities. *Psychological Bulletin, 125*, 701–736.
- Lehman, B. J., Taylor, S. E., Kiefe, C. I., & Seeman, T. E. (2005). Relation of childhood socioeconomic status and family environment to adult metabolic functioning in the CARDIA study. *Psychosomatic Medicine, 67*, 846–854. <http://dx.doi.org/10.1097/01.psy.0000188443.48405.eb>
- Levine, C. S., Hoffer, L. C., & Chen, E. (2017). Moderators of the relationship between frequent family demands and inflammation among adolescents. *Health Psychology, 36*, 493–501. <http://dx.doi.org/10.1037/hea0000469>
- Liu, L. Y., Coe, C. L., Swenson, C. A., Kelly, E. A., Kita, H., & Busse, W. W. (2002). School examinations enhance airway inflammation to antigen challenge. *American Journal of Respiratory and Critical Care Medicine, 165*, 1062–1067. <http://dx.doi.org/10.1164/ajrccm.165.8.2109065>
- Mangan, J. M., Wittich, A. R., & Gerald, L. B. (2007). The potential for reducing asthma disparities through improved family and social function and modified health behaviors. *Chest, 132*, 789S–801S. <http://dx.doi.org/10.1378/chest.07-1908>

- McEwen, B. S. (2000). Allostasis and allostatic load: Implications for neuropsychopharmacology. *Neuropsychopharmacology*, 22, 108–124. [http://dx.doi.org/10.1016/S0893-133X\(99\)00129-3](http://dx.doi.org/10.1016/S0893-133X(99)00129-3)
- McEwen, B. S. (2012). Brain on stress: How the social environment gets under the skin. *PNAS: Proceedings of the National Academy of Sciences of the United States of America*, 109, 17180–17185. <http://dx.doi.org/10.1073/pnas.1121254109>
- McHale, S. M., Blocklin, M. K., Walter, K. N., Davis, K. D., Almeida, D. M., & Klein, L. C. (2012). The role of daily activities in youth' stress physiology. *Journal of Adolescent Health*, 51, 623–628. <http://dx.doi.org/10.1016/j.jadohealth.2012.03.016>
- McLoyd, V. C. (1990). The impact of economic hardship on Black families and children: Psychological distress, parenting, and socioemotional development. *Child Development*, 61, 311–346.
- McQuaid, E. L., Walders, N., Kopel, S. J., Fritz, G. K., & Klinnert, M. D. (2005). Pediatric asthma management in the family context: The Family Asthma Management System Scale. *Journal of Pediatric Psychology*, 30, 492–502. <http://dx.doi.org/10.1093/jpepsy/jsi074>
- Miller, G. E., & Chen, E. (2010). Harsh family climate in early life presages the emergence of a proinflammatory phenotype in adolescence. *Psychological Science*, 21, 848–856. <http://dx.doi.org/10.1177/0956797610370161>
- Miller, G., Chen, E., & Cole, S. W. (2009a). Health psychology: Developing biologically plausible models linking the social world and physical health. *Annual Review of Psychology*, 60, 501–524. <http://dx.doi.org/10.1146/annurev.psych.60.110707.163551>
- Miller, G. E., Cohen, S., & Ritchey, A. K. (2002). Chronic psychological stress and the regulation of pro-inflammatory cytokines: A glucocorticoid-resistance model. *Health Psychology*, 21, 531–541. Retrieved from https://figshare.com/articles/Chronic_Psychological_Stress_and_the_Regulation_of_Pro-Inflammatory_Cytokines_A_Glucocorticoid-Resistance_Model/6613931
- Miller, G. E., Gaudin, A., Zysk, E., & Chen, E. (2009b). Parental support and cytokine activity in childhood asthma: The role of glucocorticoid sensitivity. *The Journal of Allergy and Clinical Immunology*, 123, 824–830. <http://dx.doi.org/10.1016/j.jaci.2008.12.019>
- Nathan, R. A., Sorkness, C. A., Kosinski, M., Schatz, M., Li, J. T., Marcus, P., . . . Pendergraft, T. B. (2004). Development of the Asthma Control Test: A survey for assessing asthma control. *The Journal of Allergy and Clinical Immunology*, 113, 59–65. <http://dx.doi.org/10.1016/j.jaci.2003.09.008>
- Oakes, J. M., & Rossi, P. H. (2003). The measurement of SES in health research: Current practice and steps toward a new approach. *Social Science & Medicine*, 56, 769–784. [http://dx.doi.org/10.1016/S0277-9536\(02\)00073-4](http://dx.doi.org/10.1016/S0277-9536(02)00073-4)
- Panton, J., & Barley, E. A. (2000). Family therapy for asthma in children. *Cochrane Database of Systematic Reviews*, Article CD000089. <http://dx.doi.org/10.1002/14651858.CD000089>
- 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.
- Rodway, G. W., Choi, J., Hoffman, L. A., & Sethi, J. M. (2009). Exhaled nitric oxide in the diagnosis and management of asthma: Clinical implications. *Chronic Respiratory Disease*, 6, 19–29. <http://dx.doi.org/10.1177/1479972308095936>
- Rosales, A., McQuaid, E. L., & Koinis-Mitchell, D. (2017). Family connectedness and pediatric asthma management: The roles of child age and race or ethnicity. *Children's Health Care*, 46, 393–407. <http://dx.doi.org/10.1080/02739615.2016.1227934>
- Sarkisian, N., Gerena, M., & Gerstel, N. (2006). Extended family ties among Mexicans, Puerto Ricans, and Whites: Superintegration or disintegration? *Family Relations: An Interdisciplinary Journal of Applied Family Studies*, 55, 331–344. <http://dx.doi.org/10.1111/j.1741-3729.2006.00408.x>
- Schatz, M., Sorkness, C. A., Li, J. T., Marcus, P., Murray, J. J., Nathan, R. A., . . . Jhingran, P. (2006). Asthma Control Test: Reliability, validity, and responsiveness in patients not previously followed by asthma specialists. *The Journal of Allergy and Clinical Immunology*, 117, 549–556. <http://dx.doi.org/10.1016/j.jaci.2006.01.011>
- Schreier, H. M., & Chen, E. (2010). Socioeconomic status in one's childhood predicts offspring cardiovascular risk. *Brain, Behavior, and Immunity*, 24, 1324–1331. <http://dx.doi.org/10.1016/j.bbi.2010.06.007>
- Schreier, H. M., Roy, L. B., Frimer, L. T., & Chen, E. (2014). Family chaos and adolescent inflammatory profiles: The moderating role of socioeconomic status. *Psychosomatic Medicine*, 76, 460–467. <http://dx.doi.org/10.1097/PSY.0000000000000078>
- Shalowitz, M. U., Berry, C. A., Quinn, K. A., & Wolf, R. L. (2001). The relationship of life stressors and maternal depression to pediatric asthma morbidity in a subspecialty practice. *Ambulatory Pediatrics*, 1, 185–193. [http://dx.doi.org/10.1367/1539-4409\(2001\)001<0185:TROLSA>2.0.CO;2](http://dx.doi.org/10.1367/1539-4409(2001)001<0185:TROLSA>2.0.CO;2)
- Taylor, D. R., Pijnenburg, M. W., Smith, A. D., & Jongste, J. C. D. (2006). Exhaled nitric oxide measurements: Clinical application and interpretation. *Thorax*, 61, 817–827. <http://dx.doi.org/10.1136/thx.2005.056093>
- Telzer, E. H., & Fuligni, A. J. (2009). Daily family assistance and the psychological well-being of adolescents from Latin American, Asian, and European backgrounds. *Developmental Psychology*, 45, 1177–1189. <http://dx.doi.org/10.1037/a0014728>
- Telzer, E. H., Gonzales, N., & Fuligni, A. J. (2014). Family obligation values and family assistance behaviors: Protective and risk factors for Mexican-American adolescents' substance use. *Journal of Youth and Adolescence*, 43, 270–283. <http://dx.doi.org/10.1007/s10964-013-9941-5>
- Troxel, W. M., & Matthews, K. A. (2004). What are the costs of marital conflict and dissolution to children's physical health? *Clinical child and family psychology review*, 7, 29–57.
- Tseng, V. (2004). Family interdependence and academic adjustment in college: Youth from immigrant and U. S.-born families. *Child Development*, 75, 966–983.
- Van Den Toorn, L. M., Overbeek, S. E., De Jongste, J. C., Leman, K., Hoogsteden, H. C., & Prins, J.-B. (2001). Airway inflammation is present during clinical remission of atopic asthma. *American Journal of Respiratory and Critical Care Medicine*, 164, 2107–2113.
- Vasquez-Salgado, Y., Greenfield, P. M., & Burgos-Cienfuegos, R. (2015). Exploring home-school value conflicts: Implications for academic achievement and well-being among Latino first-generation college students. *Journal of Adolescent Research*, 30, 271–305.
- Wegman, H. L., & Stetler, C. (2009). A meta-analytic review of the effects of childhood abuse on medical outcomes in adulthood. *Psychosomatic Medicine*, 71, 805–812. <http://dx.doi.org/10.1097/PSY.0b013e3181bb2b46>
- Weisner, T. S. (2001). Children investing in their families: The importance of child obligation in successful development. *New Directions for Child and Adolescent Development*, Winter, 77–84. <http://dx.doi.org/10.1002/cd.32>
- Wood, B. L., Miller, B. D., & Lehman, H. K. (2015). Review of family relational stress and pediatric asthma: The value of biopsychosocial systemic models. *Family Process*, 54, 376–389.
- Wright, R. J., Rodriguez, M., & Cohen, S. (1998). Review of psychosocial stress and asthma: An integrated biopsychosocial approach. *Thorax*, 53, 1066–1074. <http://dx.doi.org/10.1136/thx.53.12.1066>
- Zahran, H. S., Bailey, C. M., Damon, S. A., Garbe, P. L., & Breyse, P. N. (2018, February 9). Vital signs: Asthma in children. United States, 2001–2016. *Morbidity and Mortality Weekly Report*, 67, 149–155. <http://dx.doi.org/10.15585/mmwr.mm6705e1>

Received November 8, 2017

Revision received May 11, 2018

Accepted May 22, 2018 ■