Family Influences on Pediatric Asthma

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Objective To describe pathways by which families may influence the onset and course of a child’s asthma. Methods We critically reviewed published articles and book chapters to identify research findings and integrated conceptualizations that demonstrate how families affect pediatric asthma. Results Family emotional characteristics, asthma management behaviors, and physiological factors account for key influences on pediatric asthma onset and outcomes. Conclusions Multiple family characteristics are associated with pediatric asthma onset and outcomes. Behavioral and physiological mechanisms may act independently or may interact to affect asthma manifestations. Families with specific emotional characteristics may be at an elevated risk for poorer asthma outcomes.

Key words family; pediatric asthma.

Asthma is a chronic inflammatory disease of the airways that results from a complex interaction between genetic and environmental factors (Howard, Meyers, & Bleecker, 2003). It includes the presence of recurrent but reversible respiratory obstruction and is characterized by such symptoms as wheezing, coughing, chest tightness, and shortness of breath. Asthma is a complex condition with wide variability in manifestation owing not only to physiological factors such as allergic status or bronchial hyperresponsiveness but also to environmental factors such as variation in exposure to tobacco smoke and other allergens. Psychosocial characteristics of the child, parent, and family can also contribute to variability in asthma presentation. Children with genetic predisposition for affective disorders and asthma may represent a subgroup of children at risk for developing severe asthma (Wamboldt, Weintraub, Krafchick, & Wamboldt, 1996). Given the increased prevalence and morbidity of pediatric asthma—in particular among young children and especially among non-Hispanic black children (Akinbami & Schoendorf, 2002)—comprehensive asthma intervention programs have targeted impoverished inner-city communities at high risk for asthma morbidity and mortality (Evans et al., 1999). Moreover, ongoing research seeks first to identify origins of asthma and second to better understand the natural history of asthma, which can further inform intervention and treatment strategies (Lemanske & Busse, 2003; Liu & Szefler, 2003).

It has become increasingly apparent that multidisciplinary approaches synthesizing biological, sociocultural, psychological, and family perspectives are necessary to better understand asthma (Wright, Rodriguez, & Cohen, 1998). Despite the growing number of studies examining aspects of psychosocial functioning related to asthma, it appears that psychological difficulties are not increased among children with mild to moderate asthma (Bender, Annett, et al., 2000). However, psychopathology, family dysfunction, and medication noncompliance have been found to be associated with increased risk of severe, poorly controlled asthma (Bender & Klinnert, 1998). Thus it is important for researchers to closely examine the relationships between psychological factors and severe asthma, since doing so may inform an understanding of how psychological and family variables affect, or result in, a variety of asthma manifestations.

The literature consistently demonstrates that early family social environments that include conflict, aggression, and deficient nurturing may represent a risk profile—“risky families” (Repetti, Taylor, & Seeman,
that presents implications for children's mental and physical health. Genetic and family factors interact and may directly or indirectly contribute to emotional, social, and biological disruptions that can continue to have an impact on development throughout the life span (Repetti et al., 2002). Among children with asthma, the distinction of risky families may help identify those families with similar risk factors for whom managing a child's asthma is an additional challenge and for whom the children have poorer asthma outcomes (Bender & Klinnert, 1998). Moreover, this distinction reflects the overrepresentation in the literature of children with a multitude of risk factors and more severe asthma. The National Cooperative Inner-City Asthma Study (NCICAS) was conducted in response to the excessive burden of asthma morbidity and mortality among poor and minority children. The study found a large number of risk factors for asthma morbidity in this population (Kattan et al., 1997; Mitchell et al., 1997). Moreover, within this sample of inner-city children and families, a variety of psychosocial variables were assessed, and the study found that psychosocial factors were significant predictors of children's asthma morbidity (Wade et al., 1997; Weil et al., 1999). The present review focuses on the research linking psychological variables—in particular, characteristics of distress in families—to asthma outcomes. It is important to remember that every child with severe, poorly controlled asthma does not necessarily have family functioning characterized by distress and risk; similarly, not all distressed families have children who go on to develop severe, poorly controlled asthma.

**Theoretical Model Summarizing Literature**

This paper presents a selective review of the literature to describe pathways by which families may influence the onset and course of a child’s asthma. In the literature, a variety of asthma outcomes have been examined, including health care utilization, asthma and wheezing symptoms, quality of life, activity restrictions due to asthma, risk of death, and school attendance (see Table I).

First, we present a review of how family characteristics are related to pediatric asthma outcomes (see Figure 1, Path A). Then, we examine two pathways for understanding these associations: first, how family characteristics affect asthma management behaviors and thus asthma outcomes (Paths B and C); second, how physiological factors may help researchers understand the relationships between family characteristics and asthma outcomes (Paths D and E).

**Table I. Summary of Family Characteristics, Mechanisms, and Asthma Outcomes Reviewed**

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<thead>
<tr>
<th>Family characteristics</th>
<th>Mechanisms</th>
<th>Asthma outcomes</th>
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<tr>
<td>Caregiver psychological functioning</td>
<td>Asthma management behaviors</td>
<td>Healthcare utilization</td>
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<td>Parent-child relationships</td>
<td>• Medication adherence</td>
<td>Asthma and wheezing symptoms</td>
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<td>Child attachment</td>
<td>• Exposure to allergens and tobacco smoke</td>
<td>Quality of life</td>
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<td>Parenting difficulties</td>
<td>• Daily decision making</td>
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<td>Family conflict</td>
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<td>Risk of death</td>
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<td>Emotion regulation</td>
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<td>Child adjustment and psychopathology</td>
<td>• Hypothalamic pituitary adrenal (HPA) axis and immune system</td>
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<td>Racial and ethnic background</td>
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<td>Family organization and responsibility</td>
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**Figure 1. Proposed relationships among factors contributing to pediatric asthma outcomes.**
Path A: Diagram of direct relationship.
Paths B–E: Diagram of mediation.
The majority of studies described in this review examined models that exist implicitly; very few studies explicitly delineated models that were empirically tested (e.g., Bleil, Ramesh, Miller, & Wood, 2000; Wade et al., 1997; Weil et al., 1999). Although there is evidence in the literature of bidirectional and reciprocal relationships among family characteristics and asthma outcomes, Figure 1 illustrates unidirectional relationships to emphasize how family characteristics can influence asthma outcomes. Relevant findings in each domain are summarized herein, and applicable methodological and measurement concerns are highlighted, as they may affect conclusions drawn from the study results. Implications for treatment and future research is then addressed in the conclusion. Theoretically relevant studies were selected for inclusion in the present review utilizing computer searches (e.g., PsychINFO and PubMed), manual searches of relevant journals, inspection of reference lists from published studies and reviews, and consultation with pediatric psychologists. Research conducted in the past 20 years was the focus of the review, although several seminal historical references were included as well.

**Family Functioning and Asthma**

Within families, caregiver functioning, interactions between caregivers and children, and children’s functioning influence pediatric asthma. Historically, the psychosomatic family model introduced by Minuchin and colleagues (1975) suggested that the structure and functioning of families could affect children’s asthma outcomes. However, empirical studies testing the psychosomatic family model and measures of general features of family functioning have provided limited insight into how family functioning may interact with the disease process. Families’ responses to the demands of caring for a chronic pediatric illness vary greatly and may have an effect of organizing and structuring some families but of causing detrimental changes in others (Wamboldt & Wamboldt, 2000). Thus, it has been useful to identify specific psychosocial characteristics of individuals and families that affect family functioning and asthma outcomes. Recent conceptualizations have emphasized reciprocal influences between psychological factors and asthma morbidity (Wade et al., 1997). A bidirectional relationship between psychological functioning in the parents and children’s physical disorders may exist such that family psychological factors contribute to severe, poorly managed pediatric asthma. Alternatively, having a child with asthma is challenging for families and thereby increases psychological stress and taxes psychological functioning. Incorporating a socio-ecological model to better understand interactions of the child, family, and extended environment in the context of childhood illness reflects progress in understanding how family and system functioning are linked to children’s adaptation to illness and its treatment (Kazak, Segal-Andrews, & Johnson, 1995).

The following section presents a review of the literature examining how family characteristics are related to pediatric asthma outcome. The review summarizes research in the following areas: caregivers’ psychological functioning, parent–child relationships, children’s adjustment and psychopathology, and additional factors influencing family functioning.

**Caregivers’ Psychological Functioning**

Parents’ and caregivers’ psychological functioning is a major determinant of family functioning. A persistent theme in the literature indicates that poorer caregiver psychological functioning is associated with the worse asthma outcomes for children. Among mothers of children with asthma living in the inner city, almost half (47%) reported clinically significant levels of depression (Bartlett et al., 2001). Six months after their initial report, mothers with high levels of depressive symptoms were 40% more likely to report having taken their children to the emergency department in the ensuing time, in comparison to mothers with low levels of depressive symptoms. In another inner-city population, caregivers who reported clinically significant mental health problems had children who were 1.78 times more likely to be hospitalized in the next 9 months, when compared to caregivers whose scores of psychopathology were not clinically significant (Weil et al., 1999). Similarly, lower caregiver mental health scores were associated with caregiver reports of their children’s experiencing more asthma symptoms and more acute care visits for asthma in the previous year, when compared to those caregivers with higher mental health scores (Wood et al., 2002). Among children seen in suburban and inner-city pediatric asthma subspecialty practices, caregiver-reported symptoms of depression and negative life stressors in combination with children’s sex (i.e., female) were the strongest predictors of children’s asthma morbidity, based on patterns of symptoms and health service utilization (Shalowitz, Berry, Quinn, & Wolf, 2001). Caregivers’ responses to high stress levels, including managing chronic stress, may affect their psychological functioning as well as their infants’ respiratory problems. Caregivers’ perceived stress when their infants were 2 to 3 months old was associated with an increased risk of parent report of
infant wheezing during the first 14 months of life, independent of factors associated with stress and wheezing (Wright, Cohen, Carey, Weiss, & Gold, 2002). While some studies demonstrate associations between caregivers’ psychological functioning and asthma outcomes, more recent studies have utilized prospective designs to better understand the directions of relationships.

Researchers must be aware of reporter bias, and they must consider how study conclusions and generalizability are affected by the background of the participants (e.g., low socioeconomic status) or by the study’s methodology (e.g., caregiver report). All of the studies described here included participants from low socioeconomic backgrounds and used asthma outcome data from caregiver reports. Parental reporting of asthma outcomes may be problematic since parental emotional status may influence caregivers’ reporting of the impact of asthma; likewise, caregiver-reported asthma morbidity and actual morbidity may be discrepant. One type of asthma outcome that has been studied, with some controversy (Annett, 2001; Bender, 1996), is children’s and parents’ reporting of the impact of on the family, including quality of life. Objective measures of disease morbidity during the year before admission to a pediatric day program for asthma were unrelated to caregivers’ report of quality of life (Price, Bratton, & Klinnert, 2002). Instead, a caregiver’s negative affect (i.e., anxiety and depression) was a significant predictor of a caregiver’s reporting of quality of life at admission. This is consistent with evidence demonstrating that factors such as negative affect, perceived vulnerability, and depressive symptoms may affect how individuals rate their quality of life (Mishoe & Maclean, 2001). Among children and families seen at a tertiary care hospital for asthma, parental emotional distress was the strongest significant predictor of how parents reported the extent to which their child’s asthma affected the family (Frankel & Wamboldt, 1998). A determination of asthma severity based on parental report was not a significant predictor of the illness’s impact on the family. This research highlights the influence of situational factors and respondent characteristics on reports of quality of life and potentially other asthma outcome measures, thus suggesting the importance of careful attention to study design to limit reporter bias.

**Parent–Child Relationships**

**Child Attachment**

Family relationships are associated with asthma outcomes in a number of ways. An early observational study examined interactional difficulties among mothers and children with asthma (Block, Jennings, Harvey, & Simpson, 1964). Similarly, a more negative affective climate has been documented among mothers and their preschool children with asthma, in comparison to that of healthy children (Mrazek, Anderson, & Strunk, 1985). However, causal mechanisms were not identified in these studies (Klinnert, 1997b). Results from one small study indicated that when compared to children without asthma, a significantly greater proportion of preschool-age children with severe asthma were rated as insecurely attached (Mrazek, Casey, & Anderson, 1987). Among the children with asthma, those with a secure attachment demonstrated significantly fewer overall behavior problems than those who were more insecurely attached. Similarly, among school-age children and adolescents with asthma, parent–child relationships mediated the impact of impaired functional status on depressive symptoms (Bleil et al., 2000). A secure attachment may mediate the effects of early illness on children’s emotional development because it may enhance a child’s coping capacity and minimize the expression of psychopathology (Mrazek et al., 1987).

**Parenting Difficulties**

Several longitudinal studies have examined the impact of caregiving on asthma outcomes. A prospective study of children at genetic risk for asthma demonstrated that a combination of physical and psychosocial variables—specifically, parenting difficulties assessed when infants were 3 weeks old—were predictors of asthma onset and persistence (Klinnert, Mrazek, & Mrazek, 1994; Klinnert et al., 2001; Mrazek et al., 1999). Frequent illness in the first year of life, elevated serum IgE levels at 6 months, and early parenting difficulties were independently predictive of the development of children’s asthma at 3 years of age (Mrazek et al., 1999). The parenting difficulties measured in early infancy with the elevated 6-month IgE levels continued to be associated with the persistence of asthma in these children when they reached 6 and 8 years of age (Klinnert et al., 2001). The predictive strength of the parenting rating is noteworthy given that the rating was made before asthma onset when the infants were 3 weeks old and that it focused on assessment of the emotional caregiving environment (Klinnert et al., 1994). These findings parallel those from a different longitudinal study where functional family interactions and social networks for children 18 months old were associated with a significantly lower risk for children’s having continuing atopic illness at 3 years old, when compared to those with dysfunctional interactions and networks (Gustafsson, Kjellman, & Bjorksten, 2002). Thus difficulties in parenting and the parent–child relationship appear...
to be related not only to asthma onset but also to asthma outcomes throughout early childhood.

**Family Conflict**
High levels of conflict among family members is a distinguishing characteristic of risky families (Repetti et al., 2002), and it may place children at greater risk for mental and physical health problems when compared to those children without such conflict. In a sample of children hospitalized for asthma, those who experienced more family conflict—as assessed by parents' reporting the amount of openly expressed anger, aggression, and conflict among family members—were more likely to experience a greater number of lifetime hospitalizations (Chen, Bloomberg, Fisher, & Strunk, 2003). In a seminal study by Strunk and colleagues (1985), conflict between children with asthma, their parents, and hospital staff differentiated those children who died of asthma from a control group matched for asthma severity. While global ratings of family discord and conflict are revealing, more proximal measures of parent–infant or parent–child relationships that describe affective qualities of the relationship (e.g., critical affect, emotion regulation) provide information about specific emotional processes.

Critical parent affect has been examined as a possible mechanism through which parent–child interactions are related to asthma. Utilizing measures of expressed emotion (EE), where parents are asked to speak about their child in an unstructured setting (e.g., Five-Minute Speech Sample; Magana-Amato, 1993), several studies have found that in comparison to parents of healthy children, mothers and fathers of children with asthma made significantly more critical remarks and showed a more critical attitude (Hermanns, Florin, Dietrich, Rieger, & Hahlweg, 1989; Schobinger, Florin, Reichbauer, Lindemann, & Zimmer, 1993; Schobinger, Florin, Zimmer, Lindemann, & Winter, 1992). Among children with asthma, increased frequency of asthma attacks and asthma severity were associated with mothers’ critical attitudes but not with fathers’ (Hermanns et al., 1989; Schobinger et al., 1993; Schobinger et al., 1992). These investigators considered whether the association between criticism and asthma severity may reflect critical attitude acting as a chronic stressor (Hermanns et al., 1989; Schobinger et al., 1993) or whether critical attitude may hinder compliance (Schobinger et al., 1993; Schobinger et al., 1992). Among hospitalized adolescents with asthma, higher parental criticism was more likely to be associated with greater medical noncompliance upon admission and with better response to treatment when adolescents were separated from their parents and participating in a structured treatment regimen (Wamboldt, Wamboldt, Gavin, Roesler, & Brugman, 1995). Thus, parental criticism may be another marker of distressed families that may affect children’s asthma outcomes.

**Emotion Regulation**
Emotion regulation is developed by repeated interactions between child and caregiver in which caregivers modulate and teach children how to regulate their emotions. Emotion regulation is a critical dimension of behavior expression that has been demonstrated to contribute to the development of psychopathology. Assessment of children’s behavior and parent–child interactions during a structured, challenging task found no significant group differences among children with and without asthma in their emotion regulation and negativity and in their mothers’ emotion regulation and negativity when observed alone and with their mothers (Klinnert, McQuaid, McCormick, Adinoff, & Bryant, 2000). However, were related to difficulties with emotion regulation demonstrated greater asthma severity. Furthermore, less effective emotion regulation was a significant predictor of asthma symptoms, after controlling for asthma severity, as measured by symptom frequency and required medications. Clinician ratings of behavior problems were associated with increasing levels of asthma severity. As suggested by the authors, difficulties with emotion regulation may be represented in behavior patterns that do not reach diagnostic thresholds but nevertheless result in parent–child relationships characterized by negativity and conflict.

**Child Adjustment and Psychopathology**
Recent recognition of the complex relationship between children’s adjustment and illness has resulted in closer scrutiny not only of research designs and methods used to examine this relationship but also of the discussion regarding the mechanisms responsible for the relationship. Children with early asthma onset (i.e., by 3 years of age), face a greater risk for developing behavior problems, perhaps owing to their limited range of cognitive and emotional strategies for managing symptoms, the challenges that parents face in caring for children with asthma, and the possibility of environmental stressors having a heightened impact on very young children (Mrazek et al., 1985; Mrazek, Schuman, & Klinnert, 1998). McQuaid and colleagues (2001) recently completed a meta-analysis examining studies of the behavioral adjustment of children and adolescents with asthma. They concluded that, in comparison to healthy
children, children with asthma are at greater risk for having difficulties in behavioral adjustment, with demonstrate greater evidence for internalizing, rather than externalizing, problems. Increases in asthma severity were related to more difficulties in behavioral adjustment. Similarly, in a more current study, Ortega and colleagues (2002), using a structured diagnostic interview, found that children with a history of asthma were more likely than those without to be diagnosed with having any psychiatric disorder—or more specifically, an anxiety disorder—after controlling for potentially confounding factors. Moreover, relationships between asthma and anxiety disorders were particularly strong for children with histories of asthma-related hospitalization. This suggests that children with severe asthma may be more likely to have an anxiety disorder, thereby providing further support for the importance of examining the role of illness severity. Similar to the finding that caregiver negative affects influences assessment of asthma outcomes (e.g., Price et al., 2002), there is also evidence that when children were asked to respond to asthma-related quality of life questions, children's level of anxiety was a strong predictor of quality of life responses, regardless of whether the anxiety was directly attributable to the child's asthma (Annett, Bender, Lapidus, DuHamel, & Lincoln, 2001). Further unraveling the multifaceted relationship between children's adjustment and illness will require careful consideration of reporters as well as an acute attention to the measures of illness being used.

It is unknown whether more severe asthma leads to behavioral difficulties or whether poor psychological functioning leads to more severe asthma. Another possibility is that characteristics of distressed families—for example, conflict; aggression; and cold, unsupportive, neglectful homes—may be influential not only in asthma outcomes but also in children's socioemotional development, including the development of adjustment problems or psychopathology (Repetti et al., 2002).

**Additional Factors Influencing Family Functioning**

Lack of social support—including not having spouses, friends, and family members who provide material and psychological resources to a family—may be another marker of families who are not functioning well. Clinical and empirical literature suggests that social support has a direct positive effect on well-being and that it works to protect individuals from potentially adverse effects of stressful events (Cohen & Wills, 1985). However, the mechanisms mediating these relationships, particularly in pediatric populations and specifically among children with asthma, have not been studied extensively. Even less attention has been directed to examining social support—in particular, support from friends or peers—among adolescents with chronic illness (LaGreca et al., 1995).

As described earlier, functional family interactions and social networks for children at 18 months of age were predictive of children's lower risk for continuing atopic illness at 3 years of age, when compared to children with dysfunctional interactions and networks (Gustafsson et al., 2002). However, it is unclear how family functioning and social network functioning may be interrelated. Social support was the strongest predictor of behavior problems among children with mild to moderate asthma, explaining 11.6% of the variability, after accounting for other variables (Bender, Annett, et al., 2000). However, social support was unrelated to disease variables. Parent's perceived social support, children's absence from school, and children's behavior problems were the strongest predictors of parents' perceptions of how the child's illness affects the family. These results underscore how parents' perceptions of disease, rather than objective ratings of disease, affect reports about the extent of disruption due to children's asthma.

Intervention studies where social support needs to be quantified for research purposes offer some clarification about what aspects of social support may affect health outcomes. Moreover, there are a multitude of individual and community variables that may affect whether interventions that offer social support are effective (Thompson & Ontai, 2000). Despite an emphasis in practice of helping families establish contacts with other families who have children with similar medical conditions, there is limited empirical evidence that such strategies are successful. Children with asthma were one subgroup of participants in a randomized trial of community-based support for families (Chernoff, Ireys, DeVet, & Kim, 2002). The study found that a family support intervention—which involved visits, telephone calls, letters, and special family events with child life specialists and “experienced mothers”—had a modest, positive effect on improving children's adjustment, in particular for children with low physical self-esteem at baseline. There were no effects of the intervention on children's symptom unpredictability or activity limitations. This intervention also demonstrated a reduction in maternal symptoms of anxiety, and effects were greater for mothers in poor health and for those with higher baseline anxiety (Ireys, Chernoff, DeVet, & Kim, 2001). Thus, improving maternal psychological functioning via social support interventions may in turn affect children's adjustment, but it may also have limited
impact on aspects of physical functioning for children with a chronic illness. Research examining the impact of social support, or lack of social support, for children with asthma and their families must strive to further identify mechanisms by which social support affects children’s mental and physical health.

**Potential Mechanisms Accounting for Associations Between Family Characteristics and Asthma Outcomes**

As reviewed in the previous section, there is accumulating evidence documenting relationships between family and child characteristics and pediatric asthma outcomes. Theoretical and empirical evidence supports two mediational models for understanding these associations. First, family characteristics may affect asthma management behaviors and lifestyle factors that in turn affect asthma outcomes (see Figure 1, Paths B and C). Second, an emerging literature has been investigating physiological mechanisms that may link child and family emotional processes and asthma outcomes (see Figure 1, Paths D and E). The next two sections review evidence for these possible models.

**Family Functioning Affects Asthma Outcomes Through Asthma Management**

Effectively managing a child’s asthma involves health care providers collaborating with the entire family system and with alternative caregivers. Management of asthma includes a complex set of behaviors, with one of the family’s responsibilities being adherence to prescribed medical regimens (Klinnert, McQuaid, & Gavin, 1997). Five general areas of parental responsibility include symptom intervention, symptom prevention, use of medical and educational resources, communication of caregivers, and child development and family relationships (Wilson, Mitchell, & Rolnick, 1993).

The most well-studied and specific aspect of asthma management is adherence. It is well-documented that child and family behaviors associated with adherence are related to asthma outcomes (see Figure 1, Path C). Adherence to prescribed treatment regimens for children with asthma is a pervasive problem, with adherence rates often below 50% (Bender, 2002). Families who are unable to perform the health care behaviors required in pediatric asthma might have children with more poorly controlled asthma. In a study monitoring inhaled corticosteroid usage for 90 days, lower rates of compliance with inhaled corticosteroid therapy were associated with disease exacerbation, thereby illustrating the potential risk and impact of medication nonadherence (Milgrom et al., 1996). In the National Cooperative Inner-City Asthma Study, children whose caregivers reported more frequent nonadherence with a physician’s recommendation for asthma management experienced significantly worse morbidity on eight of nine measures, regardless of illness severity (Bauman et al., 2002).

While research has sought to identify factors that may potentially influence poor adherence, it is not known what factors may facilitate high levels of adherence; furthermore, the factors that promote adherence may be different from those that impede adherence (Drotar et al., 2000). Four factors that do not predict adherence include health insurance or health insurance status (e.g. Bender, Wamboldt, et al., 2000; Weinstein & Faust, 1997), asthma knowledge (e.g. Ho et al., 2003; McQuaid, Kopel, Klein, & Fritz, 2003), illness severity (e.g. Apter, Reisine, Affleck, Barrows, & ZuWallack, 1998), and single-parent families (e.g. Weinstein & Faust, 1997). This section discusses how family characteristics—including family conflict and distress, racial or ethnic differences, and family organization and responsibility—have been found to affect adherence and, in turn, asthma outcomes (see Figure 1, Paths B and C). For families experiencing several of these predictors, asthma outcomes may be further affected.

**Conflict and Distress in Families**

Family conflict and distress that undermine effective asthma management behaviors may be manifested in relationships within the family as well as in disagreements with health care providers. Day-to-day asthma management may be more difficult in high-conflict relationships since effective communication, supervision, and division of responsibilities may be compromised (Schobinger et al., 1993). A combination of psychological adjustment, degree of family cohesiveness versus conflict, and the interaction of these two variables have been found to predict adherence. For instance, children with high levels of family conflict and high levels of behavior problems were at greatest risk for being non-adherent, when compared to children with moderate or low levels (Christiaanse, Lavigne, & Lerner, 1989). Similarly, among hospitalized adolescents with asthma, high parental criticism was associated not only with greater noncompliance upon admission but also with better response to treatment when the adolescents were separated from their parents and participating in a structured treatment regimen (Wamboldt et al., 1995). Another study found that families in which parents reported no displays of affection and where expectations...
and consequences for children’s behavior were not clearly expressed had poorer medication adherence than did families with different levels of affection and expectations (Bender, Milgrom, Rand, & Ackerson, 1998). In another study, children with severe asthma participated in a short-term inpatient rehabilitation program and then were followed for the subsequent year. One year later, those families who had significantly fewer problems with intrafamilial communication, more effective ways of managing child care, and more efficient use of resources had children who were more compliant with treatment than families of children who were noncompliant (Weinstein & Faust, 1997). Similarly, there is emerging evidence that conflict in relationships with health care providers may lead to poorer asthma adherence outcomes. Difficulties communicating effectively with a child’s treating physician and with other medical personnel have been associated with ineffective asthma management behaviors, including failure to provide appropriate intervention for children’s asthma symptoms (Wilson et al., 1993). Physicians’ reports of better treatment alliance with adolescents at discharge from an inpatient program was associated with better medication adherence at program admission, better multifaceted treatment adherence in the year after hospitalization, and fewer urgent office visits in the subsequent year, when compared to reports of less-effective treatment alliance (Gavin, Wamboldt, Sorokin, Levy, & Wamboldt, 1999). Conflict with health care providers was one of several factors associated with poor adherence and increased risk of death in children with asthma (Strunk et al., 1985). Accumulating evidence suggests that relationships characterized by conflict place children and families at risk for having problems with effective asthma management.

Parents who are suffering from psychopathology have more difficulty caring for a child with a chronic illness than parents who are not suffering. A study with an inner-city population distinguished between admitted nonadherence and risk factors for nonadherence. The poorer the caregivers’ mental health, the more they admitted nonadherence. Also, cases in which caregivers endorsed family characteristics and described asthma regimens that placed themselves at risk for nonadherence were more likely to have originated from caregivers with clinically significant mental health problems and children with clinically significant psychological symptoms (Bauman et al., 2002). Parental psychopathology may impair parents’ ability to perform behaviors necessary to effectively manage children’s asthma since depressed patients, whether children or adults, are three times more likely to be noncompliant with medical treatment recommendations (DiMatteo, Lepper, & Croghan, 2000). Maternal depression has been found to be related to maternal behaviors associated with child health; specifically, maternal depression was associated with an decreased likelihood of administering vitamins to children, of placing a child in a car seat all or most of the time, and of being a nonsmoker (Leiferma, 2002). Thus, depression likely affects a caregiver’s ability to perform daily behaviors associated with asthma management.

Racial or Ethnic Background

A better understanding is needed of the underlying mechanisms for racial and ethnic group differences in medical adherence and asthma outcomes. For example, one study found that non-White children (i.e., Black and Hispanic), older children and adolescents, and children from families with poorer functioning were more likely to have poorer adherence as recorded by electronic recording (Bender, Wamboldt, et al., 2000). Another recent study documented that Black and Latino children were more likely to undermine asthma preventive medications, in comparison to White children after adjusting for sociodemographic variables and asthma status (Lieu et al., 2002). Adolescence, Black race, and residence in rural regions independently predicted failure of families to get oral corticosteroid prescriptions filled following children’s hospitalization or a visit to the emergency department (Cooper & Hickson, 2001).

Understanding racial and ethnic differences in asthma management behaviors is complex and requires examining multiple determinants. Recent literature has suggested examining whether asthma morbidity varies among the subgroups of Latino children based on differences in ethnic and geographic origin (Lara, Morgenstern, Duan, & Brook, 1999). The authors called attention to specific risk and protective factors—including possible genetic, environmental, and health care factors—that may affect differences in asthma outcomes. The most frequently reported barriers to the treatment of asthma among parents from urban, minority backgrounds were patient and family characteristics (43%), environmental factors (28%), health care provider factors (18%), and health care system factors (11%; Mansour, Lanphear, & DeWitt, 2000). As noted by the authors, these responses differed considerably from widespread beliefs that problems involving access to medical care, health insurance, and continuity of care are primary barriers to quality asthma care. Caregiver beliefs about asthma management (e.g., not believing the appropriateness of daily medication use without symptoms, concerns about side effects)
were significant predictors of caregiver–physician concordance about medication (Riekert et al., 2003). Addressing patient and family's health beliefs and concepts of disease and evaluating the cultural competence of health care system practices may be particularly important for improving asthma outcomes (Lieu et al., 2002).

Reducing exposure to allergens and environmental tobacco smoke is another behavioral requirement of management of pediatric asthma. Family psychosocial characteristics and racial or ethnic group differences are related to environmental asthma management. A recent study found patterns of family characteristics associated with smoking to be different from those associated with pet ownership (Wamboldt et al., 2002). Specifically, household smoking was associated with more family stress and poorer family resources (e.g., coping resources, parental education level) than that of nonsmoking households, whereas pet ownership was related to better family behavioral control and better asthma knowledge than that of households with no pet ownership. Different patterns of environmental risk factors for childhood asthma, such as environmental tobacco smoke and cat and cockroach exposure, were found among European Americans, African Americans, high-acculturated Hispanics, and low-acculturated Hispanics (Klinnert, Price, Liu, & Robinson, 2002). For example, the low-acculturated Hispanics had no measurable pet dander in the home, since indoor pets are not normative in this immigrant group. Within the African American group, better maternal mental health was associated with lower infant urinary cotinine and cat exposure. These findings suggest that different mechanisms may underlie families' efforts and decisions to alter their home environments consistent with treatment recommendations.

**Family Organization and Responsibility**

Effective management of pediatric asthma places demands on children and adults and requires families to face ongoing and new challenges and changes. A family's ability to organize and reorganize as new tasks emerge is central to successful adherence. Tasks that may reflect a family's ability to organize include taking a child's developmental status into account in dividing responsibilities for asthma management and incorporating family rituals and routines. A shifting set of responsibilities is indicated as children grow and develop, which is characterized by the transfer of self-management tasks from adults to children with an appreciation for children's socioemotional and cognitive development (Miller & Wood, 1991). Asthma management expectations for children at different developmental levels have been delineated (as described in Wamboldt & Wamboldt, 1995). Several studies have examined assignment of responsibilities in families of children with asthma. Paternal involvement in caring for children's asthma—that is, whether the father was living in the home—was associated with mothers' reporting less disruption in their daily lives due to childhood asthma; however, Hispanic ethnicity, severity of child's asthma, and child age were also associated with maternal report of disruption (Wasilewski et al., 1988). In the National Cooperative Inner-City Asthma Study, older children were rated by their parents as assuming more self-care responsibilities, but 37 children were identified as being the primary managers for their asthma (Wade et al., 1997). Since participating children were 6 to 9 years old, this extent of asthma management likely exceeds their developmental capacities (Klinnert, 1997a). A substantial level of disagreement concerning allocation of family responsibility for asthma management was found in a sample of Black adolescents and their caregivers (Walder, Drotar, & Kercsmar, 2000). Families where caregivers overestimated the level of adolescents involvement for self-care tasks had adolescents with increased nonadherence and greater functional morbidity. Caretakers reported decreasing responsibility for asthma management for older adolescents, yet there was not a significant relationship between older adolescents assuming more self-care responsibilities, a finding that highlights the need for routine assessment of family members' allocating responsibilities (Walder et al., 2000). Family rituals may offer a protective function in families of children with asthma and offer stability, organization, and meaning (Markson & Fiese, 2000). Age-appropriate division of responsibility among family members as well as routines and continuity, which may be absent or diminished in homes characterized by conflict and unsupportiveness, are essential in maintaining adequate asthma management.

In summary, distressed families may be unable to effectively manage asthma, owing to numerous factors. In addition, racial or ethnic group differences and family organization may also influence asthma management behaviors. It is notable that family factors—not illness severity or institutional barriers, as frequently hypothesized—have been found to be predictive of adherence behavior. Given the pervasive problem of nonadherence among children with asthma and their families, research and clinical work can be advanced with increasing knowledge about what family characteristics predict adherence, which may in turn affect asthma outcomes.
Family Functioning Affects Asthma Outcomes Through Physiological Factors

Several physiological mechanisms have been proposed to better understand how emotional factors in the context of family functioning may be related to pediatric asthma outcomes. Specifically, three mechanisms may reflect interactions between psychological and physiological processes: first, functioning of the hypothalamic pituitary adrenal (HPA) axis and the immune system; second, autonomic nervous system functioning; and, third, symptom perception. Evidence supporting these proposed mechanisms is the result of integrating multidisciplinary perspectives. Although the evidence at this time is largely theoretical, we nonetheless reviewed the preliminary data in support of these mechanisms.

HPA Axis and Immune System

The HPA axis may mediate the relationship between emotional factors and asthma in two ways. First, the HPA axis may be involved in the regulation of inflammation, which is a central component of asthma. Second, the impact of emotional factors on the HPA axis's functioning has primarily been examined within the context of better understanding individuals' responses to stress.

There is accumulating theoretical and empirical evidence suggesting that the HPA axis regulates allergic disease expression and allergic inflammatory responses. The interaction between immune and nervous systems may affect susceptibility and resistance to inflammatory diseases (Sternberg, 2001). In particular, neuroendocrine regulation of inflammatory and immune responses and disease may occur through the release of glucocorticoids by stimulation of the HPA axis, the presence of glucocorticoids in immune organs, and the release of neuropeptides and neurohormones at sites of inflammation. While glucocorticoids generally have anti-inflammatory and immunosuppressive effects, excess stress hormone responses are associated with enhanced susceptibility to infection whereas inadequate stress hormone responses are associated with enhanced susceptibility to inflammatory, autoimmune, and allergic diseases. The interplay between endogenous cortisol production and allergic inflammation may be evident in a variety of ways: lung function varies with plasma cortisol levels; the number of circulating inflammatory cells varies with plasma cortisol levels; and low levels of endogenous cortisol may be associated with risk for asthma (Schleimer, 2000).

Recent promotion of a biopsychological model of stress and asthma explains how psychological stressors can modulate interactions among the central nervous system and the immune system, which may affect inflammatory processes (Wright et al., 1998). Also, stress-related effects on the central nervous system and immunologic changes can alter responses to pathogens. Several researchers have suggested that early caregiver stress and quality of caregiving may affect alterations in immune development (Klinnert et al., 2001; von Hertzen, 2002; Wright et al., 2002). Sustained maternal stress during pregnancy may be associated with sustained excessive cortisol secretion that could in turn alter the developing immune system of the fetus (von Hertzen, 2002). In particular, cortisol might influence helper T cell phenotype differentiation and increase susceptibility to atopy and asthma in genetically predisposed children. The ways in which infants and children respond to stress, including developing strategies to modulate their emotions and behavior, may have an effect on their physiological functioning. Numerous psychosocial factors—such as trauma history, quality of caretaking in infancy and childhood, psychopathology, or temperament—may be associated with alterations in the HPA axis (Kelsay, Wamboldt, Kaugars, Klinnert, & Robinson, 2004). These alterations in the HPA axis's functioning may interact with current stressors in children with asthma to affect the severity of their asthma. In addition, exposure to violence can be considered a psychological and environmental stress that may affect onset of asthma by triggering exacerbations through neuroimmunological mechanisms (Wright & Steinbach, 2001).

There is emerging evidence that individuals with atopic conditions may also have an altered HPA axis response. Adolescents with a history of atopic illnesses demonstrated an attenuated cortisol response to the stress of laboratory procedures, in particular a blood draw, in comparison to adolescents who had no history of atopic illness or to those with positive skin tests and no clinical symptoms (Wamboldt, Laudenslager, Wamboldt, Kelsay, & Hewitt, 2003). The authors suggested that an attenuated cortisol response to a stressor may increase the likelihood that an individual develops an inflammatory response to the stress and thus have one's symptoms worsened after the stress. Furthermore, children with allergic asthma, in comparison to children without, demonstrated significantly attenuated cortisol responses to psychosocial stress (Buske-Kirschbaum et al., 2003), thereby extending the existing literature's examination of HPA axis's responsiveness among individuals with atopic conditions.

Further investigation of neuroendocrine regulation of inflammatory and immune diseases is necessary. A better understanding is needed of HPA axis activity among individuals with atopic conditions and the manner in which HPA axis activity may be altered in
response to chronic and situation-specific stress. Longitudinal studies, preferably beginning in infancy, are indicated to better understand the interplay of endocrine and immune systems in the development of atopy and asthma. Moreover, research is needed to examine how differences in the way children regulate their responses to different types of stress are related to the neuroendocrine system’s functioning throughout the course of development.

**Autonomic Nervous System**

A second mechanism that has been examined as a possible link between emotional factors and asthma is vagal mediation of the autonomic nervous system. In a review of the empirical literature on possible effects of suggestion and emotional arousal on pulmonary function (Isenberg, Lehrer, & Hochron, 1992), the authors proposed a model of parasympathetic mediation. In particular, increases in vagus nerve activity may mediate psychological influences resulting in constriction of the upper airways. Results of the review pointed toward a discrete subgroup of individuals with asthma who respond to particular emotionally charged stimuli with increased bronchial obstruction.

Similarly, Miller and colleagues have proposed a model of “psychophysiological vulnerable asthma” (Miller & Strunk, 1989; Miller & Wood, 1997). The model suggests that increased cholinergic activation in despairing, depressed, and hopeless states and cholinergically mediated airway reactivity in asthma result in a psychophysiological vulnerable affective state (i.e., autonomic dysregulation and cholinergic bias), which may in turn cause increased morbidity and mortality. In support of this model, sadness was found to evoke patterns of autonomic influence that are consistent with cholinergically mediated airway constriction (Miller & Wood, 1997). In contrast, states of happiness may be accompanied by autonomic patterns, which would be consistent with better pulmonary function. The authors hypothesized that psychophysiological reactive temperaments or previous emotionally traumatic experiences may place some children at greater risk for developing psychologically vulnerable asthma. In a retrospective controlled study comparing children who died of an acute attack of asthma with children who survived a life-threatening attack of asthma, significantly more children who died had experienced recent or impending separation or loss and exhibited emotional states of hopelessness and despair in the days preceding their deaths (Miller & Strunk, 1989).

This research contributes to a literature that examines how emotional factors within families affect asthma outcomes. More investigation is indicated to better understand the specific mechanisms underlying the observed relationship. Replication and extension of existing findings are needed, with particular attention to measurement and a comprehensive understanding of the subgroup of children for whom emotional factors contribute to a particular type of asthma vulnerability.

**Symptom Perception**

Emotional factors may affect one’s accuracy in perceiving symptoms and asthma outcomes. Perceptual accuracy is defined as “the degree to which subjective assessment of asthma symptomatology/severity corresponds with an objectively measured rating of severity” (Fritz, Yeung, et al., 1996, p. 158). Empirical work on perceptual accuracy in children with asthma has utilized various objective and subjective measures of respiratory status and symptoms (Fritz & Wamboldt, 1998; Fritz, Yeung, et al., 1996). More accurate symptom perception has been found to be related to fewer emergency medical visits and fewer days of school absence, after controlling for asthma severity (Fritz, McQuaid, Spirito, & Klein, 1996). While few associations between psychological constructs (e.g., anxiety symptoms, internalizing behavior, externalizing behavior) and accuracy of symptom perception have been demonstrated, children with higher cognitive ability had more accurate symptom perception than children with lower ability (Fritz, McQuaid, et al., 1996). Future research directions for this area include developing appropriate methodologies for assessing symptom perception, replicating existing studies with children who have varying degrees of asthma severity, examining how symptom perception contributes to adherence, and investigating the relationship between anxiety disorders and symptom perception (Fritz & Wamboldt, 1998).

In summary, HPA axis functioning, autonomic nervous system functioning, and symptom perception have been proposed as potential mechanisms that mediate relationships between emotional factors in families and asthma outcomes. While a significant amount of research is still needed to understand each of these mechanisms, it is important to examine interactions among multiple mechanisms and to understand how the mechanisms may function differently among subtypes of pediatric asthma.

**Conclusion**

Childhood asthma is strongly affected by family factors, including the psychological functioning of the parent, the interactions between the parent and the child, and the children’s functioning. Some families may be particularly
at risk for difficulties in managing asthma, owing to problems in their family social environment (“risky families”; Repetti et al., 2002) and to risk factors such as poverty and minority status.

This literature review intends to summarize existing knowledge about relationships between family characteristics and asthma outcomes. Although this provides us with an overview of the field’s progress, significant gaps exist in the literature that preclude development of more sophisticated models that can examine the direction of relationships and test mediating and moderating factors. Specifically, prospective longitudinal designs are essential first to delineate characteristics of premorbid functioning of caregivers and children and second to evaluate changes in functioning in response to asthma. More information is needed about normative development of the HPA axis among individuals with atopic conditions so that individual differences in illness manifestation and responses to stress can be better understood.

Future research will benefit from attention to numerous additional methodological concerns. Since many of the proposed relationships among aspects of psychological functioning and asthma outcomes may be bidirectional, more complex research designs need to take into account the multiple factors potentially contributing to asthma onset, manifestation, and morbidity. Sampling bias is rarely acknowledged in study limitations, yet it is evident that the factors determining selection of participants (e.g., socioeconomic background, asthma severity) greatly affect findings and subsequent generalizations. Although samples that represent population extremes (i.e., severe caregiver psychopathology) may provide significant relationships with asthma outcomes, such samples characterizing extremes may not necessarily be representative of the functioning of all children with asthma and their caregivers. Small sample sizes also limit generalizability of findings and require replication. Finally, what will advance this field of research is attention to reporter bias and the utilization of objective, multimethod assessment measures of psychological characteristics and asthma outcomes.

We have proposed that two pathways may explain the association between family characteristics and asthma outcomes. First, family conflict and distress may affect the asthma management behaviors in which families engage (see Figure 1, Paths B and C). Greater family conflict and distress are associated with poorer adherence and thus worse asthma outcomes. Moreover, family organization and membership in certain racial or ethnic groups have also been found to influence asthma outcomes via asthma management behaviors.

Second, theoretical models with some empirical evidence explain how HPA axis functioning, autonomic nervous system functioning, and symptom perception may contribute to the relationships between family characteristics and asthma onset and outcomes (see Figure 1, Paths D and E). Whereas much of the literature illuminates cross-sectional relationships, longitudinal designs would help examine complicated, intertwining relationships throughout the developmental process. This is an exciting area for future research that can utilize multidisciplinary approaches to better understand the complexity of pediatric asthma. Most elements of the proposed theoretical model have not been empirically tested; however, it is our hope that proposing this model will stimulate future research in this area.

If the morbidity associated with pediatric asthma is to improve, it will be critical that assessment and treatment take into account the various emotional, behavioral, and physiological factors within families that affect pediatric asthma outcomes. Integrating research findings into treatment could benefit child and family functioning as well as asthma outcomes. As discussed in this review, multiple facets of family functioning, which in some cases could be altered with intervention, may be influential in pediatric asthma. As the treatment guided by research develops, not only could it minimize the functional and emotional impact of asthma on children and families, but it could also help children and families effectively manage asthma, with the aims of decreasing disruption and integrating asthma management into their lives. As we advance our understanding of developmental processes, we will gain better insight into where and how to intervene to improve asthma outcomes.

Acknowledgments

This work was supported by a National Institute of Mental Health–funded institutional postdoctoral research training program, the “Development of Maladaptive Behavior” 5 T32 MH15442; by the Developmental Psychology Research Group at the University of Colorado Health Sciences Center, Denver, Colorado; and by a National Institute of Child Health and Human Development–funded National Research Service Award, Individual Postdoctoral Fellowship 1 F32 HD042894.

Received April 23, 2003; revisions received September 15 and November 23, 2003; accepted November 26, 2003
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