A RISK AND RESISTANCE MODEL FOR PREDICTING MEDICATION ADHERENCE IN YOUNG CHILDREN WITH ASTHMA: ROLE OF PARENT STRESS, CHILD TEMPERAMENT, AND SOCIAL SUPPORT

By

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To Sandra and Robert Lipe

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Asthma is the most common chronic illness in children and can lead to negative outcomes if not properly controlled through good regimen adherence. This study aimed to fill gaps in the extant pediatric asthma literature by examining risk and resistance factors associated with medication adherence in preschool-aged children with asthma. Participants included 43 caregivers of children aged 2 to 5 years with persistent asthma. Assessment involved the measurement of general and illness-related parenting stress and child temperament as possible risk factors, social support as a potential protective factor, and review of pharmacy refill records to measure adherence objectively.

Linear regression analyses revealed that the proposed risk and resistance factors were not significantly associated with medication adherence. These findings suggest that caregivers of young children with asthma may be a unique population as the results were not comparable to previous studies assessing similar relationships in caregivers of older children with asthma (Carson & Schauer, 1992; DeMore, Adams, Wilson, & Hogan, 2005). Future research should focus on examining the way in which length of diagnosis and other factors related to a young asthmatic population may contribute to the relationship between caregiver psychosocial factors

and child medication adherence. Given that asthma is a chronic condition, it is necessary to understand and establish good adherence behaviors in children early in life to facilitate healthy lifestyles in the future.

CHAPTER 1
INTRODUCTION

Epidemiology, Symptoms, and Treatment of Asthma

In 2005, it was estimated that asthma prevalence rates in children were as high as 9% or 6.5 million in the United States (National Center for Health Statistics, 2006), with the largest increase in prevalence rates seen recently in children age 4 or younger (Mannino et al., 1998). Given these high rates, control of childhood asthma has become one of the top priorities of health professionals and researchers. Indeed, reduction of pediatric asthma related deaths, hospitalizations, and emergency department visits are cited as goals of the Healthy People 2010 initiative (United States Department of Health and Human Services, 2000).

Asthma is a chronic disease defined by symptoms including tightening of the chest, coughing, and wheezing that result from restricted bronchial airways and increased mucous in the airways. If asthma is not managed effectively and treatment regimens are not followed consistently, it can lead to poor outcomes, including school absences, missed work for parents, and even death of the child (American Lung Association, 2006). Asthma-related hospitalization rates have been reported to be highest in preschool-aged children (Centers for Disease Control and Prevention, 1996). Taken together with the high prevalence rates in this age range, these statistics provide further evidence emphasizing the need for additional research in the very young asthmatic population.

In children with persistent asthma (i.e., symptoms occurring on a weekly basis), the treatment regimen includes the recognition and avoidance of environmental triggers that may exacerbate symptoms and the regular use of controller or preventative medication. A popular prophylactic option for persistent asthma is the use of anti-inflammatory medications (e.g., inhaled corticosteroids) that reduce airway restriction. As the airways become less restricted,

they are less sensitive to environmental triggers; therefore, allowing for greater symptom control and fewer flare-ups (American Lung Association, 2007). Parents are often unable to use inhalers with young children because it is difficult for children to coordinate their breathing with the quick release of the medication. Consequently, medications are not sufficiently consumed when such difficulties are present (Canny & Levison, 1988). As a result, young children are often given their preventative asthma medications using nebulizers or pressurized metered dose inhalers (pMDI) with spacers and/or facemasks. Nebulizers are machines that use compressed air to deliver medications as a mist that can be inhaled passively. The use of spacers, tubes that can be connected to inhalers that contain the medication, with pMDI devices slows down the rate at which doses are delivered, making it easier for young children to synchronize their inhalation with actuation. Facemasks are often used in conjunction with spacers to maximize inhalation in children under the age of 4 (O'Connell, 2005). The complex equipment involved in these methods of delivery and the requirement of children to remain stationary for a number of minutes may potentially provide a barrier to treatment success in children, especially those exhibiting difficult behaviors. Regardless of the delivery method, these anti-inflammatory medications must be taken regularly (i.e. daily) in order to be effective, and beneficial results are less likely to occur if they are not taken according to instruction or if child behavior precludes proper use.

Medication Adherence in Children with Asthma

Given the risks of poorly controlled asthma, medication adherence is a key component of asthma management that deserves research focus. Non-adherence to long-term daily asthma controller medications has been found to correlate with asthma morbidity (i.e., increased emergency room visits and number of school absences) in children aged 8-16 (Walders, Kopel, Koinis-Mitchell, & McQuaid, 2005). Moreover, in children and adults, regular use of inhaled

corticosteroids has been associated with a significant decrease in hospitalizations (Suissa, Ernst, & Kezouh, 2002). A literature review of adherence in pediatric asthma reported that non-adherence rates range between 17%-90% across multiple studies (Lemanek, 1990). Even in preschool children requiring parental administration of medication, adherence has been found to be less than optimal despite frequent parent-reported asthma symptoms in their children (Gibson, Ferguson, Aitchison, & Paton, 1995). Furthermore, in a study of young urban children aged 2 to 9, approximately 28% of children with persistent asthma did not refill any controller medications within a 6-month period (Mudd, Bollinger, Hsu, Donithan, & Butz, 2006). Adherence rates vary across research studies; however, they consistently indicate that a significant number of children and families do not follow physician recommended dosages for asthma medications.

Parenting Stress as a Risk Factor for Low Medication Adherence

Asthma does not just impact the patient, but has the potential to affect the child's entire family. In fact, asthma has been conceptualized as a "family illness" (Hookham, 1985), necessitating consideration of factors outside the child when seeking to understand adherence and disease management. At a young age, children with persistent asthma are unable to remember to take and administer their asthma medications independently without parental prompting, guidance, and direct assistance. Aside from physical limitations in initiating medication treatment, young children do not yet have the mental capacity to recognize the relationship between symptoms and symptom reduction in the context of regular use of preventative medications; therefore, the responsibility falls on their caregivers to be cognizant of the benefits attributable to following prescription guidelines (Rand, 2002). In addition to everyday parenting demands, the requirement of direct parental involvement in administering medications with preschoolers potentially can be a significant burden for families.

Within the family context, children with asthma have been found to have difficult temperament characteristics that can be stressful to the family. As compared to healthy controls, children with asthma present with low adaptability, demanding behavior, and negative mood (Carson & Schauer, 1992), as well as social withdrawal (Liu & Wan, 2001). In a school-aged sample, children with severe asthma demonstrated nearly three times the odds of having severe externalizing or aggressive behavior problems as compared to healthy children (Bussing, Halfon, Benjamin, & Wells, 1995). Consequently, not only does the child's behavior have the potential to adversely affect parental adjustment, but such negative behavior also has the potential to increase parental demands related to an asthma treatment plan. Research has shown that managing discipline, providing developmental and emotional support, and handling asthma episodes can be quite burdensome for mothers of children with asthma. Mothers in one study reported managing their own fatigue as the most difficult task in maintaining the role as caregiver (Svavarsdottir, McCubbin, & Kane, 2000). Moreover, in a study of children with asthma aged 8 to 13 years, mothers had parenting stress scores approaching the 85th percentile as compared to mothers in the normative sample (Carson & Schauer). These authors speculated that a variety of factors were associated with stress, including difficult child temperament characteristics and lack of self-efficacy in the parenting role. What is particularly concerning about these results is that the mothers were approaching clinically significant levels of stress, given that scores at or above the 90th percentile are considered grounds for referral for further evaluation and possible treatment (Abidin, 1995). The amount of stress and fatigue associated with caring for a child with asthma, particularly in the context of difficult child behavior, may potentially present significant barriers to treatment adherence in families with preschool-aged

children who require more medication assistance. To date, research examining similar risk factors in younger children with asthma and their families has not been conducted.

Parental psychosocial factors have also been associated with asthma morbidity in children. One study of children with asthma aged 4 to 9 and their caregivers (Weil et al., 1999), found that an increased number of asthma-related hospitalizations was associated with poor caregiver mental health and high caregiver life stress. These factors, in addition to child mental health, were also associated with lower child functional status. Furthermore, increased wheezing in children was associated with poor caregiver and child mental health. The relationship between parental psychosocial factors (e.g., life stress and mental health) and child health is unclear; therefore, further research examining such factors and behaviors associated with child health (e.g., regimen adherence) could potentially provide useful information regarding the direction and nature of this relationship.

Parent-Reported Barriers to Medication Adherence

Extant literature provides evidence that parents of children with asthma report barriers to treatment adherence, specifically in the use of inhaled corticosteroids. In one study, the majority (71%) of parents of school-aged children with asthma reported barriers to consistent administration of these medications (Modi & Quittner, 2006). Interestingly, parents of children in this group reported significantly more barriers to adherence to inhaled corticosteroids as compared to parents of children with Cystic Fibrosis, a more severe pulmonary disease with a more complex and demanding daily regimen. Child oppositional behavior and forgetting were reported most commonly as barriers to treatment by parents in the asthma group (Modi & Quittner). Although this study elucidated barriers to adherence in school-aged children with asthma, more research is needed to understand if these same barriers, or perhaps others, exist for families with younger children.

Difficult Child Temperament as a Risk Factor for Low Medication Adherence

Temperament, a construct primarily used in characterizing young children, has been found to positively correlate with oppositional behavior in preschoolers (Earls, 1982). Little is known about how child temperament may be associated with poor health outcomes among children with asthma. As previously discussed, school-aged children with asthma have been found to exhibit greater difficult temperament characteristics and oppositional behaviors as compared to healthy controls (Carson & Schauer, 1992; Liu & Wan, 2001; Bussing et al., 1995). However, no published research has examined whether difficult child temperament may be associated with poor health outcomes via oppositional behavior and poor adherence to inhaled corticosteroids among preschool-aged children with asthma.

Social Support as a Resistance Factor

In contrast to risk factors such as barriers, research has shown that social support may act as a buffer, or resilience factor, to alleviate parenting stress (Sepa, Frodi, & Ludvigsson, 2004). Specifically, high levels of perceived social support have also been found to provide a buffer to assist caregivers responsible for children with chronic illnesses. This relationship was seen in a study of children with cancer and their parents, where overall social support was a protective factor against psychological distress in mothers, while fathers seemed to benefit most from primary support within the marriage (Lavee, 2005). Similarly, high levels of perceived spousal support in mothers of adolescents with Type I diabetes have been associated with lower levels of mother-adolescent conflict and better adolescent adherence to daily insulin injections, dietary restrictions, and blood glucose monitoring (Lewandowski & Drotar, 2007). In children with asthma, research targeting inner-city families has found parental perceived social support to be associated with less morbidity (i.e., wheezing) in their children (Weil et al., 1999).

Discrepancies in Extant Literature

Although research has examined parenting stress in pediatric asthma populations, it has been limited to school-aged children. Indeed, research has found that parental distress and difficult child temperament significantly predict medication adherence; however, children of participating parents ranged in age from 6 to 12 years (DeMore, Adams, Wilson, & Hogan, 2005). It is likely that school-aged children are able to take some degree of personal responsibility for the management of their asthma, whereas very young children require full parental monitoring and involvement. The demands involved in providing care to young children likely increase the parental burden, especially if the child displays difficult temperament behaviors that would be stressful even in the absence of managing a medical regimen for a chronically ill child. Research has not examined these variables (parenting stress and difficult child temperament) in their relation to medication adherence in young children nor tried to identify buffers or resilience factors such as social support within this relationship.

Current Study

The purpose of this research study was to fill gaps in the current pediatric asthma literature by examining risk and resistance factors associated with medication adherence in young children with asthma. It is important to understand how these variables are associated with adherence so that the content of family interventions aimed at improving adherence can specifically target key concerns. Using a “family illness” model for understanding asthma, this research study aimed to identify both family and child factors associated with medication adherence by investigating the relationships between (a) parenting stress and medication adherence and (b) child temperament and medication adherence in young children with asthma. Parenting stress was assessed in two specific contexts - in general parenting situations (e.g., giving up one’s life to care for child’s needs, parent-child dysfunctional interaction) and in the

context of caring for a child with a chronic illness - in order to identify if varying types of parenting stress differed in their association with medication adherence. In addition, caregiver social support was evaluated as a possible moderator between these variables (parenting stress and child temperament) and the outcome (medication adherence) (Figure 1-1).

Given support from existing literature, it was hypothesized that (a) greater difficult child temperament (e.g., children who excessively cry, fuss, and/or are easily upset), (b) greater parenting stress, and (c) lower perceived parental social support (i.e., parents who reported having low social support) would be significantly associated with lower adherence to inhaled corticosteroids among young children with asthma. It was further hypothesized that parenting stress associated with caregiving for a chronically ill child would be a stronger predictor of lower medication adherence than parenting stress associated with non-asthma related issues. Furthermore, it was also hypothesized that greater perceived parental support would buffer the relationships between difficult child temperament/parenting stress and lower medication adherence.

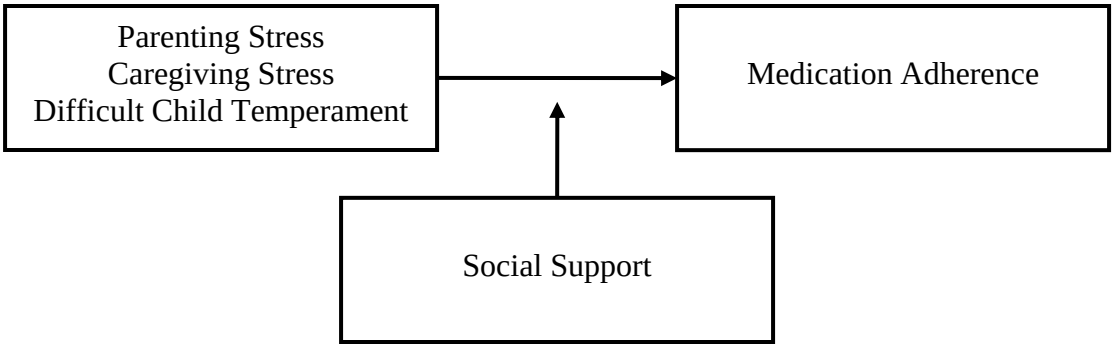

Figure 1-1. "Family illness" model for predicting medication adherence in young children with asthma

CHAPTER 2
METHODS

Design

The current study applied a cross-sectional design. Forty three caregivers of young children with asthma completed a series of psychosocial questionnaires and provided authorization to obtain their child's pharmacy refill history regarding prophylactic asthma medications. Statistical analyses examined the relationships between parenting stress and difficult child temperament as predictors of medication adherence, as well as social support as a moderator of these relationships.

Participants

Participants were recruited as part of a study funded by the Center for Pediatric Psychology and Family Studies at the University of Florida that was approved by the Institutional Review Board (IRB Project # 630-2007). All caregivers of patients meeting the following criteria were eligible for participation: (a) child diagnosis of persistent asthma; (b) child age between 2 and 5 years; and (c) child prescribed a daily controller or preventative medication for asthma. Caregivers were excluded if: (a) they were non-English speaking; (b) they had significant cognitive impairments that rendered them unable to consent and/or complete study-related measures; or (c) child's asthma medications were obtained via samples (as opposed to pharmacy refill).

Procedure

Participants in this study were recruited from a pediatric pulmonary clinic in north-central Florida. Caregivers meeting eligibility criteria were approached by research staff during regularly scheduled clinic visits. Once informed consent was obtained, the primary caregiver completed the study measures in random order. In accordance with clinic protocol, caregivers

were informed that the research was secondary to the clinic visit and the health of the child to ensure that the appointment would not be disrupted due to involvement in the study. Caregivers were also assured that their responses would not be shared with the pulmonary staff in order to decrease the risk of social desirability. Research staff regularly checked with participating caregivers to address any questions they may have had concerning the measures. Upon completion, participants were compensated with a $5 gift card.

For each pharmacy location that the caregiver reported using to obtain the child's asthma medication, a release form was completed by the research staff, indicating the specific asthma medications of interest (i.e., controller or preventative medicines), and then signed by the caregiver prior to contacting the pharmacies to obtain refill data. It is noteworthy that this procedure is common practice in the standard clinical care of asthma patients.

Psychosocial Measurement

Parenting Stress

The Total Stress score from the Parenting Stress Index-Short Form (PSI-SF), an instrument common in pediatric asthma research (Carson & Schauer, 1992; DeMore et al., 2005), was used as a measure of general parenting stress (Abidin, 1995). The PSI-SF is a self-report measure intended for parents of children ages 1 to 12 that is divided into 3 subscales: Parental Distress (PD); Parent-Child Dysfunctional Interaction (P-CDI); and Difficult Child (DC). Scores for each of these subscales are combined to yield a Total Stress score that takes into account each of these domains. Cronbach's alpha coefficients have ranged from .80 to .91, indicating good internal consistency. Satisfactory test-retest reliability has also been demonstrated with coefficients ranging from .68 to .85 in each of the subscales.

Caregiving Stress

The Pediatric Inventory for Parents (PIP) was used to measure the frequency and difficulty of stressors related to the role of caregiver for a child with a chronic illness (Streisand, Braniecki, Tercyak, & Kazak, 2001). A 5-point Likert scale is used to examine stress across 4 domains: Communication, Emotional Distress, Medical Care, and Role Function. Each domain is also measured across Frequency and Difficulty scales, although only the Total Frequency score will be used for purposes of this study. Total Frequency scores have been found to be internally consistent, with Cronbach's alpha coefficient of .95. Individual subscales also demonstrate high internal consistency, with Cronbach's alpha coefficients ranging between .80 and .96. Scores on this measure significantly correlate with other standardized self-report measures of parent stress and state anxiety, indicating construct validity.

Difficult Child Temperament

The Difficult Child subscale from the aforementioned Parenting Stress Index – Short Form (Abidin, 1995) was used as the measure of difficult child temperament. The Difficult Child subscale has demonstrated acceptable test-retest reliability (r = .78) and internal consistency with a Cronbach's alpha coefficient of .85.

Social Support

The Multidimensional Scale of Perceived Social Support (MSPSS) was used to measure the perceived social support of caregivers in our sample (Zimet, Dahlem, Zimet, S.G., & Farley, 1988). The MSPSS is a self-report measure with 12 items that identifies levels of perceived social support across 3 subscales: Family, Friends, and Significant Other. Cronbach's alpha coefficients ranging from .85 to .91 have been reported to indicate strong internal consistency. Test-retest reliability values are acceptable with coefficients ranging from .72 to .85. In a sample of college students, the MSPSS was significantly negatively correlated with the Beck Depression

Inventory (higher social support scores correlated with lower depression scores), indicating construct validity (Zimet et al., 1988).

Measurement of Medication Adherence

As an indirect, but objective measure of medication adherence, pharmacy refill data were obtained for the child's preventive or controller asthma medication (e.g., inhaled corticosteroids). The desired time period for adherence calculations was 6 months retrospective of caregiver participation in this study. Due to the timing of refills, however, refill history was obtained for the 9 months prior to the study visit in order to most accurately calculate 6 months of adherence data. For each medication, the number of doses refilled was divided by the number of doses prescribed, and then multiplied by 100 to yield a percentage of maximum possible adherence. This percentage was used as a continuous variable in our analyses; however, as a rule of thumb, very poor adherence is characterized by values between 0 to 50%, less than optimal between 51 to 84%, and optimal adherence between 85 to 100%. This method has been found to be 92% accurate and compared to physician assessments, was able to detect very poor adherence in twice as many patients in its original application (Sherman, Hutson, Baumsterin, & Hendeles, 2000).

Statistical Procedures

Results presented in this paper are based upon cross-sectional psychosocial data and child pharmacy refill data. First, the relationships between potential demographic control variables and medication adherence were examined. One-sample t-tests were used to compare the average levels of the measured variables reported by caregivers in this sample to the averages obtained by standardization samples on the respective measures. Linear regression analyses were used to examine the relationships between the predictors (e.g., parenting stress, caregiver stress, and difficult child temperament) and medication adherence. Furthermore, moderator analyses were

performed using Interaction! Version 1.3.1733 (Soper, 2006) to test the role of perceived social support as a potential moderator between these variables.

CHAPTER 3
RESULTS

Demographics

Forty-six caregivers of children with asthma were enrolled in this study. The results reported here are based on 43 participants on whom we were able to obtain pharmacy refill history for their child's daily asthma controller or preventative medication. Three participants were excluded from analyses because pharmacy refill histories were not available.

The 43 caregivers ranged in age from 21 to 58 years (*M* = 33 years, *SD* = 8.2 years). The majority of caregivers were birth mothers (84%), with the remainder of the sample being comprised of adoptive mothers (7%), grandmothers (5%), and fathers (5%). The majority (65%) of caregivers were non-Hispanic/Caucasian, 26% were African American, and 9% were of Hispanic ethnicity. Approximately 58% of the caregivers were married, whereas 35% were single/never married, 5% were divorced, and 2% were separated. The majority (58%) of caregivers were employed outside the home during their time of participation and averaged 34.2 hours (*SD* = 80.7 hours) of time taken off of work in the previous 6 months to care or obtain treatment for their child's asthma. Children of the participating caregivers ranged in age from 2 to 5 years (*M* = 3.3 years, *SD* = 1.2 years) and were primarily male (67%).

General Parenting Stress and Difficult Child Temperament

Caregivers participating in this study reported Total Stress scores on the Parenting Stress Index-Short Form (PSI-SF) that fell, on average, in the 50th percentile (*M* = 69, *SD* = 23; maximum possible score = 180). Using the 90th percentile as a recommended clinical marker (Abidin, 1995), analyses revealed that approximately 21% of the caregivers in this sample reported clinically significant parenting stress scores. With regard to the individual subscales of the PSI-SF, the responses of 21% of caregivers revealed clinically significant elevations on the

difficult child subscale, 16% of caregivers reported clinically significant parent-child dysfunctional interactions, and 12% reported clinically significant levels of parental distress.

The PSI-SF also includes a defensive responding scale that aims to identify participants who are "faking good." Approximately 35% of caregivers in this sample met criteria for defensive responding. In an attempt to control for defensive responding, initial regression analyses were performed excluding caregivers who met these criteria; however, these results were identical to those obtained when the entire sample was included. Therefore, the results presented later in this chapter did not exclude participants who met criteria for defensive responding.

Caregiving Stress

The Total Frequency score from the Pediatric Inventory for Parents (PIP) was used to determine the extent to which caregivers experienced disease-related stressors. On average, caregivers in this sample reported similar frequency of health-related stressors (M = 90.1, SD = 28.4) to caregivers of children with cancer (M = 94.0, SD = 33.3), who comprised the standardization sample for this measure, $t(34) = -0.82$, $p = .42$ (Streisand, 2001).

Social Support

Using the Multidimensional Scale of Perceived Social Support (MSPSS) scale ranging from 12 to 84, with higher scores indicating higher levels of perceived social support, caregivers in this sample reported levels of total perceived social support (M = 65.6, SD = 19.6) that were not significantly different than those reported by a sample of college students in the standardization sample, $t(41) = -1.33$, $p = .19$ (Zimet et al., 1988). With regard to the individual subscales, which ranged from 4 to 28, perceived support from significant other was reported as the highest source of support (M = 22.5, SD = 6.9), followed by friends (M = 21.7, SD = 6.8), and family (M = 21.5, SD = 7.4).

Medication Adherence

Although attempts were made to calculate medication adherence based on the 6 month time period prior to caregiver participation in the study, pharmacy refill data revealed that some children had prescription histories less than 6 months in duration. Given that the present study included pre-school children, this was likely due to recent treatment initiation. On average, medication adherence was calculated based on 151.7 days of data (*SD* = 47.8 days). Pharmacy refill patterns revealed that on average, the maximum possible adherence rates of children whose caregivers participated in this study were less than optimal, as outlined by Sherman, Hutson, Baumsterin, and Hendeles (2000). Furthermore, there was a great deal of variability within the sample (*M* = 57%, *SD* = 31%) as the modal maximum possible adherence percentage was 0% and the median was approximately 56%.

Relations between Psychosocial Variables and Medication Adherence

A series of bivariate correlations and one-way ANOVAs were conducted to identify possible continuous and categorical variables that may have confounded existing relationships between the predictors and medication adherence. Caregiver age, $r(43) = .12$, $p = .46$, marital status, $r(43) = -.22$, $p = .15$, and number of people living in the household, $r(43) = -.13$, $p = .40$, were unrelated to medication adherence. Thus, there were no control variables entered into the regression analyses that follow.

Relations between Parenting Stress and Medication Adherence

Using the PSI-SF Total score as a measure of general parenting stress, linear regression analysis failed to reveal a significant association between parenting stress and adherence, $\beta = -0.22$, $t(41) = -1.46$, $p = .15$. Contrary to the hypothesis, a significant proportion of variance in adherence was not explained by self-reported general parenting stress, $R^2 = .05$, $F(1,41) = 2.12$, $p = .15$. (Table 3-1).

Relations between Caregiving Stress and Medication Adherence

Linear regression analysis revealed that caregiving stress was not significantly associated with adherence, β = -0.13, t(34) = -0.78, p = .44. Furthermore, a significant proportion of variance in child medication adherence was not explained by caregiving stress, R^2 = .02, F(1,33) = 0.61, p = .44. (Table 3-2).

Relations between Difficult Child Temperament and Medication Adherence

Linear regression analysis was performed to evaluate the relationship between difficult child temperament - as measured by the PSI-SF difficult child subscale - and child medication adherence. Contrary to hypothesis, there was no association between temperament and adherence, β = -0.16, t(41) = -1.06, p = .30. Difficult child temperament failed to account for a significant proportion of variance in adherence, R^2 = .03, F(1,41) = 1.12, p = 0.30. (Table 3-3).

Social Support as a Moderator

Moderator analyses were performed using Interaction! Version 1.3.1733 (Soper, 2006) to examine whether social support moderated (buffered) a relationship between the predictors of interest (parenting stress, caregiver stress, child temperament) and child medication adherence. Three hierarchical linear regression analyses were performed to determine whether the respective interaction terms were significant above and beyond the main effects of each of the predictor variables and the proposed moderator (social support). In the first equation, child medication adherence was regressed on the main effects of PSI-SF total (predictor) and MSPSS (moderator) (Block 1) and the centered interacted term (PSI-SF total x MSPSS total) (Block 2). In the second equation, PIP frequency was substituted as the predictor; and in the third equation, PSI difficult child was entered as the predictor.

In the first equation, the overall model failed to account for a significant amount of variance in medication adherence, R^2 = .13, F(3,31) = 1.50, p = .23. Furthermore, the centered

interaction term (PSI-SF total x MSPSS total) was not a significant predictor of medication adherence above and beyond the main effects of PSI-SF total and MSPSS, $\beta = 0.01$, $t(34) = 1.15$, $p = .26$. (Table 3-4).

In the second equation, social support also failed to moderate the relationship between caregiving stress and medication adherence. The overall model was not significant, $R^2 = .06$, $F(3,31) = 0.69$, $p = .57$. The centered interaction term (PIP frequency x MSPSS total) was not a significant predictor above and beyond the main effects of PIP frequency and MSPSS total, $\beta = 0.01$, $t(34) = 0.66$, $p = .52$. (Table 3-5).

In the third equation, the overall model did not account for a significant amount of variance in medication adherence, $R^2 = .07$, $F(3,31) = 0.73$, $p = .54$. Furthermore, the centered interaction term (PSI difficult child x MSPSS total) was not a significant predictor of medication adherence above and beyond the main effects of PSI difficult child and MSPSS total, $\beta = 0.03$, $t(34) = 0.92$, $p = .36$. (Table 3-6).

Table 3-1. General parenting stress predicting child medication adherence

Step number	Predictor variable	R^2	β	F of R^2
1	PSI Total Score	.05	-0.22	2.12

N=42. Significance of Model, $F(1, 41)=2.12$ p=.15
*p≤.10, **p≤.05

Table 3-2. Caregiving stress predicting child medication adherence

Step number	Predictor variable	R^2	β	F of R^2
1	PSI Total Frequency	.02	-0.13	0.61

N=34. Significance of Model, $F(1, 33)=.61$ p=.44
*p≤.10, **p≤.05

Table 3-3. Difficult child temperament predicting child medication adherence

Step number	Predictor variable	R^2	β	F of R^2
1	PSI: Difficult Child	.03	-0.16	1.12

N=42. Significance of Model, $F(1, 41)=1.12$ p=.30
*p≤.10, **p≤.05

Table 3-4. Moderator analyses: Predicting medication adherence from parenting stress and social support

Step number	Predictor variable	R^2	*t*	*p* value
1	PSI Total	-0.33	-1.25	.22
	MSPSS Total	-0.52	-1.55	.13
2	PSI Total x MSPSS Total interaction	0.01	1.15	.26

N=34, Significance of Model, R^2 = .13, $F(3,31)$ = 1.50, p=.23
*p≤.10, **p≤.05

Table 3-5. Moderator analyses: Predicting medication adherence from caregiving stress and social support

Step number	Predictor variable	R^2	*t*	*p* value
1	PIP Total Freq.	-0.20	-1.02	.31
	MSPSS Total	-1.02	-0.92	.36
2	PIP Total Freq. x MSPSS Total interaction	0.01	0.66	.52

N=34, Significance of Model, R^2 = .06, $F(3,31)$ = 0.69, p=.57
*p≤.10, **p≤.05

Table 3-6. Moderator analyses: Predicting medication adherence from difficult child temperament and social support

Step number	Predictor variable	R^2	*t*	*p* value
1	PSI-DC	-0.59	-1.00	.33
	MSPSS Total	-0.43	-1.24	.23
2	PSI-DC x MSPSS Total interaction	0.03	0.92	.36

N=34, Significance of Model, R^2 = .07, $F(3,31)$ = 0.73, p=.54
*p≤.10, **p≤.05

CHAPTER 4
DISCUSSION

Research has consistently demonstrated that adherence to preventative asthma medications in children is poor in many families (Lemanek, 1990) despite evidence associating regular use of daily preventative medications with decreased morbidity (Suissa, Ernst, & Kezouh, 2002). In preschool-aged children, hospitalizations related to asthma have been reported to be the highest (Centers for Disease Control and Prevention, 1996), although the factors that are associated with these high levels of morbidity have not yet been determined. Pediatric research has found that mothers of school-aged children with asthma report higher levels of parenting stress as compared to mothers of healthy children (Carson & Schauer, 1992) and that children with asthma display more difficult behaviors than healthy children (e.g., demandingness, negative mood, low adaptability, and social withdrawal) (Carson & Schauer, Liu & Wan, 2001; Bussing et al., 1995). Furthermore, although recent research by DeMore et al. (2005) revealed a predictive relationship between parenting stress, difficult child behavior, and medication adherence, their sample was limited to school-aged children and, therefore, did not take into account the additional parenting challenges associated with providing care for a very young child.

The current study was the first, to our knowledge, to use a “family illness” model (Hookham, 1985) to examine risk factors (e.g., parenting stress and difficult child temperament) and a resistance factor (e.g., social support) associated with poor adherence to daily asthma preventative medications in preschool-aged children. Regarding the proposed risk factors, it was hypothesized that higher levels of parenting stress (both general and specific to the role of caregiver for a chronically ill child) and higher levels of difficult child temperament would be associated with greater non-adherence in young children. However, none of the hypothesized

risk factors emerged as predictors of medication adherence in this sample. In addition, contrary to published research suggesting that social support may serve as a resistance factor to protect caregivers of chronically ill children from psychological distress (Lavee, 2005), social support failed to buffer the relationships between our hypothesized risk factors and medication adherence in our sample.

The lack of significant findings may possibly be explained by the prevalence of defensive responding by caregivers in this sample. Overall, caregivers in our sample reported average (50th percentile) levels of parenting stress that were not clinically significant. These findings were inconsistent with previous research suggesting that mothers of asthmatic children typically reported levels of parenting stress that approached or met criteria for clinical significance (Carson & Schauer, 1992). Given that caregivers in our sample were caring for children of a younger age, these considerably lower levels of parenting stress as compared to mothers of school-aged children were highly unexpected. Approximately 34.9% of caregivers met criteria for "faking good" on the PSI-SF defensive responding subscale and although results from our regression analyses did not differ when these participants were excluded, the rate of defensive responding in this sample suggests that a considerable portion of caregivers may have underreported levels of parenting stress and difficult child temperament. Therefore, it is possible that a significant relationship between the hypothesized risk factors and medication adherence may have failed to emerge due to defensive or socially desirable responses provided by caregivers.

However, while defensive responding may have contributed to these null findings, these results also suggest that adherence to asthma medications in young children may be better explained by other risk and resistance factors that were not measured in this study. For example,

the discrepancy in reported levels of parenting stress between caregivers in our sample as compared to those reported in previous studies with parents of school-aged children may indicate that the experiences for caregivers of asthmatic children are vastly different as a function of the length of diagnosis. Given the relative recency of asthma diagnoses in preschool-aged children, caregivers in our sample may not have yet experienced their children's asthma as a chronic stressor, and perhaps it is the chronic stress of parenting/caregiving for a young child with asthma that most strongly affects adherence. This will be important to consider in future research endeavors with families of very young asthmatic children in order to identify the unique factors contributing to poor medication adherence in this population.

Study Limitations

There are several limitations to this study that should be considered when interpreting the reported results, such as the modest sample size and the cross-sectional design, the latter of which precludes our ability to infer causal relationships between any of our measured variables. The use of self-report measures and the nature of our study procedures (i.e., directly obtaining completed questionnaires from caregivers in the clinic) are also limitations to this study because participating caregivers may have been more likely to respond in a socially desirable manner under these conditions.

Another limitation is the across subject variability in the intervals on which child pharmacy refill history was obtained. More specifically, some children of caregivers who participated in this study were prescribed their daily asthma preventative medication only one to two months prior to caregiver participation; therefore, their rates of adherence were based on shorter intervals of time than desirable (e.g., 6 months). This may be problematic for several reasons. First, adherence data based on shorter intervals may be more variable and less representative of true adherence than those based upon longer intervals. Second, a shorter

interval of medication usage may indicate that the child was recently diagnosed and/or recently initiated treatment, although these areas were not formally assessed in this study. As alluded to above, parenting and caregiver stress, as well as adherence, may be associated with length of time since diagnosis and/or treatment initiation. For instance, caregivers of children with newly prescribed medications may be more adherent initially because they are more vigilant about maintaining the medication regimen or because parenting stress may not have emerged as a significant problem early on in the treatment process. Thus, the variability across subjects in length of time since diagnosis and/or treatment initiation may have impacted our findings and/or the generalizability of these results to the population given that preventative asthma medications are typically part of a long term treatment.

Future Directions

This study is one of the first to examine a family illness model of child medication adherence in the very young asthmatic population. The results of this study suggest that further investigation is needed to determine risk and resistance factors associated with non-adherence in pediatric asthma. Families of the preschool-aged asthmatic population should continue to receive focus as it is clear from the results of this study that the challenges of maintaining adherence for parents of very young children are quite different than those faced by parents of school-aged children. Consistent with asthma-related adherence research, medication adherence was quite poor in this sample, and in some cases, families failed to refill any preventative asthma medications within six month time periods or longer. It is unclear as to whether these families were having difficulty refilling the medications, if they encountered barriers to administration of these medications, if they simply did not believe in the efficacy of the medications, or if they were experiencing a combination of these and other factors. Notwithstanding these inconclusive findings, the results highlight the necessity of further research to identify the barriers to

adherence in pediatric asthma and ultimately the development of interventions to assist families with children who are not receiving their asthma medications as prescribed.

The variables examined in the present study were broad psychosocial factors, and considering that these did not predict adherence in this sample, caregiver health beliefs regarding asthma treatments may be a worthwhile predictor to incorporate into a "family illness" model of non-adherence. Extant literature suggests that adults with asthma who have more skeptical beliefs about the necessity and efficacy of their prescribed asthma medications (e.g., belief that they do not have to use their preventative medication when symptoms are not present) refilled their asthma medications significantly fewer times than those who did not hold these beliefs (Menckeberg et al., 2008). Pediatric research has revealed similar relationships with regard to caregivers who provide care to children with asthma; however, these earlier results were based on parent-reports of adherence rather than objective measurements (Conn, Halterman, Lynch, & Cabana, 2007). Taken together, this evidence suggests that examining caregiver health beliefs may potentially be useful in explaining the relationships between medication adherence and the risk and resistance factors measured in the present study.

Given that asthma is a chronic condition, it will be important to establish behaviors that will facilitate good adherence to preventative medications in children at a young age. As caregivers of these children model adherent practices to their children early in life, the children will be much more likely to engage in similar health behaviors as they age and begin to take more responsibility for their own treatment. Thus, continued research is needed to identify the most salient factors associated with adherence such that we are able to develop interventions to assist families in maximizing their child's care and ultimately their health.

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BIOGRAPHICAL SKETCH

Megan Lipe graduated magna cum laude from Louisiana State University in 2007, receiving a Bachelor of Science degree in Psychology. During her time at Louisiana State University, she worked as a research assistant in a laboratory investigating the psychological impact of Hurricane Katrina on school-aged children in Louisiana and was a research assistant in the Women's Health, Smoking Cessation, and Eating Behaviors laboratory at Pennington Biomedical Research Center in Baton Rouge, Louisiana. She also worked as a school shadow for a child with autism, implementing Applied Behavioral Analysis protocol.

Megan began attending graduate school at the University of Florida in the Department of Clinical and Health Psychology in August 2007. She is focusing her research on psycho-oncology, with a specific interest in pediatrics, as well as women's health. She received her Master's degree in the spring of 2009 and is currently pursuing her Ph.D. in Clinical Psychology.