

Predictors of Repeat Hospitalizations in Children With Asthma: The Role of Psychosocial and Socioenvironmental Factors

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This study examined relationships between psychosocial factors and asthma rehospitalization patterns in 115 children (ages 4–18) who had ≥ 1 hospitalization during the study period. Lifetime history of hospitalizations and new hospitalizations during a 1-year follow-up period were measured, controlling for baseline asthma symptoms and medications. Prospectively, caretaker characteristics (lower sense of mastery, being less emotionally bothered by asthma) predicted greater likelihood of future asthma hospitalizations. Lifetime history of hospitalizations was associated with family impacts (greater family strain and family conflict, greater financial strain) as well as caretaker characteristics (greater personal strain, beliefs about not being able to manage one's child's asthma). These findings could help guide future interventions targeted at the subgroup of children who represent a high proportion of asthma hospitalizations.

Key words: asthma, family, psychosocial, socioeconomic, children

Asthma is the most common chronic illness in childhood, as well as the most common reason for hospitalization in childhood (Mannino et al., 1998; Pamuk, Makuc, Heck, Reuben, & Lochner, 1998). A minority of patients has been found to account for the majority of hospitalizations for asthma (Adams, Smith, & Ruffin, 2000; Bloomberg, Goodman, Fisher, & Strunk, 1997). A recent study demonstrated that patients who had been hospitalized multiple times did not differ in their hospitalization characteristics (e.g., length of stay, readmission interval) from patients who had been hospitalized only once over the 10-year study period (Bloomberg et al., 1997). Rather, initial analyses replicated previous findings (Carr, Zeitel, & Weiss, 1992; Finkelstein et al., 2000; Ray, Thamer, Fadillioglu, & Gergen, 1998) that factors such as race (being African American) and insurance status (e.g., having Medicaid) were associated with greater likelihood of multiple

lifetime hospital admissions. However, further analyses showed that these factors did not have as much specificity in predicting future hospitalizations as did lifetime history of hospitalizations (Bloomberg et al., 1997). This suggests that patients who are readmitted to the hospital even once are at continued risk for future hospitalizations, a finding consistent with previous research (Li, German, Lulla, Thomas, & Wilson, 1995; Mitchell, Bland, & Thompson, 1994). That race, insurance status, and hospitalization characteristics did not fully explain this pattern leads to an examination of other factors, such as social influences, in predicting repeat hospitalizations.

Psychological and Social Factors Associated With Asthma

Factors that influence repeat hospitalization patterns are likely to occur at a variety of levels, from the broad neighborhood level to the more circumscribed family level and to the individual level. For example, at the neighborhood level, living in a community that lacks resources may mean that high-quality medical care is not easily accessible. Additionally, community norms and beliefs may result in different health practices in low and high socioeconomic status (SES) neighborhoods. Both factors may then contribute to health outcomes. Some studies have shown that neighborhood SES markers relate to health over and above individual-level SES markers (Robert, 1998). Associations of neighborhood SES have been demonstrated with poorer health practices (Petridou et al., 1997), as well as with poorer health status, both for asthma (Huang & Joseph, 1999; Robert, 1999; Watson, Cowen, & Lewis, 1996) and other health conditions (Diez-Roux et al., 2001; Robert, 1998). In the present study, we examined the contribution of neighborhood-level SES variables to repeated hospitalizations for asthma.

At the family level, the nature of relationships between parents and children could play a role in asthma hospitalizations. Children

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with asthma have been found to have higher rates of clinically significant family stress as compared with healthy children (Bus-sing, Burket, & Kelleher, 1996). Children whose families are more cohesive are more likely to have controlled rather than uncontrolled asthma (Meijer, Griffioen, van Nierop, & Oppenheimer, 1995). Additionally, parenting difficulties early in a child's life, particularly during times of high stress, have been found to predict the onset of asthma in childhood (Klennert, Mrazek, & Mrazek, 1994; Klennert et al., 2001; Mrazek et al., 1999). Thus, strain in the family, in terms of both conflicts among family members and impact of illness on family relationships, could be associated with more frequent hospitalizations among children with asthma.

At the level of characteristics of the individual caretaker, the beliefs that parents hold about their ability to manage their child's asthma and the quality of life that they maintain while caring for a child with asthma may be associated with asthma hospitalizations. A health education intervention study conducted to improve asthma management skills and to build family self-confidence in the ability to manage asthma found that families that participated in the intervention reported better attack management strategies and preventive strategies compared with a control group (Clark et al., 1986). Adults with asthma who have greater confidence or trust in the care they receive from their doctor report having better controlled asthma and are more likely to have mild, as opposed to severe, asthma (Janson & Reed, 2000; ten Brinke, Ouwerkerk, Bel, & Spinhoven, 2001). Thus, parents who hold strong beliefs about their ability to care for their child's asthma may be less likely to bring their child to the hospital repeatedly for acute episodes.

Also at the level of the individual caretaker is the issue of quality of life. In adults with asthma, poor quality of life has been associated with more severe asthma ratings (Kucera, Greenberger, Yarnold, Choy, & Levenson, 1999). The relationship between asthma control and quality of life is also seen in intervention studies in which asthma management programs have been shown to improve quality of life ratings (de Oliveira, Bruno, Ballini, BritoJardim, & Fernandes, 1997; Lahdensuo et al., 1996) and in studies demonstrating that programs aimed at improving quality of life reduce asthma hospitalizations (Legorreta, Leung, Berkbigler, Evans, & Liu, 2000). Although these associations were all found in adults with asthma, we hypothesized that adult caretakers' quality of life might also relate to the hospitalization patterns of the children they care for.

Although these factors all have been associated with asthma outcomes, previous research has not addressed the question of whether these factors can distinguish children who get hospitalized repeatedly for asthma from those who do not. The present study examined the role of these neighborhood, family, and individual parent factors in relationship to patterns of asthma hospitalizations using both a retrospective and a prospective design. In the retrospective portion of the study, children who had been admitted to the hospital for asthma were assessed on these characteristics to determine whether the characteristics were associated with the number of lifetime hospital admissions. In the prospective portion of the study, these measures were used to predict the likelihood of returning to the hospital again for asthma during the 1-year follow-up period of the study. The possibility exists that findings may be due to confounds such as severity of illness (i.e., more severe illness being associated with both more negative family impact and more hospitalizations). We attempted to address this

issue by gathering data on baseline asthma symptoms in our participants.

Method

Participants

All children between the ages of 4 and 18 who were hospitalized for asthma at St. Louis Children's Hospital (SLCH) between June and December, 1999, were recruited for this study, provided they met the following eligibility criteria: (a) they had a diagnosis of asthma with no other chronic illness, (b) their primary reason for hospitalization was asthma, and (c) they spoke English. Research staff were made available 7 days a week in order to approach all eligible families during the period of the child's hospitalization. Families were asked to volunteer their time in completing the questionnaires described below; no payment was provided for study participation.

A total of 260 patients between the ages of 4 and 18 were admitted to SLCH for asthma during this period of time. Of these patients, 115 (44%) completed the psychosocial measures. Reasons for nonparticipation were assessed as part of the study protocol, and included the following: a parent was not able to be located during the hospitalization period despite repeated visits to the child's hospital room in 85 (59%) of the families; 45 (31%) of parents were approached but declined to participate; 13 (9%) of children were excluded because of other medical problems; 1 (0.7%) of the families did not speak English; and 1 (0.7%) of the families had been referred to the Division of Family Services. Children whose families completed the psychosocial questionnaires ($n = 115$) were not different from the group who did not complete study questionnaires ($n = 145$) in terms of race, gender, medical insurance, any neighborhood SES variable, or number of previous hospitalizations ($ps > .05$). However, children whose families completed questionnaires were significantly younger ($M = 8.22$, $SD = 3.12$) than children whose families did not complete study measures ($M = 9.39$, $SD = 3.88$), $t(251) = 2.66$, $p < .01$. In addition, families who participated were compared with families who were eligible and approached but declined participation ($n = 45$). These two groups did not differ on age, race, medical insurance, or number of previous hospitalizations ($ps > .05$). However, parents who participated were more likely to have a male child, $\chi^2(1, N = 154) = 4.42$, $p < .05$, and to live in more densely populated neighborhoods, $t(152) = 2.04$, $p < .05$.

Patients of families who completed the psychosocial measures averaged 8.2 years of age ($SD = 3.1$); 65% were male, and 77% were African American (with 21% Caucasian and 2% other). Of the families, 54% were on Medicaid. Families had an average of 2.31 ($SD = 1.37$) children living in the home, and 49% of parents were married or living with a partner (35% were divorced). Families had lived in the same home for an average of 6.29 years ($SD = 8.55$).

Measures

Impact on Family Scale (IFS). This questionnaire assesses the effects of chronic childhood illness on the family (Stein & Riessman, 1980). The measure consists of 24 items, with four subscales: Family and Social Impact, which refers to disruptions in normal social interactions (e.g., family having to give up things because of child's illness); Personal Strain, which refers to the psychological burden of the illness on the caretaker (e.g., feeling that others do not understand caretaker's burden); Financial Impact, which refers to the economic consequences of illness (e.g., missing work because of medical care-related responsibilities); and Mastery, which refers to the ways in which the family is able to master the stress of illness (e.g., caretaker feeling better about self because of ability to manage child's illness). Items are scored on a 4-point scale, ranging from 1 (*strongly agree*) to 4 (*strongly disagree*). Higher scores indicate more negative impact for all scales except mastery, for which higher scores indicate greater perceived mastery.

Family Environment Scale (FES). This questionnaire assesses the social environment of families (Moos & Moos, 1981). Three scales from this measure (the Family Relationship dimension) are reported here: Cohesion, defined as how much feeling of togetherness there is in the family; Conflict, defined as the amount of openly expressed anger, aggression, and conflict among family members; and Expressiveness, defined as the extent to which family members are encouraged to act openly and to express their feelings directly. Each subscale consists of nine statements that respondents are asked to rate as either true or false. Higher scores indicate greater cohesion, conflict, or expressiveness.

Pediatric Asthma Caregiver's Quality of Life Questionnaire (PACQLQ). This is a disease-specific measure of the emotional and social impairments that are experienced by parents of children with asthma (Juniper et al., 1996). The caregiver version consists of two subscales: Caregiver Activity Limitations (4 items; e.g., how often child's asthma interfered with work) and Caregiver Emotional Functioning (9 items; e.g., how often caregiver felt upset because of child's asthma symptoms). Items are answered with regard to the past week on a 7-point scale, ranging from 1 (*extremely bothered/all of the time*) to 7 (*not bothered/none of the time*). Higher scores indicate being less bothered by asthma (i.e., having higher quality of life).

Beliefs. This questionnaire was based on items developed as part of evaluation surveys of a previous study of asthma management in low-income, African American neighborhoods (Fisher et al., 1996). It assesses asthma-related beliefs, including beliefs about how often the parent can tell that his or her child's asthma is going to act up before it actually does (one item), being able to prevent asthma from occurring or worsening (three items), and how often the parent can stop asthma once it has started (one item). The three asthma prevention items are scored on a 3-point scale ranging from 1 (*very sure*) to 3 (*not at all sure*). The other two belief questions are scored on a 5-point scale ranging from 1 (*always*) to 5 (*never*). Higher scores on these items indicate being able to stop or recognize an asthma problem less often.

SES measures. SES in this study was assessed through neighborhood-level data on socioeconomic variables from the 1990 U.S. Census. The census tract/block group for each family was determined on the basis of the family's address, and then the following variables were extracted for each participant's neighborhood: median family income, percentage unemployed, percentage with less than a high school degree, and population density.

Medical records. Information about the total number of SLCH admissions throughout the child's lifetime was obtained from medical records. In addition, 1 year after study enrollment was completed, medical records were reviewed to determine number of asthma hospitalizations during this follow-up period. It should be noted that an accurate assessment of asthma hospitalizations can be difficult to determine from medical records if patients move or seek care at multiple hospitals. Thus, all parents were asked during the psychosocial assessment and were phoned after the follow-up period to ask about any additional hospitalizations other than at SLCH. During the follow-up period, 41 parents could not be reached; however, of the 71 that were contacted, only 1 reported an additional hospitalization outside of SLCH. This pattern fits with previous research that demonstrated a high level of consistency in site of admission over a 10-year period for patients in the St. Louis area (Bloomberg, Trinkaus, Fisher, Musick, & Strunk, 2002). To determine the robustness of our hospitalization results, we conducted all analyses using three different approaches: medical records plus patient report for non-SLCH hospitalizations (total hospitalizations); medical records only (total SLCH hospitalizations); and analysis of medical records for only those participants who lived within the city or county of St. Louis (residents of Illinois, for example, might be more likely to visit hospitals other than SLCH). The pattern of significant and nonsignificant results remained the same when we used these three approaches, and thus we report on only the total hospitalizations measure (medical records plus patient report) below.

Asthma symptoms at baseline (before the exacerbation started), as an indication of asthma severity, were evaluated from data recorded in the

chart at admission by the physician or nurse-practitioner and were scored according to criteria from the Guidelines for the Diagnosis and Management of Asthma from the National Heart, Lung, and Blood Institute (National Heart, Lung, and Blood Institute, 1997). In some cases, the physician or nurse-practitioner made a direct statement about the patient's severity category in a note. If no such statement was made by the physician or nurse-practitioner, then information was extracted from record notes on frequency of asthma symptoms on average over the month prior to onset of exacerbation. The number of days with asthma symptoms was coded as follows: 0–2 times per week (intermittent: I); 3–6 times per week (mild persistent: MiP); daily (moderate persistent: MoP); or more than once per day (severe persistent: SP). The number of nocturnal awakenings was coded as follows: 0–2 times per month, I; 3–4 times per month, MiP; 5–9 times per month, MoP; or 10 or more times per month, SP. Interference with exercise or play due to asthma was coded as follows: 0–2 times per month, I; 3–4 times per month, MiP; 5–9 times per month, MoP; or 10 or more times per month, SP. The highest score in any of the above categories was selected as the overall baseline asthma symptom score (1 to 4 scale: I, MiP, MoP, or SP). Of all information used to determine the extent of ongoing symptoms, 40 ratings were based on physician or nurse-practitioner summary statement of symptom category, 32 were based on days with asthma symptoms, 34 were based on nocturnal awakenings, and 29 were based on interference with exercise. As an index of acute symptoms, we included respiration rate and oxygen saturation levels in room air at the time of presentation to the emergency department for the index hospital visit (obtained from medical records). Additional information that was available pertaining to the asthma attack that resulted in the index hospitalization included first symptoms of asthma exacerbation (e.g., cough, wheeze, or symptoms of upper respiratory tract infection), time (days) from first symptoms indicating the start of exacerbation to hospitalization, trigger for asthma attack, action taken (contacting the primary care physician first or taking child to the emergency department first), and discharge information (medications and education received). This information was gathered from medical records. Information about the medications the child had taken in the week prior to their emergency department visit was obtained through parent report.

Procedures

Families who met eligibility criteria during the study period were identified through hospital records. Research members attempted to meet the families during the child's index hospitalization. If parents were present, they were informed about the study. Families who agreed to participate were asked to complete the questionnaires during their hospital stay. One parent from each family completed the IFS, FES, PACQLQ, and Beliefs questions. This study was approved by the Washington University Medical School Human Studies Committee.

Data Analyses

To examine associations of lifetime hospitalization patterns with psychosocial variables, we conducted a series of partial correlations. Because the distribution of number of hospitalizations was skewed, we log-transformed this variable first. We then tested associations of the log-transformed hospitalization variable with the psychosocial variables, controlling for any demographic and medical variables that were associated with hospitalizations. All analyses used a Bonferroni correction to adjust for the number of subscales tested within each psychosocial measure (alpha levels were set to .013 for IFS, .017 for FES, .017 for confidence items, .025 for PACQLQ, and .013 for neighborhood SES measures).

For prospective analyses predicting likelihood of being rehospitalized during the 1-year follow-up period, we categorized children as either being rehospitalized or not (given the brief follow-up period, there were not enough hospitalizations to divide children into many vs. some hospitalizations). Logistic regressions were computed, in which hospitalization during

the follow-up (yes vs. no) was regressed onto the psychosocial variable of interest. In these analyses, we added the log-transformed number of previous lifetime hospitalizations as a control variable. Significant odds ratios can be interpreted as the increase in likelihood of being rehospitalized for each 1-point increase in score on the psychosocial measure.

Results

Lifetime Hospitalizations

Clinical and demographic information. Table 1 presents information about the sample and about the asthma exacerbation that resulted in the index hospitalization. Age was positively associated with number of lifetime hospitalizations, $r(115) = .31, p < .01$. Having a child with more severe baseline symptoms of asthma was associated with greater number of lifetime hospitalizations, $F(3, 84) = 6.39, p < .01$. Medications taken the week prior to hospitalization as well as discharge medications were associated with

number of lifetime hospitalizations. Children who had taken albuterol, $t(112) = 4.08, p < .01$, inhaled steroids, $t(112) = 4.19, p < .01$, and oral steroids, $t(112) = 2.18, p < .05$, had a higher number of previous hospitalizations compared with children who had not. In addition, at discharge, children who were prescribed a controller medication had a higher number of previous hospitalizations than those who were not prescribed a controller medication, $t(112) = 4.47, p < .01$. Finally, children whose parents identified allergy as a trigger for their current asthma exacerbation had fewer lifetime hospitalizations compared with children whose parents identified other types of triggers (viral infection, tobacco smoke, unknown triggers), $F(3, 104) = 5.44, p < .01$. Hospital oxygen saturation levels, age-adjusted respiration rate, action taken for current asthma exacerbation, time from first symptoms to hospitalization, type of symptom the child presented with, and characteristics of discharge (receiving education, asthma action plan, and follow-up appointment) were not associated with number of lifetime hospitalizations ($ps > .05$).

Psychosocial variables and lifetime hospitalizations. Of the patients admitted to SLCH during the study period, 30% were being hospitalized for the first time in their lives. Table 2 reports the coefficients for the partial correlations conducted. These correlations controlled for all clinical and demographic factors significantly associated with lifetime hospitalizations (asthma baseline severity, medications taken, medications prescribed at discharge, age, and trigger for current asthma attack). A higher number of lifetime hospitalizations was significantly associated with parents perceiving greater personal strain ($p < .01$), greater family or social impact ($p < .01$), greater family conflict ($p < .001$), and greater financial impact ($p = .01$). A higher number of lifetime hospitalizations was also significantly associated with lower beliefs of parents that they could prevent their child's asthma problems from getting worse ($p < .01$) or could stop their child's asthma once it started ($p < .01$). No significant associations were found with number of hospitalizations and quality of life or neighborhood SES measures.

Table 1
Descriptive Characteristics of Study Sample by Lifetime History of Hospitalization

Variable	%	<i>M</i>	<i>SD</i>
Child's age (<i>n</i> = 115)		8.21	3.12
Hospital respiration rate (<i>n</i> = 113)		33.98	10.70
Hospital oxygen saturation level (<i>n</i> = 112)		92.85	10.10
Baseline asthma symptoms (<i>n</i> = 88)			
Mild intermittent	23		
Mild persistent	8		
Moderate persistent	28		
Severe persistent	41		
Medications taken in week prior to ED visit (<i>n</i> = 114)			
Albuterol	87		
Inhaled steroid	32		
Oral steroid	20		
Asthma trigger (<i>n</i> = 108)			
Viral/infection	45		
Allergy exposure	10		
Other	8		
Unknown	36		
Symptoms of asthma exacerbation (<i>n</i> = 109)			
Runny nose	31		
Cough	64		
Wheeze	35		
Days from first symptoms to increase in asthma (<i>n</i> = 109)		2.94	2.25
Action taken for asthma exacerbation (<i>n</i> = 92)			
Called PCP	27		
Took child to ED	73		
Received on discharge:			
Asthma education (<i>n</i> = 114)	96		
Asthma action plan (<i>n</i> = 114)	95		
Follow-up appointment (<i>n</i> = 114)	73		
Medication prescribed on discharge (<i>n</i> = 114)			
Inhaled corticosteroid only	41		
Other controller medication only	11		
Combination (inhaled + other)	24		
Oral steroid	87		

Note. *ns* represent the number of participants for whom data were available from medical records for each variable. ED = emergency department; PCP = primary care physician.

Prospective Analyses of New Hospitalizations

Thirty percent of children with an index hospitalization during the study period were readmitted to the hospital for asthma during a 1-year follow-up period, a rate similar to other studies (Bloomberg et al., 1997). Lifetime history of hospitalizations was strongly associated with the likelihood of a future hospitalization (odds ratio: 5.36, confidence interval [CI]: 1.90–15.14, $p < .01$). After adding number of previous hospitalizations to the covariates assessed at baseline that were relevant to hospitalizations during the 1-year follow-up period (asthma severity and medications taken), few variables were associated with likelihood of follow-up hospitalization. Parents who reported less mastery with respect to their child's illness (on the Impact of Family Scale) were more likely to have a child who was rehospitalized during the 1-year follow-up period (odds ratio: 0.68, CI: 0.46–1.00, $p = .01$). Additionally, parents who reported being less bothered emotionally by their child's asthma (Emotion subscale of the PACQLQ) were more likely to have a child who was rehospitalized during the 1-year follow-up (odds ratio: 1.64, CI: 1.00–2.70, $p = .02$; see Table 2). The same patterns were found when associations were tested without controlling for number of previous hospitalizations.

Table 2
Associations of Psychosocial Variables With Lifetime and Prospective Hospitalizations

Variable	Lifetime hospitalizations (<i>r</i>)	Prospective hospitalizations	
		Odds ratio	CI
IFS			
Family/social	.38 ^a	1.08	0.93–1.25
Financial strain	.29 ^a	0.98	0.77–1.24
Personal strain	.36 ^a	1.00	0.82–1.20
Mastery	–.05	0.68	0.46–1.00 ^a
FES			
Conflict	.47 ^a	0.98	0.90–1.06
Cohesion	–.14	0.98	0.92–1.03
Expressiveness	.16	0.97	0.90–1.04
Beliefs			
Prevent worse	.30 ^a	1.14	0.75–1.74
Stop asthma	.42 ^a	1.22	0.45–3.32
Asthma act up	–.14	1.41	0.67–2.98
QOL			
Activity	–.12	1.34	0.86–2.09
Emotion	–.15	1.64	1.00–2.70 ^a
SES			
Education	–.07	1.02	0.98–1.07
Unemployment	.10	1.05	0.96–1.13
Family income	.01	0.98	0.93–1.03
Pop. density	.11	1.07	0.92–1.24

Note. Values of *r* indicate partial correlations of psychosocial variables with lifetime hospitalizations, controlling for baseline asthma severity, medications, child's age, and trigger for the most recent asthma attack. Odds ratios indicate associations of psychosocial variables with the likelihood of being hospitalized during the 1-year follow-up period, controlling for number of lifetime hospitalizations, baseline asthma severity, and medications. CI = confidence interval (level set by Bonferroni correction); IFS = Impact on Family Scale; FES = Family Environment Scale; prevent worse = how often parent can prevent asthma from getting worse; stop asthma = how often parent can stop asthma once it has started; asthma act up = how often parent can tell that their child's asthma is going to act up before it actually does (higher scores on belief variables represent being able to stop or recognize asthma symptoms less often); QOL = quality of life (higher scores indicate being less bothered by asthma); SES = socioeconomic status; education = percentage of people with less than a high school degree; unemployment = percentage of people unemployed; family income = median family income; pop. density = population density per square mile.

^a Significant with *p* value at or below level set by Bonferroni correction.

Discussion

The results from this study suggest that family and individual caretaker variables are robustly associated with childhood asthma hospitalization patterns. At the family level, a higher number of lifetime hospitalizations was associated with reporting more negative impact on the family and the family's social network (IFS Family and Social Impact subscale), greater family conflict (FES Conflict subscale), and more negative impact on the family's finances (IFS Financial subscale). With respect to individual characteristics of the parent, a higher number of lifetime hospitalizations was associated with more negative impact on the parent personally (IFS Personal Strain subscale) and with parents reporting lower beliefs about being able to prevent their child's asthma from worsening and being able to stop their child's asthma once it had started. These associations were all found over and above the

effects of baseline asthma symptoms (as an indicator of severity level), asthma medications, and child age.

The present findings are generally consistent with previous research that has demonstrated the relationship of negative psychosocial characteristics and asthma prevalence (Wade et al., 1997), as well as asthma mortality (Sears & Rea, 1987; Strunk, Mrazek, Fuhrmann, & LaBrecque, 1985). They are also consistent with broader trends in research on family impact in other childhood chronic illnesses (Burlaw, Evans, & Oler, 1989; Zahr, Khoury, & Saoud, 1994). The current study extends these findings to a population not frequently studied, children who are hospitalized repeatedly for acute asthma episodes. Despite the fact that the majority of patients in our study received education, follow-up plans, and controller medications upon discharge, 30% of them were readmitted within 1 year, thus pointing to the need for investigating other factors, such as psychosocial variables, in understanding readmissions.

The findings from the cross-sectional analyses raise several possibilities regarding the direction of relationships among psychosocial factors and asthma. One possibility is that these associations may depict the psychosocial toll that multiple asthma hospitalizations take on families who have a child with a serious chronic illness. Consistent with this explanation, one previous longitudinal study in young children concluded that dysfunctional family interactions *resulted from* wheezing rather than being related to the *development* of wheezing (Gustafsson, Bjorksten, & Kjellman, 1994). Alternatively, it is possible that the psychosocial characteristics found related to hospitalizations may be present early in a child's life and may predict a subsequent long-term pattern of hospitalizations. Both possibilities—as well as the possibility of bidirectional relationships—are consistent with the data.

Prospectively, however, we found that few psychosocial factors predicted the likelihood of future hospitalizations. Neighborhood- and family-level relationship factors were not associated prospectively with hospitalizations. Two individual-level characteristics of caretakers emerged as significant. Parents who perceived less mastery over their child's asthma (IFS Mastery subscale) and who reported themselves to be less emotionally bothered by their child's asthma (PACQLQ Emotion subscale) were more likely to have a child be rehospitalized for asthma during the 1-year follow-up period. This pattern of associations was also found over and above the effects of number of previous hospitalizations, baseline asthma symptoms (severity), and asthma medications. It should be noted that even when previous hospitalizations (a strong predictor of future hospitalizations) were not controlled, the same two psychosocial factors were the only ones to predict hospitalizations during the follow-up period. Other studies that have prospectively examined relationships between psychosocial variables and asthma morbidity have found support for other individual caretaker variables (e.g., caretaker mental health) relating to asthma morbidity during a follow-up period (Weil et al., 1999).

The mastery finding suggests that less caretaker confidence in providing home asthma care may be associated with feeling more overwhelmed and thus with a higher likelihood of child hospitalizations. The mastery questions on the IFS tap confidence specific to handling a chronic illness, rather than general perceptions of mastery in life. This suggests that illness-related mastery in a parent forms an important component of a child's hospitalization patterns. This finding is consistent with previous research on other chronic illnesses that has found both adolescents' self-efficacy and

mothers' sense of empowerment to be related to adherence to treatment for diabetes (Florian & Elad, 1998; Ott, Greening, Palardy, Holderby, & DeBell, 2000).

The finding related to parent emotional quality of life suggests, as one possibility, that asthma-related emotional distress or burden may serve an adaptive role in terms of parents managing their children's acute asthma exacerbations. Although emotional concern about one's child's asthma may contribute to poorer parent quality of life, it is possible that being emotionally bothered is associated with higher asthma-related vigilance, earlier action taken for asthma symptoms, and a lower likelihood of the child requiring hospital-based care for severe symptoms. With regard to preventive health behaviors, some researchers have suggested that higher levels of anxiety or worry are beneficial for promoting behaviors such as mammography screening (McCaul, Branstetter, Schroeder, & Glasgow, 1996; McCaul, Schroeder, & Reid, 1996). Similar factors may be beneficial for parents caring for children with chronic illnesses. This relationship can also be seen as indicating poor asthma care among those less concerned about or cognizant of the potential seriousness of their child's asthma, a feature noted among family members in a study of a series of asthma deaths among children and youth (Birkhead, Attaway, Strunk, Townsend, & Teutsch, 1989).

Our follow-up interval to assess rehospitalization was relatively brief, only 1 year; however, this type of interval is important in terms of understanding the issues that are currently relevant to families and that may operate in the short term to predict new hospital admissions. Psychosocially, two individual parent factors were associated with hospitalizations over this short interval. However, the general pattern suggests that over and above a child's history of hospitalizations, it is a challenge to uncover psychosocial predictors of future hospitalizations. This is consistent with previous research that has found that number of previous hospitalizations is one of the most robust predictors of future hospitalizations (Bloomberg et al., 2002). It is also possible that one reason previous history of hospitalizations predicts future hospitalizations so strongly is that lifetime history in part reflects a constellation of psychosocial factors that indicate vulnerability to hospitalization. If lifetime history is, in some sense, a marker of this constellation of psychosocial factors, then it may predict future hospitalizations better than the set of individual psychosocial variables.

However, it should be noted that the psychosocial variables that were associated with lifetime hospitalizations did not predict future hospitalizations (even when lifetime hospitalizations were not controlled). There are a number of possible reasons for this pattern. One possibility is that the psychosocial variables associated with lifetime hospitalizations reflect the impact of a cumulative lifetime experience of hospitalizations and do not causally relate to future hospitalizations. Another possibility is that the psychosocial issues related to long-term patterns of hospitalizations are different from the processes that relate to hospitalizations in the short term. A third possibility is that as children age, the relevant psychosocial predictors change and that the lifetime versus prospective analyses reflect some of these changes.

In sum, we found that lifetime patterns of asthma hospitalizations were associated with both family-level relationship factors (conflict, negative family and social impact, and family financial impact) and individual caretaker characteristics (negative personal impact and confidence). However, after controlling for the effect of lifetime history of hospitalizations, these variables did not

predict future hospitalizations. Only two individual caretaker characteristics, parents reporting lower levels of mastery and lower emotional burden of asthma, were associated with the likelihood of future asthma hospitalizations. Important future research directions include identifying how these factors are related to medical care and compliance in chronically ill children. That is, differences in health-care-seeking behaviors and prescription of as well as adherence to medications are important contributors to asthma morbidity (Finkelstein et al., 2000; Warman, Silver, & Stein, 2001). Some of the psychosocial and SES variables that we studied may play an important role in explaining why adherence or health care experiences differ across children. Thus, future studies could work toward understanding pathways among SES, psychosocial variables, health-care-related variables, and asthma hospitalizations.

Limitations of the current study include the lack of assessment of individual-level child characteristics and the lack of more comprehensive information about patients' asthma history and characteristics, such as lung-functioning measures. Future studies that examine these factors could help researchers develop a broader picture of the characteristics that influence repeated asthma hospitalizations. Another limitation is the remaining difficulty in drawing definitive conclusions about causality, that is, whether psychosocial factors cause certain families to use hospital services more, or whether greater use of hospital services takes a psychosocial toll on families. Directionality could be further clarified in future intervention studies that examine the effects of changing family relationship variables or caretaker characteristics on hospitalization rates. Nevertheless, this study provides important information to guide future psychological or social-work-based interventions targeted at a specific subgroup of children who represent a high proportion of hospital readmissions for acute asthma episodes.

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