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Influence of social support on asthma self-management in adolescents

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ABSTRACT

Objective: Adolescents with asthma are influenced by peers and family. The objective was to better understand family social support and test its association with medication adherence, asthma control, and Emergency Department (ED) use.

Methods: This study is a cross-sectional secondary data analysis from a randomized controlled trial with urban adolescents from three U.S. cities. Participants (12–20 years old) with asthma completed the Perceived Family Support Scale (PFS) and Horne's Medication Adherence Report Scale (MARS). Data from both tools were classified into 2 categories—high and low (< 25th percentile) perceived family support and high (total score >10) and low medication adherence, respectively. Chi-square statistic and logistic regression were used for analysis.

Results: Of the 371 participants, the majority were young (96% ≤ 17 years), African American or Bi-racial (85%), and Medicaid-insured (72%); over one-third had maternal family history of asthma. Among those on a controller medication ($n = 270$), only 37% reported its use ≥8 days over 2 weeks. Asthma control was poor with 50% categorized “not well controlled,” 34% “very poorly controlled.” Participants responded positively to most social support items. One item, providing and receiving social support to and from family members, was less often positively reported. Low medication adherence was significantly associated with lower perceived social support ($p = 0.018$).

Conclusion: This study underscores the importance of family social support in understanding the extent of adolescents' self-management, particularly medication adherence.

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Introduction

Asthma is the most common chronic condition in children under the age of 18 in the United States and is the leading cause of childhood hospitalization globally, especially in low- and middle-income countries (1–3). Asthma rates reflect the health disparities in the United States and disproportionately affects children living in families with lower socioeconomic status who experience higher morbidity and mortality due to asthma (4, 5). African American children are affected by asthma more than other racial and ethnic groups, with higher rates of diagnosis, hospitalizations, morbidity, and mortality (6). Although Hispanic and white children have similar asthma prevalence, Hispanic

children have higher rates of asthma related Emergency Department (ED) visits and hospitalization (7).

Adolescence is a period of particular vulnerability because adolescents are taking increasing control of their asthma management although they often underestimate the severity of their asthma and overestimate its control (8). Adolescents also have different priorities compared to their parents, which often leads to difficulty creating and adhering to asthma management plans. For example, Ungar and colleagues found that adolescents cared most about physical activity limitations while their parents cared most about the night time symptoms and avoiding multiple ED visits (9). Asthma can be controlled with proper

education, reduced exposure to triggers, and medical management (7), however, many barriers prevent adequate asthma control in children, including psychosocial factors such as transportation issues, parental difficulty in taking time off work, limited health care office hours, negative care experiences, and health knowledge, attitudes or beliefs (10, 11). Pediatric asthma imposes a heavy burden on patients and their families. Treatment burden, which reflects patients' involvement in the health care system and self-care, is negatively affected by financial and psychosocial obstacles such as living in disadvantaged neighborhoods and having few educational opportunities (12). Asthma management is cumbersome, as it requires discipline, familiarity with disease-related symptoms, and avoidance of triggers. Hence, external psychosocial stressors may disproportionately affect proper management among vulnerable families such as those affected by poverty. For instance, perceived racial discrimination among African American youth has been associated with a greater likelihood of not only experiencing asthma but also of poor disease management (13). Parental concern regarding neighborhood safety, exposure to violence, and inadequate housing conditions impose further negative impact on the management of this chronic condition (1).

Social support has been associated with many health indicators such as mental health, endocrine and immune status, and chronic illness control (14). Studies have shown that family support correlates with better mental health among adolescents in the United States (15), African American college students (16), and adolescents in Israel (17) and Jamaica (18). While social support from adolescents' friends has been identified as one of the strongest predictors of good asthma control, family social support has also been associated with greater asthma control and higher quality of life in adolescents (14, 19). Family social support was also found to be associated with better asthma control and improved quality of life in adolescents of diverse racial and socioeconomic status in the U.S (19). High levels of support can change negative perceptions that adolescents may have toward asthma and promote positive attitudes toward self-care, enhancing treatment adherence (19). Few recent studies, however, have focused on family social support and its relationship to asthma for urban adolescents in the United States.

Medication adherence is a significant factor in controlling asthma, and is inadequate among many children and adolescents. In a recent study, youth and caregivers both reported that the youth took their

asthma medication exactly as prescribed less than 70% of the time (20). Difficulty remembering to take the medications and trouble using an inhaler correctly were significantly associated with youth-reported adherence to their asthma medications (20). As children grow up, adherence to asthma medications decreases among African American (21) and Hispanic adolescents with persistent asthma (22). Researchers in Australia found that youth and caregiver beliefs surrounding asthma management significantly affected medication adherence and asthma control, and most significant was the belief that the doctor can control asthma outcomes (23). Using pharmacy data for 2,193 patients for use of asthma controller medications over a 6 month period, the mean overall proportion of days covered was only 42% (24). This suggests widespread failure to even pick up controller medications from the pharmacy among patients with asthma (24).

Research question

This paper presents selected findings from a multisite research project focused on improving asthma self-management in urban adolescents. The aim of this paper is to examine family social support perceived by adolescents and its relationship to adolescent characteristics (demographics), medication adherence, ED use, and asthma control. We hypothesized that perceived family social support would be positively related to high medication adherence and the level of asthma control reported by adolescents and negatively related to ED visits.

Methods

Study sites and sample

This study is a cross-sectional analysis of baseline data collected from a randomized controlled trial evaluating the effectiveness of a peer-led asthma self-management program for urban adolescents. Study participants were recruited from three U.S. metropolitan areas located in New York, Maryland, and Tennessee, using multiple strategies including clinician/emergency department referrals ($n=106$, 28.6%), school events/referrals ($n=90$, 24.3%), word-of-mouth ($n=76$, 20.5%), study advertisements or flyers ($n=35$, 9.4%), community groups/events ($n=32$, 8.6%), or a previous study contact database ($n=32$, 8.6%) (25). Adolescents were considered eligible if they were 12–20 years of age, had provider-diagnosed asthma for at least one year, and reported asthma-related health care utilization in the 12 months preceding their enrollment. We included

Table 1. Perceived family social support: frequency of “positive responses” to individual items.

Item	N (%)
Family gives me moral support (Yes)	348 (93.8)
I get good ideas about how to do or make things from my family (Yes)	321 (86.8)
Most other people are closer to their family than I am	71 (19.2)
When I confide in family members who are closet to me, it makes them uncomfortable	46 (12.4)
My family enjoys hearing about what I think	261 (70.7)
Members of my family share many of my interests	268 (72.2)
Certain members of my family come to me when they have problems or need advice	233 (63.0)
I rely on my family for emotional support	254 (68.5)
There is a member of my family I could go to if I were just feeling down without feeling funny about it later	317 (85.0)
My family and I are very open about what we think about things	273 (73.6)
My family is sensitive to my personal needs	185 (49.9)
Members of my family come to me for emotional support	205 (55.3)
Members of my family are good at helping me solve problems	314 (84.6)
I have a deep-sharing relationship with a number of members of my family	273 (73.6)
Members of my family get good ideas about how to do or make things from me	271 (73.8)
When I confide in members of my family, it makes me uncomfortable	68 (18.5)
Members of my family seek me out for companionship	194 (53.3)
I think my family feels that I am good at helping them solve problems	261 (71.1)
I do not have a relationship with a member of my family that is as close as other people's relationships with family members	90 (24.5)
I wish my family were much different	46 (12.5)

only those who either reported current use of a control medication or had persistent asthma based on the National Asthma Education and Prevention Program (NAEPP) criteria (26). Adolescents reporting other comorbid conditions requiring daily medication or unable to understand spoken and written English were excluded.

Data collection and study measures

The study protocol was reviewed and approved by the Institutional Review Board within each of the participating academic institutions. Written informed consent and assent were obtained from parents and adolescents younger than 18 years of age, respectively. Parental consent was not obtained from older adolescents (≥ 18 years old) who consented for themselves. Baseline data collection was conducted during in-person appointments in the project office or in the home. The following are the measures used in the current study.

Perceived family support (PFS) scale. The PFS (27) consists of 20 items with a response set of 3 options: “Yes (1),” “No (0),” or “Don’t know (not scored).” The total score ranged from 0 to 20, with higher scores indicating greater perceptions of family support (Table 1). The scale demonstrated construct and criterion validity in a study sample of college students (27) and acceptable internal consistency in an earlier study of adolescents with asthma ($\alpha = 0.85$) (19). In the current sample, Cronbach alpha of the scale was 0.82.

Asthma control. We developed a basic survey questionnaire to determine asthma severity directly based on the NAEPP classification consisting of four items representing impairment criteria including symptoms,

night time awakenings, activity limitations, and short-acting beta-agonist (SABA) use in the past 4 weeks. Each item was measured on a 4-point scale, reflecting varying degrees of frequency and intensity of these impairments consistent with the NAEPP classification for severity. The severity measure of the 4-point scale was converted to a 3-point scale by consolidating response options to determine the levels of asthma control (28). For symptoms and SABA use, responses corresponding to moderate and severe-persistent severity (e.g. daily and throughout the day symptoms) were consolidated into the “very poorly controlled” category to closely align with the NAEPP control classification. For night time awakenings and activity limitations, the responses for mild and moderate persistent severity levels (e.g. “minor limitation” and “some limitation”) were consolidated to correspond with the “not controlled” level. Subsequently, asthma control was classified into three levels (1 = well controlled, 2 = not-well controlled, or 3 = very poorly controlled) by the impairment category with the highest frequency or intensity as the guideline indicated. This asthma control scale is valid because it is directly based on the NAEPP Guidelines and considered reliable with a Cronbach alpha of 0.79.

Medication adherence. Horne’s 4-item Medication Adherence Report Scale (MARS) (29) was administered to measure adolescents’ self-reported adherence. The scale estimates adherence based on the extent of an individual’s general tendency to forget to take or intentionally alter or miss medication. Sum scores of the 5-point scale ranging from 1 (very often) to 5 (never) ranging from 4 to 20 were computed, with higher scores indicating higher levels of adherence.

Cronbach alpha in the current sample was 0.77. MARS data were dichotomized using ≤ 10 of sum score as a cutoff to low (at or below the cutoff) and high MAR (above 10, the cutoff). In addition to the MARS, adolescents were asked to report controller medication doses taken in the prior two weeks to estimate adherence in a more clinically meaningful way. Using 7 days/2 weeks as a cutoff, controller medication-use data were dichotomized at or below the cutoff and above the cutoff. The cutoff of >7 was used based on the distribution, with only 28% of the adolescents reporting they used their controller 8 or more days in the two week period. Only adolescents who reported a prescribed controller medication completed the MARS and responded to the dose question, as daily adherence is not appropriate for rescue medication use.

Emergency department (ED) visits. Adolescents reported the number of asthma-related visits to an ED in the past 3 months. ED data were dichotomized to either 0 or 1 or more visits over the past 3 months.

Sociodemographic and asthma health factors. Sociodemographic (age, gender, racial and ethnic groups, family income, health insurance types) and asthma-related (use of controller medication, age at asthma diagnosis, and family history of asthma) information was obtained from parents and older teens.

Data analysis

Frequency analyses with percentage were performed to describe the sample regarding sociodemographic characteristics and asthma-related factors as well as to summarize responses to items on the Perceived Family Social Support Scale. Subjects were grouped into either low family support group or moderate to high family support group based on their total PFS scores at or under 25% or above, respectively. Contingency table analyses including Chi-square statistics were conducted between the two levels of family support, medication adherence, controller medication use, and reported ED use, and three levels of asthma control. Subsequently, logistic regression models were computed to examine the relationships between family support (continuous level) and asthma control (continuous level), ED visits (0 or ≥ 1), and medication adherence measured by either MARS scores (low vs. high) or controller medication use (> 7 days vs. ≤ 7 days) in the past 2 weeks, after controlling for covariates including gender, age at diagnosis, health insurance type (public vs. private), family annual income, family history of asthma. These were considered covariates because their significant

relationships with at least one of the outcome measures (i.e. asthma control, MARS scores or the number of days using controller medication) (data are not provided).

Results

Sample sociodemographic and health characteristics

Of the 373 adolescents enrolled in the study, 371 were included in the analysis because two did not complete study measures. Overall adolescent participants were younger (≤ 17 years, 96%), African American or Bi-racial (85%), and Medicaid-insured (72%), as depicted in Table 2, Baseline Characteristics. The sample of

Table 2. Baseline characteristics.

Characteristic	N (%)
Gender	
Male	187 (50.1)
Female	186 (49.9)
Age (categorized)	
12–14 years	173 (46.4)
15–17 years	184 (49.3)
18–20 years	16 (4.3)
Race/ethnicity	
White	55 (14.7)
Nonwhite (African American, Bi-racial)	318 (85.3)
Household income	
$< \$30\,000$	105 (28.2)
$> \$30\,000$	257 (68.9)
Missing	11 (2.9)
Health insurance type N = 359	
Medicaid insurance	260 (72.4)
Private	99 (27.6)
Family history of asthma (YES)	
Sibling (biological)	114 (30.6)
Mother	133 (35.7)
Father	87 (23.3)
Age diagnosed with asthma	
Mean (range 0–16 years)	4.11
Controller medication use	
Yes	275 (73.7)
Used controller medication in past 2 weeks	
Not at all	130 (34.9)
1–3 days	105 (28.2)
4–7 days	33 (8.8)
8–11 days	21 (5.6)
12–13 days	30 (8.0)
14 days (every day)	54 (14.5)
Asthma Control Levels (NAEPP)	
Well controlled	58 (15.5)
Not well controlled	187 (50.1)
Very poorly controlled	127 (34.0)
Number of ED visits for asthma in past 3 months	
None	298 (80.3)
1	35 (9.4)
2	12 (3.2)
3 or more	26 (7.0)
Perceived social support (2–20) (Higher score = more social support)	
Mean	14.85
25 percentile	12.00
50 th percentile	16.00
75 percentile	18.00

Reliability of Scales.

Perceived Family Support: Cronbach alpha = 0.82.

NAEPP Cronbach alpha = 0.79.

Table 3. Factors associated with low versus moderate to high family social support. *N* = 371.

Characteristic	Low social support (25% lower scores cutoff) <i>N</i> = 96 <i>N</i> (%)	Moderate to high social support (26-100%) <i>N</i> = 275 <i>N</i> (%)	Total <i>N</i> = 371 <i>N</i> (%)	Statistic
Medication adherence (MARS scale) ^a <i>n</i> = 267				
Low MARS	30 (42.3)	51 (26.0)	81 (30.3)	$\chi^2 = 5.75$, <i>df</i> = 1 <i>P</i> = 0.016
High MARS	41 (57.7)	145 (74.0)	186 (69.7)	
Asthma control NAEPP				
Well controlled	10 (10.4)	47 (17.1)	57 (15.4)	$\chi^2 = 3.14$, <i>df</i> = 2 <i>P</i> = 0.208
Not well controlled	48 (50.0)	138 (50.4)	186 (50.3)	
Very poorly controlled	38 (39.6)	89 (32.5)	127 (34.3)	
In past 2 weeks used controller medication <i>n</i> = 270:				
<7 times past 2 weeks	49 (69.0)	121 (60.8)	170 (63.0)	$\chi^2 = 1.18$, <i>df</i> = 1 <i>P</i> = 0.277
>7 times past 2 weeks	22 (31.0)	78 (39.2)	100 (37.0)	
ED visit (over past 3 months)				
0	79 (82.3)	219 (79.6)	298 (80.3)	$\chi^2 = 0.172$, <i>df</i> = 1 <i>P</i> = 0.679
1 or more	17 (17.7)	56 (20.4)	73 (19.7)	
Adolescent age				
12 - 14	47 (49.0)	126 (45.8)	173 (46.6)	$\chi^2 = 0.17$, <i>df</i> = 1 <i>P</i> = 0.680
15 - 20	49 (51.0)	149 (54.2)	198 (53.4)	
Gender				
Male	45 (46.9)	141 (51.3)	186 (50.1)	$\chi^2 = 0.389$, <i>df</i> = 1 <i>P</i> = 0.533
Female	51 (53.1)	134 (48.7)	185 (49.9)	

^aMARS Scores (Split < 10/20 =Low) and includes only those (*n* = 267) on controller medications.

adolescents included an equal proportion of males and females. Over one-third had a maternal family history of asthma, and their mean age at asthma diagnosis was young at 4 years. Although most participants reported controller medication use (74%), adherence was low, with only 28% reporting controller medication use 8 or more days over the prior 2 weeks. Asthma control, based on national guidelines, was low, with most adolescents categorized as having “not well controlled” (50%) or “very poorly controlled” (34%) asthma. Most children reported no ED asthma visits within the past 3 months. The mean social support score was 14.85 out of 20, a possible maximum score, indicating moderate to high social support (Table 2).

Factors associated with low social support

Most social support items were positively responded by the majority of participants across all items (Table 1). Perceptions of receiving and providing social support from and to their family members, however, were less often positively reported than other items were. Items regarding receiving and providing social support from family members included: I rely on my family for emotional support (69%), members of my family come to me for emotional support (55%), members of my family seek me out for companionship (53%), and my family is sensitive to my personal needs (49%). Lower social support group included 93 adolescents whose PFS scores were at or below 25% of the scores of the group.

Table 3 summarizes the results examining the associations between the levels of family support and selected asthma health or sociodemographic factors. For the two analyses involving medication adherence variables (MARS and controller medication use), only the subset of the sample who responded positively to being on a controller medication was included. Of note, the level of social support did not differ by asthma control level, number of ED asthma visits within the past 3 months, adolescent age, or gender. Likewise, family support was not a significant predictor for asthma control or ED visits after controlling for the covariates.

Medication adherence

The only factor significantly associated with lower social support was low medication adherence scores. Significantly more adolescents with low MARS scores (defined as $\leq 10/20$) reported lower social support than those with high MARS scores ($>10/20$) at 42.3% and 26.0%, respectively ($\chi^2 = 5.75$, *df* = 1, *p* = 0.016) (Table 3). Similarly, in a logistic regression model, low family support remained a significant predictor of low MARS scores (*B* = 0.09, *p* = .01) after adjusting for covariates including gender, health insurance type, family income, age at diagnosis and family history of asthma (Table 4). We also conducted correlation analyses on the variables included in the logistic regression model and found that the predictors are not correlated with one another.

Table 4. Logistic regression results for factors associated with medication adherence level (total MAS score greater than 10 vs. 10 or less) $N = 267$ (controller medication users only).

Variable	Estimate	Standard error	P value
Intercept	0.497	1.17	0.67
Female gender	−0.525	0.28	0.06
Health insurance			
Public vs private	−0.260	0.45	0.57
Household income	−0.177	0.12	0.13
Age at diagnosis of asthma	0.029	0.04	0.41
Family member has asthma			
Yes vs no	0.202	0.29	0.48
Perceived social support			
Total score	0.090	0.03	0.01

The asthma control measure was not associated with medication adherence, controller medication use, or the MARS scores.

Discussion

We hypothesized that adolescents' perceived family social support would be positively related to high medication adherence and the level of asthma control, and negatively related to ED use. Our data partially supported the hypothesis and showed that low family social support was associated with low adherence to controller medication. However, asthma control and ED visits were not associated with perceived level of family social support. Our findings appear contradictory because we would expect that adherence to asthma controller medications would result in better asthma control and less use of the ED. It is well known that adherence to controller medicine as prescribed, particularly inhaled corticosteroids, is key to asthma control in terms of minimizing symptoms and optimizing quality of life (30, 31). It seems that perhaps other important factors are involved in asthma control that we did not measure or account for. For example, it may be that some parents maintained family routines that supported medication adherence but did not also give adolescents a sense of being supported emotionally or socially by their parents/family. In contrast, other adolescents may have reported high social family support but some of these families may have had other challenges or stressors (e.g. poverty with environmental conditions including rodents and smoke exposure that are known predictors of more severe asthma), which may help explain these results.

Our finding about the importance of family social support is consistent with results reported in other studies. Congruent perceptions between adolescents and their parents have been found to be positively associated with responsibility sharing related to adolescents' asthma and parental involvement and communication (32). In a

study investigating peer and parent support in adolescents with asthma, while both factors were important with respect to asthma management, parent support appeared to have stronger association with healthy lifestyle conducive to asthma management (33). In contrast to our findings, Chen and colleagues reported that low levels of family support were related to greater asthma symptoms in a group of children 9–18 years old (34), which may be due to the small sample size and younger children in the study.

Interestingly, our results about family social support and asthma control differ from an earlier study reporting a moderate positive association between family social support and asthma control among adolescents of diverse race backgrounds (19). Differences in income and race/ethnicity may have contributed to the lack of an association between asthma control and family support in our sample. Our sample was largely low income and ethnic minority, which has been associated with non-adherence in other studies of children with similar demographics (35, 36).

Our adolescent participants reported low levels of asthma controller medication use, which is consistent with findings from several studies that looked at asthma controller medication use by means of objective methods such as electronic monitoring devices (30). Other researchers who explored adherence to controller medications (inhaled corticosteroids) among young adolescents with asthma of similar age, racial composition, and SES to ours found similarly low rates of adherence, defined as taking less than 48% of the prescribed puffs of their medication (22).

This study has important clinical implications. In light of our mixed results with respect to asthma control, it is sensible to continue exploring the roles of social support for asthma control. Meanwhile, health care providers or school nurses who work with adolescents with asthma can offer additional assistance linking those with lower family support to community resources designed to increase social support among adolescents. Improving social support from sources outside the family as well as bolstering support within the family could promote medication adherence, leading to optimum health including better asthma control among adolescents who perceive low family support.

This study had limitations. Some researchers report wide variability in how readily parents relinquished disease-management responsibilities to their children, reporting that some parents had great difficulty giving any control to their adolescents and others did so prematurely (37). We did not, however, measure or

control for the variations in parental involvement in asthma care in this study. Using self-report for family support and medication adherence may be biased toward higher support and adherence due to social desirability and unconfirmed accuracy, particularly for medication use. In addition, our measure of asthma control based on the national guidelines may not be sensitive enough to capture the varying degrees of asthma control. The Asthma Control Test, a standardized instrument, that measures asthma control on a continuum, may have afforded more detailed information about this variable. We also recognize the limited generalizability of our findings, particularly to non-urban or white adolescents.

Future directions for research could include exploring the extent of adolescent self-management of asthma in comparison to parent/caretaker management to add clarity to the picture of asthma control in adolescents. Further exploration could focus on the kinds of support that parents provide to their adolescents. For example, it would be helpful to know whether the adolescents' parents provided specific support (reminders, collaboration to develop strategies to remember medications, encouragement) for taking the controller medication, which would address the relationship between asthma behavior-specific and general social support.

Conclusion

Family social support is associated with medication adherence among urban adolescents with persistent asthma. Health care providers of adolescents with asthma can assess family support in the office and home in order to offer additional assistance to adolescents as needed to effectively promote optimum asthma self-management and health in this vulnerable population.

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Data availability

Data is available on request.

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