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The relationship between patient–provider communication and quality of life for children with asthma and their caregivers

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Abstract

Objective: This study examined whether patient–provider communication is associated with asthma-related quality of life (QOL) and asthma outcomes among children with asthma and their caregivers.

Methods: Children ages 8–16 years with asthma and their caregivers ($n = 296$) were recruited at five pediatric practices in North Carolina. Children and caregivers reported demographic and clinical characteristics immediately after an audio-taped medical visit with their health care provider. During a home visit that took place 1 month after the medical visit, children and caregivers reported asthma-related QOL, and caregivers reported child asthma outcomes, including asthma symptom days and missed school days. Generalized estimating equations were used to determine whether patient–provider communication during the medical visit was associated with child and caregiver QOL and child asthma outcomes 1 month later.

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Results: On average, providers asked caregivers 4.5 questions and asked children 3 questions per visit, whereas caregivers and children asked less than 1 question per visit. Providers asked children more asthma-related questions, caregivers reported better QOL and fewer asthma symptom days 1 month later. Children and caregivers with higher asthma-management self-efficacy at the office visit reported better QOL 1 month later.

Conclusions: Mirroring national guideline recommendations, our results suggest that providers should ask children about their asthma during medical visits. Future longitudinal studies should conduct mediation analyses to determine whether asking children asthma-related questions during medical visits increases children's asthma-management self-efficacy and ultimately improve outcomes, such as QOL, health care utilization, symptom days and missed school days.

Keywords

Adolescents; caregiver–provider communication; child–provider communication; health care utilization; missed school days; self-efficacy; symptom days

Introduction

Asthma affects almost 10% of children under age 18 years, making it the most common chronic condition among youth in the USA [1,2]. The economic burden of asthma among school-aged children is substantial, costing upwards of two billion dollars per year in direct and indirect expenses [3]. In addition to causing financial strain, asthma also negatively impacts the quality of life (QOL) of children and their caregivers. For children, asthma is responsible for over 10 million days of school absences and over half a million emergency department visits each year [4]. In addition, poorly controlled asthma can impair children's psychological, emotional and social functioning by limiting their ability to engage in normal daily activities [5]. For caregivers, asthma can increase worry and concern as well as limit their ability to perform work and household activities [6,7].

Negative asthma sequelae are largely preventable if children and caregivers engage in asthma management behaviors, such as adherence to controller medications, symptom monitoring, and reducing exposure to environmental triggers. One factor that has been consistently associated with asthma management behavior in pediatric populations is patient–provider communication. In addition to improving short-term outcomes such as child and caregiver satisfaction with the medical visit and self-efficacy, effective provider communication has the potential to improve children's medication adherence and asthma device technique [8–12].

The benefits of patient–provider communication may extend beyond the short-term and intermediate outcomes described previously. In fact, research with populations of adult chronic disease patients suggests that patient–provider communication can affect long-term health outcomes, such as physiological health status and QOL [13,14]. For example, randomized control trials designed to improve patient–provider communication among patients with hypertension and diabetes have shown improvements in blood pressure and blood serum glucose levels as well as more positive perceptions of overall health status and QOL [14,15]. To our knowledge, only one study has examined whether patient–provider

communication is associated with long-term asthma outcomes [16]. This study found that a home-based caregiver asthma communication intervention was not significantly associated with asthma symptom days at 12-month follow-up. However, the study relied on caregiver reports, rather than objective measures (e.g. audio-tape recordings), of provider communication. Moreover, because outcomes were measured up to 10 months after the intervention was delivered, it is unknown whether the intervention yielded short-term benefits in symptom days that were not sustained in the long term.

This study builds upon previous research by using transcripts of audio-taped medical visits to explore whether patient–provider communication during a medical visit is associated with QOL and asthma outcomes in a diverse sample of 296 children and caregivers. We specifically examine whether child, caregiver and provider question-asking during a medical visit are associated with child and caregiver-reported QOL, as well as caregiver reports of child’s asthma symptom days, missed school days, emergency room visits and unscheduled office visits 1 month later. We hypothesize that more provider, caregiver and child question-asking about asthma would be associated with better child and caregiver QOL and fewer negative consequences of poor asthma control.

Research design and methods

Study design

Data for this secondary analysis were collected from 2005 to 2008 as part of a larger, longitudinal study that examined the relationship between patient–provider communication and asthma outcomes. The study was approved by the University of North Carolina Institutional Review Board (Approval #: 03–1404). All participants provided informed consent prior to enrolling in the study. Data for this manuscript came from five sources: (1) transcripts of audio-taped medical visits, (2) a child medical visit interview, (3) a child 1-month home visit interview, (4) a caregiver medical visit questionnaire and (5) a caregiver 1-month home visit questionnaire.

Participants

A convenience sample of providers, children and caregivers was recruited at five primary care pediatric practices in non-urban areas of North Carolina. Budget constraints limited our ability to sample additional clinics. The practices served between 12 000 and 25 000 patients and employed between 6 and 14 physicians. On average, the practices’ patient base was approximately 30% African American and approximately 50% of patients had Medicaid insurance. The Principal Investigator (BS) explained the study procedures to 43 providers who worked at the five participating practices. Of the 43 providers, 41 agreed to participate in the study, yielding a provider participation rate of 95.3%.

Clinic staff referred interested families to a research assistant, who explained the study, obtained caregiver consent and child assent, and administered the eligibility screener. Clinic staff did not record how many families they referred to the research assistant. Of the 377 families who approached the research assistant, 333 agreed to participate, yielding a family participation rate of 88%. Of the 333 participating families, 296 (89%) had useable

audio-tape data. These families were seen by 35 of the 41 study providers. Four of these 35 providers were nurse practitioners or physician assistants. Missing audio-tape data was primarily due to poor quality recordings.

Procedures

After eligible children and caregivers were enrolled, their medical visit was audio-tape recorded. The research assistant accompanied each child and caregiver to the exam room, turned on the recorder after the provider entered, and left the room. Physicians turned off the recorder at the end of the visit. After the visit, the research assistant interviewed the child while the caregiver separately completed a self-administered questionnaire.

Children were eligible for the study if they: (a) were 8–16 years old, (b) spoke English, (c) could read the assent form, (d) had visited the clinic at least once before, (e) were accompanied by a primary adult caregiver (parent or legal guardian) who could read and speak English, and (f) had mild, moderate, or severe persistent asthma [17].

Each audio-tape visit was transcribed verbatim. A detailed coding tool was developed to assess transcripts for provider, child and caregiver communication about asthma. The transcripts were reviewed by two research assistants who met twice a month with the investigators to develop and refine the coding rules. Using the coding tool, coders recorded child, caregiver and provider questions as well as whether the provider educated the family about asthma.

Approximately 1 month after the medical visit, the study research assistant travelled to the family's home to interview the child while caregivers separately completed a self-administered questionnaire. Both children and caregivers received a \$15 incentive after completing the office visit and again after completing the home visit.

Measures

Child asthma-related QOL—Children's asthma-related QOL was measured on the 1-month home visit survey with the valid and reliable 23-item Pediatric Asthma QOL questionnaire [18]. For each item, children indicated on a 7-point scale how much their asthma had affected them during the past week. The measure includes items about asthma symptoms (e.g. woke up during the night because of asthma), activity limitations (e.g. could not keep up with others because of asthma) and emotional functioning (e.g. felt different or left out because of asthma). Overall QOL is calculated by taking the mean of all 23 items ($\alpha = 0.96$). Higher scores reflect better QOL.

Caregiver asthma-related QOL—Caregiver's asthma-related QOL was measured on the 1-month home visit survey with the valid and reliable 13-item Pediatric Asthma Caregiver's QOL Questionnaire [7]. For each item, caregivers indicated on a 7-point scale how often they experienced a particular event during the past week. The measure includes items about activity limitations (e.g. had a sleepless night because of your child's asthma) and emotional function (e.g. felt worried or concerned about your child's ability to perform normal daily activities.). Overall QOL is calculated by taking the mean of all 13 items ($\alpha = 0.90$). Higher scores reflect better QOL.

Asthma outcomes—As part of the 1-month home visit survey, caregivers responded to four items about the child’s asthma outcomes. For asthma symptom days, caregivers reported how many days during the past 14 days the child had daytime or nighttime symptoms, including wheezing, slow play, and nights awakened. Caregivers also reported: (1) the number of days during the past 2 weeks the child missed school because of asthma, (2) the number of asthma-related emergency room visits that occurred during the past month and (3) the number of unplanned doctor visits (not including previously scheduled appointments) due to asthma during the past month.

Child and caregiver asthma management self-efficacy—Asthma self-efficacy was measured immediately after the medical visit using the 14-item Child Asthma Self-efficacy ($\alpha=0.80$) and 13-item Parent Asthma Self-efficacy ($\alpha=0.87$) scales. The scales assess child and caregiver confidence in preventing attacks and managing attacks and have performed well in terms of validity and internal consistency reliability in previous studies [19,20]. Higher mean scores indicate greater asthma self-efficacy.

Demographic and clinical characteristics—Demographic and clinical characteristics were measured immediately after the medical visit. Using data from the study’s eligibility screening instrument, the child’s asthma severity (mild versus moderate/severe) was classified by a research assistant based on caregiver report of child’s symptoms and medication use and verified by a pediatric pulmonologist or clinical pharmacist [21]. We used the primary asthma severity classification system that was in use when the study was designed [22,23]. More detail about the asthma severity classification system is provided by Sleath et al. [24]

As part of the medical visit questionnaire, caregivers reported the following: (1) years of education, (2) marital status (never married, married or living as married, separated, divorced, widowed), (3) number of years their child had been living with asthma, (4) whether the child was taking an asthma controller medication (yes/no), (5) the child’s insurance status, which was measured using five categories (none, private insurance, Medicaid, the State Children’s Health Insurance Program, and other) and (6) total household income. As part of the medical visit interview, children self-reported their age, gender and race. For descriptive purposes, caregiver and child race was recoded into three categories: White, African American, or Other (includes categories of: Hispanic, Native American, Asian American, other). However, for the generalized estimating equation (GEE) models, child and caregiver race was recoded into a dichotomous variable (White versus non-White). Caregiver marital status was also dichotomized (married versus single).

Patient–provider and caregiver–provider communication—Using the coding tool (see the second-to-last paragraph of the procedures section), coders recorded the following: (a) the number of questions that providers asked children about asthma medications, asthma triggers and environmental trigger control, and monitoring devices such as peak flow meters, (b) the number of questions that providers asked caregivers about asthma medications, asthma triggers and environmental trigger control, and monitoring devices such as peak flow meters, (c) the number of questions the caregiver asked, (d) the number of questions the child asked and (e) whether the provider provided education to the family about asthma

control medications. The research assistants coded 20 of the same transcripts throughout the study period to assess inter-coder reliability, which was calculated using correlations. The inter-rater correlations were: 0.97 for number of caregiver questions about asthma; 0.96 for the number of child questions about asthma; 0.90 for the number of questions providers asked children, 0.90 for the number of questions the provider asked caregivers and 0.91 for whether the provider educated the family about controller medications.

Statistical analyses

All analyses were conducted using SAS version 9.2. We examined univariate statistics as well as bivariate relationships among all outcome variables (e.g. QOL and other asthma outcomes). GEE models were used to appropriately adjust standard errors to account for non-independence due to children being clustered by provider. The six GEE models examined the following outcomes measured at the 1-month home visit: (1) child QOL; (2) caregiver QOL; (3) the number of asthma symptom days the child experienced during the past 14 days; (4) the number of school days the child missed during the past 14 days due to asthma; (5) the number of emergency room visits due to asthma during the past month and (6) the number of unplanned physician visits due to asthma during the past month. The GEE models for child QOL and asthma outcomes controlled for: child gender, child race, child age, caregiver education, caregiver marital status, total household income, asthma severity, years with asthma, whether the child was taking a control medication and child asthma management self-efficacy. The caregiver QOL model controlled for: caregiver gender, caregiver race, caregiver age, caregiver education, caregiver marital status, total household income, asthma severity, years with asthma, whether the child was taking a control medication and caregiver asthma management self-efficacy. Control variables were selected based on their correlation with QOL and asthma outcomes in previous studies [25–30].

Results

Participant characteristics

Table 1 presents the sample's characteristics. Approximately half of children were female and the average age was 11 years. Most children were White and had been living with asthma for approximately 6 years. The majority of children had moderate or severe persistent asthma and almost three-quarters were taking an asthma controller medication. Children and caregivers reported moderate to high levels of asthma management self-efficacy.

On average, during the medical visit, providers asked caregivers more asthma-related questions than children. Similarly, caregivers asked more questions than children; however, both caregiver and child question-asking were low. Providers educated about asthma controller medications during approximately 60% of the medical visits.

One month later, both children and caregivers reported a moderately high asthma-related QOL. In terms of asthma outcomes, asthma symptom days were most common with 16% of children experiencing more than 5 days of asthma symptoms over a 2-week period.

Missed school days, unplanned doctor visits and emergency room visits due to asthma were infrequent.

Bivariate associations

Overall, there were weak to moderate correlations between QOL and 1-month asthma outcomes (Table 2). Children and caregiver's QOL were modestly associated with each other ($r=0.33$), such that children who reported a higher QOL were likely to have caregivers who also reported a higher QOL. Children's QOL was negatively associated with each indicator of asthma outcomes; however, asthma symptom days had the strongest relationship with child QOL ($r=-0.25$). In contrast, caregiver QOL was significantly associated with three outcomes; specifically, caregivers who reported that their child had more asthma symptom days ($r=0.32$), more missed school days ($r=0.25$) and more unplanned doctor visits ($r=0.17$) reported worse QOL.

Correlations between the four communication variables were negligible ($r=-0.002$) to moderate ($r=0.30$). The largest correlation was observed between the number of questions the provider asked the caregiver and the number of questions the caregiver asked ($r=0.30$).

Communication and child QOL

Table 3 presents the GEE model for child QOL. When controlling for demographic and clinical characteristics, there were no significant associations between child, caregiver and provider communication about asthma during the medical visit and child QOL 1 month later. Regarding control variables, greater asthma management self-efficacy was associated with better QOL.

Communication and asthma outcomes

Table 4 displays the GEE models for the four asthma outcomes. Children whose providers asked them more asthma-related questions during the medical visit had fewer asthma symptom days 1 month later. No other communication variables predicted asthma outcomes 1 month later. Regarding control variables, children who had unmarried caregivers and more total household income had fewer asthma symptom days 1 month later. Children who had been living with asthma longer missed more school days 1 month later. In addition, children who had more total household income had fewer unscheduled physician visits 1 month later.

Communication and caregiver QOL

Table 5 shows the GEE model for caregiver QOL. When controlling for various sociodemographic and clinical characteristics, caregivers reported better QOL at 1 month later when providers asked their children more asthma-related questions. Better QOL was also associated with white caregiver race, more total household income, the child not taking asthma controller medications and greater asthma management self-efficacy.

Discussion

This study examined whether patient-provider and caregiver-provider communication during a medical visit was associated with QOL and asthma outcomes 1 month later.

Using transcripts of audio-taped medical visits, we found that the number of asthma-related questions the provider asked the child during the medical visit was associated with fewer asthma symptom days and better caregiver QOL 1 month later. Thus, our hypotheses that provider, caregiver and child question-asking would be associated with better child and caregiver QOL, and fewer negative asthma outcomes were only partially supported. However, in conjunction with previous research [13,14,31], these findings suggest that child-provider communication has the potential to affect outcomes for children with asthma and their caregivers.

The importance of child-provider communication for asthma medication adherence [8,9,11,32], device technique [33], self-efficacy [34], and patient and caregiver satisfaction with the medical visit [10] has already been established. Given this large body of research, it is not surprising that national guidelines recommend that providers engage families in asthma-related discussions during medical visits [35]. Although a previous study found that provider communication was not associated with asthma symptom days at 12-month follow-up for school-aged children, that study relied on caregiver reports of communication rather than objective communication measures, such as transcripts of audio-tape recordings of office visits [16]. Nonetheless, these results underscore that the ways in which patient-provider communication is measured may influence study results. Readers who are interested in more qualitative aspects of provider questions, such as the specific topics asked about, are referred to two articles by Sleath and colleagues [24,36].

Like other studies of child-provider communication [31,37-41], we found that although children in the sample were old enough to converse with the provider, providers directed more questions to the caregiver than to the child. In addition, the number of questions that children and caregivers asked was low, averaging less than one question per visit. Other analyses with these data have shown that even though children and caregivers express problems with their asthma medications, they are very unlikely to ask questions about these problems during the visit [42]. Moreover, additional analyses have revealed that even though over 95% of children in the study wanted to be involved in treatment-related discussions, one-third of providers did not ask children any treatment-related questions [43]. Taken together, these findings suggest that providers may need assistance with creating an environment where families can engage more in asthma-related discussions. One innovative method for encouraging balanced child and caregiver participation would be through the shared medical appointment, in which a provider addresses disease management and patient education to a small group of four to nine children with asthma and their caregivers [44]. By nature of the group appointment format, children may feel more comfortable answering provider questions and sharing their asthma concerns, especially if they see other children actively participating during the appointment.

Only one communication measure, the number of asthma-related questions that the provider asked the child, was associated with fewer child asthma symptom days and better caregiver QOL. This finding suggests that involving children in the medical visit has the potential to improve outcomes for both children and their caregivers. For this reason, providers should attempt to directly involve children in asthma-related discussions. Butz and colleagues [8] make several recommendations for how to maximize the effectiveness of asthma

communication between providers, children with asthma and their caregivers. Two of these recommendations include teaching children to take turns talking with the provider and clarifying communication with the child. In addition, providers may want to consider these three simple strategies for increasing child participation: (1) ask the child yes–no questions; (2) gaze at children when asking a question and (3) get children to answer questions early in the visit [39]. Children often want to make important decisions in conjunction with their caregivers; hence, providers should also involve caregivers in treatment-related discussions [45].

Other studies have found that child–provider communication is associated with patient satisfaction, medication adherence and self-efficacy [9–11,32], and that medication adherence and self-efficacy are related to QOL [20]. Thus, both medication adherence and self-efficacy should be considered as potential mediators of the relationship between child–provider communication and QOL. Because we did not code how children and caregivers reacted to provider questions, we were unable to assess whether provider questions resulted in children and caregivers expressing greater confidence about managing asthma. Similarly, we are unsure of whether children and caregivers felt more informed and engaged when they were asked questions. Future studies should gauge child and caregiver reactions to provider questions to better understand the potential mechanisms through which provider questioning may affect immediate cognitive and psychological outcomes, medium-term behavioral outcomes and ultimately long-term outcomes, like QOL.

The clinical significance of our findings is not clear. The fact that providers educated families about control medications during only 61% of visits is of concern. Additional analyses published previously demonstrated that providers are more likely to educate about control medications when the child has moderate to severe persistent asthma and when the child is younger [36]. It is possible that some children would have reported fewer symptom days 1 month after their medical visit regardless of how many questions the provider asked the child. For this reason, future studies should incorporate and control for baseline measures of outcome variables to determine whether question-asking is truly causally related to asthma outcomes. A first step for future research would involve determining whether our results can be replicated at 3-, 6- and 12-month follow-up, which would allow researchers to account for variation in patients' asthma status. If the results are replicated, then additional studies that incorporate at least three time points could be conducted in order to investigate whether particular variables, such as self-efficacy and medication adherence, mediate the relationship between communication and child asthma symptom days and caregiver QOL. Including mediating variables may help to elucidate why provider question-asking was associated with caregiver, but not child, QOL.

Although our GEE models controlled for variables that had been associated with QOL and asthma outcomes in previous studies [25–30], only a few of these variables were significantly associated with asthma outcomes in our study. Of note, children and caregivers who had higher levels of asthma-management self-efficacy at the office visit reported better QOL 1 month later. Thus, providers should provide families with the education and resources they need so they can feel confident that they can effectively manage asthma. Specifically, ensuring that children and caregivers have an updated and easy-to-understand

asthma action plan can help boost families' asthma self-management self-efficacy. We also found that families with a higher household income reported fewer asthma symptom days, fewer unplanned physician visits and better caregiver QOL, which has been documented in previous studies [30]. Again, ensuring that all families, regardless of income, have access to asthma resources is important. For example, if a family has limited financial resources to deal with environmental control issues (e.g. mold and mildew in an apartment), the provider may want to give the family a list of local organizations that could help the family address this issue.

The study is limited in generalizability in that it was conducted in five pediatric clinics in non-urban areas of North Carolina. Clinic staff referred potentially eligible patients to the research assistant; thus, we do not know how many patients chose not to talk with the research assistant. We did not ask clinic staff members to track these numbers because they were too busy and documenting these numbers would have interrupted clinic flow. In addition, we audio-taped rather than video-taped medical visits; hence, we were unable to document nonverbal communication between providers, caregivers and children. We also did not code for child and caregiver responses to provider questions, so we do not know whether children or their caregivers answered provider questions or whether provider questions remained unanswered. Therefore, we are unable to determine whether provider questions resulted in more child and caregiver engagement in asthma-related discussions. Future studies should video-record office visits in order to determine how children and caregivers react verbally and non-verbally to provider questions. In-depth conversation analyses [46] can then be used to determine whether the quality of child-caregiver-provider communication predicts short-term and long-term asthma outcomes.

As noted previously, we did not control for baseline QOL or asthma outcomes. However, given the dearth of research in this area, our results offer some insight into whether patient-provider communication is related to asthma outcomes and QOL 1 month later. In addition, provider question-asking remained significant in two of our GEE models, even when controlling for a multitude of variables that have been associated with QOL and asthma outcomes in previous studies. Therefore, future longitudinal studies that investigate the effects of communication on asthma outcomes and QOL are warranted.

Conclusions

Child-provider communication about asthma is important and may affect clinical outcomes for children as well as caregiver QOL. Our findings lend additional support for national guidelines that recommend that providers should involve children in asthma management discussions. Future research should examine whether the effects of provider communication on child asthma symptom days and caregiver QOL can be replicated in a longitudinal study that controls for baseline measures of symptom days and QOL.

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Table 1.Sample characteristics for children with asthma and their caregivers ($n = 296$).

Characteristic	Mean (SD) or % (n)
<i>Demographic characteristics</i>	
Child age	11.1 (2.4) Range: 8–16 years
Child male	53.7% (159)
Child race	
White	55.4% (163)
African American	28.4% (84)
Other	16.6% (49)
Insurance type	
Medicaid	51.7% (153)
Private	26.4% (78)
State Children’s Health Insurance Program	17.6% (52)
Other	2.7% (8)
None	1.0% (3)
Caregiver age	41.1 (8.4) Range: 26–80 years
Caregiver gender (% female)	85.8% (253)
Caregiver race	
White	62.4% (181)
African American	28.3% (82)
Other	9.3% (33)
Years of education	12.8 (2.5) Range: 2–20 years
Caregiver married	58.4% (171)
Total household income	
Less than \$10 000	21.5% (62)
\$10 000–\$19 999	20.1% (58)
\$20 000–\$29 999	13.8% (40)
\$30 000–\$49 999	23.9% (69)
\$50 000–\$69 999	8.7% (25)
More than \$70 000	12.1% (35)
<i>Clinical/other characteristics</i>	
Years living with asthma	6.00 (3.9) Range: 0–16 years
Asthma severity	
Mild persistent	28.0% (83)
Moderate/severe persistent	72.0% (213)
Child taking asthma controller medicine	84.0% (247)
Child asthma management self-efficacy ^a	3.76 (0.7) Range: 1.5–5.0

Characteristic	Mean (SD) or % (n)
Caregiver asthma management self-efficacy ^a	4.34 (0.5) Range: 2.2–5.0
<i>Asthma communication during medical visit</i>	
No. of asthma questions provider asked caregiver	4.54 (5.7) Range: 0–36 questions
No. of asthma questions provider asked child	2.94 (4.5) Range: 0–43 questions
No. of questions child asked	0.22 (0.7) Range: 0–6 questions
No. of questions caregiver asked	0.75 (1.4) Range: 0–8 questions
Provider educated about controller medications	61.1% (181)
<i>Quality of life at 1 month home visit</i>	
Child quality of life ^b	5.81 (1.2) Range: 1.2–7.0
Caregiver quality of life ^b	5.72 (1.1) Range: 1.7–7.0
<i>Asthma outcomes at 1 month home visit</i>	
No. of asthma symptom days in past 2 weeks	5.09 (4.7) Range: 0–14 days
No. of missed school days in past 2 weeks	0.54 (1.2) Range: 0–6 days
No. of emergency room visits in past month	0.14 (0.5) Range: 0–4 visits
No. of unplanned doctor visits in past month	0.47 (1.0) Range: 0–10 visits

^aResponses ranged from 1='not at all sure', 5='completely sure'.

^bHigher scores indicate better quality of life.

Table 2.

Bivariate associations among quality of life and asthma outcomes.

	Caregiver QOL	Asthma symptom days	Missed school days	ER visits	Unplanned physician visits
Child QOL	0.33 ^{****}	-0.25 ^{****}	-0.15 [*]	-0.05	-0.06
Caregiver QOL	-	-0.32 ^{**}	-0.25 ^{**}	-0.03	-0.17 ^{**}
Asthma symptom days	-	-	0.22 ^{**}	0.02	0.18 ^{**}
Missed school days	-	-	-	0.21 ^{**}	0.36 ^{****}
Emergency room visits	-	-	-	-	0.16 ^{**}

QOL, quality of life.

^{****} $p < 0.001$,

^{**} $p < 0.01$,

^{*} $p < 0.05$.

Table 3.GEE model for child quality of life at 1-month home visit ($n = 243$).

Variable	β	SE	p Value
No. of questions provider asked caregiver	-0.01	0.02	0.63
No. of questions provider asked child	0.03	0.01	0.08
No. of questions caregiver asked	-0.03	0.06	0.59
No. of questions child asked	0.01	0.13	0.93
Provider educated about controller medications	-0.27	0.17	0.11
Child gender	-0.15	0.15	0.33
Child race	0.10	0.15	0.51
Child age	-0.02	0.04	0.63
Caregiver education	0.03	0.04	0.44
Caregiver married	0.34	0.19	0.08
Total household income	0.05	0.06	0.40
Asthma severity	-0.02	0.15	0.91
Years with asthma	0.03	0.02	0.23
Child taking controller medication	0.05	0.20	0.81
Child self-efficacy	0.32	0.13	0.01

Values in bold are statistically significant ($p < 0.05$).

Table 4.

GEE models for caregiver-reported asthma outcomes at 1-month home visit.

	Child asthma symptom days (<i>n</i> =246)			Missed school days (<i>n</i> =207)			Emergency room visits (<i>n</i> =246)			Unplanned physician visits (<i>n</i> =245)		
	β	SE	<i>p</i> Value	β	SE	<i>p</i> Value	β	SE	<i>p</i> Value	β	SE	<i>p</i> Value
No. of questions provider asked caregiver	-0.01	0.04	0.76	0.01	0.01	0.48	-0.00	0.00	0.73	0.00	0.01	0.88
No. of questions provider asked child	-0.09	0.03	0.001	0.01	0.01	0.57	-0.00	0.00	0.65	-0.01	0.01	0.17
No. of questions caregiver asked	-0.05	0.10	0.65	0.04	0.03	0.11	0.01	0.01	0.25	0.02	0.04	0.56
No. of questions child asked	0.18	0.17	0.28	0.00	0.03	0.94	-0.01	0.01	0.54	-0.04	0.05	0.48
Provider educated about controller medications	0.49	0.36	0.18	0.09	0.13	0.50	-0.05	0.03	0.09	0.02	0.08	0.8
Child gender	0.15	0.36	0.67	0.06	0.11	0.61	0.02	0.03	0.54	-0.03	0.07	0.66
Child race	-0.18	0.29	0.54	0.03	0.13	0.82	-0.04	0.03	0.18	0.11	0.07	0.15
Child age	0.08	0.09	0.37	-0.04	0.02	0.05	-0.00	0.00	0.53	-0.01	0.01	0.55
Caregiver education	-0.00	0.06	0.94	-0.00	0.02	0.99	-0.01	0.01	0.39	-0.00	0.01	0.98
Caregiver married	1.01	0.43	0.02	0.18	0.13	0.17	0.01	0.02	0.57	0.02	0.09	0.84
Total household income	-0.46	0.12	<0.01	-0.05	0.04	0.15	-0.01	0.01	0.33	-0.06	0.02	<0.01
Asthma severity	-0.38	0.31	0.21	0.02	0.16	0.88	0.03	0.02	0.30	0.03	0.07	0.67
Years with asthma	-0.06	0.04	0.15	0.02	0.01	0.02	0.00	0.00	0.94	0.00	0.01	0.89
Child taking controller medication	0.45	0.50	0.36	0.11	0.07	0.09	0.02	0.03	0.54	0.12	0.07	0.08
Child self-efficacy	0.37	0.19	0.05	-0.08	0.07	0.24	-0.01	0.03	0.76	0.05	0.06	0.42

Values in bold are statistically significant (*p*<0.05).

Table 5.GEE models for caregiver quality of life and at 1-month home visit ($n=231$).

Variable	β	SE	<i>p</i> Value
Total no. of questions provider asked caregiver	0.00	0.02	0.82
Total no. of questions provider asked child	0.03	0.01	0.01
No. of questions caregiver asked	0.09	0.06	0.13
No. of questions child asked	-0.10	0.10	0.31
Provider educated about controller medications	-0.18	0.26	0.48
Caregiver gender	0.04	0.17	0.80
Caregiver race	0.47	0.16	<0.01
Caregiver age	0.00	0.01	0.67
Caregiver education	0.05	0.04	0.15
Caregiver married	-0.15	0.14	0.30
Total household income	0.15	0.07	0.03
Asthma severity	-0.19	0.12	0.13
Years with asthma	0.01	0.02	0.67
Child taking controller medications	-0.35	0.15	0.02
Caregiver self-efficacy	0.45	0.18	0.01

Values in bold are statistically significant ($p<0.05$).