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To cite this article: Betsy Sleath, Delesha Carpenter, Scott A. Davis, Charles Lee, Nacire Garcia, Daniel S. Reuland, Gail Tudor & Ceila E. Loughlin (2019): The impact of a question prompt list and video intervention on teen asthma control and quality-of-life one year later: results of a randomized trial, Journal of Asthma, DOI: [10.1080/02770903.2019.1633542](https://doi.org/10.1080/02770903.2019.1633542)

To link to this article: <https://doi.org/10.1080/02770903.2019.1633542>

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 Published online: 16 Jul 2019.

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The impact of a question prompt list and video intervention on teen asthma control and quality-of-life one year later: results of a randomized trial

Betsy Sleath, PhD^{a,b} , Delesha Carpenter, PhD^a , Scott A. Davis, PhD^a , Charles Lee, MD^c ,
Nacire Garcia, MS^a , Daniel S. Reuland, MD^d , Gail Tudor, PhD^e , and Ceila E. Loughlin, MD^f 

^aDivision of Pharmaceutical Outcomes and Policy, UNC Eshelman School of Pharmacy, University of North Carolina at Chapel Hill, Chapel Hill, NC, USA; ^bCecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill, Chapel Hill, NC, USA; ^cAlexor, Inc., Morrisville, NC, USA; ^dDivision of General Internal Medicine and Clinical Epidemiology, School of Medicine, University of North Carolina at Chapel Hill, Chapel Hill, NC, USA; ^eSouthern New Hampshire University, Manchester, NH, USA; ^fDepartment of Pediatric Pulmonology, School of Medicine, University of North Carolina at Chapel Hill, Chapel Hill, NC, USA

ABSTRACT

Objective: This study examined whether youth who received an asthma question prompt list/video intervention were more likely to have their asthma controlled and better quality-of-life at 12 months than youth who received usual care.

Methods: English or Spanish-speaking youth ages 11–17 were enrolled and randomized to intervention or usual care. The 185 youth and parents in the intervention group watched the video on an iPad and then received a one-page asthma question prompt list to complete before their visits. One hundred seventy-four received usual care. Baseline and 6-month visits were audio-tape recorded. Generalized Estimating Equations were used to predict a youth's quality-of-life and whether asthma was controlled at 12 months.

Results: Asthma control and quality-of-life improved significantly from baseline to 12-month follow-up in both intervention and usual care groups. Baseline asthma control and quality-of-life were significantly associated with 12-month asthma control and quality-of-life, respectively. Adolescents on a control medication at baseline were significantly more likely to have their asthma controlled at 12 months.

Conclusions: Asthma control and quality-of-life did not improve significantly more in the intervention group than in the usual care group.

ARTICLE HISTORY

Received 13 February 2019
Revised 13 June 2019
Accepted 14 June 2019

KEYWORDS

asthma management
self-efficacy; adolescents;
empowerment; respiratory;
asthma quality-of-life;
question asking;
educational video

Introduction

Asthma is the most common chronic condition among U.S. children (1,2). Asthma exacerbations can be prevented with appropriate care (1,2). Prior research has found that asthmatic children and adolescents are not actively involved during their medical visits (3–5). Active involvement is important, especially for adolescents who have chronic diseases such as asthma, because interactive discussions with providers can help adolescents learn how to self-manage their treatment regimens (6). The Centers for Disease Control and Prevention emphasizes that adolescents with asthma should be empowered to manage their asthma (2). The clinical practice guidelines of the National Asthma Education and Prevention Program encourage providers to determine treatment goals jointly with the patient and family (2,7).

In our prior work that examined provider–patient communication during pediatric asthma visits, we

found that only 13% of teens asked questions about asthma management and that the majority of questions that teens asked were about asthma medications (8). We also found that 78% of teens expressed one or more asthma medication problems yet only 11% asked a question about their medications during their medical visits (4,9–12).

Only a few studies have attempted to improve asthma communication between youth, parents, and providers during pediatric visits (13–16). Tapp et al. (13) implemented a shared decision-making intervention at practices and found that the proportion of pediatric patients with exacerbations was significantly lower among pediatric patients seen at the practices who received the shared decision-making toolkit. The researchers also found that youth who received shared decision-making had higher asthma quality-of-life and fewer asthma control problems over a three-year

CONTACT Betsy Sleath  betsy_sleath@unc.edu  Division of Pharmaceutical Outcomes and Policy, UNC Eshelman School of Pharmacy, University of North Carolina at Chapel Hill, CB# 7573, Chapel Hill, NC 27599-7573, USA.

 Supplemental data for this article can be accessed on the [publisher's website](#).

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period (14). Clark and her team (15,16) conducted a randomized, controlled trial to examine whether an interactive seminar program for physicians could improve their communication with youth during pediatric asthma visits. The researchers found that patients reported that physicians in the intervention group were more likely than control group physicians to address patients' fears about medicines, review written instructions, provide a sequence of educational messages, and write down how to adjust the medicines at home when symptoms change (15,16). Clark et al. (16) also found that children seen by physicians who had received the educational program had fewer hospitalizations and those with higher levels of emergency department use at baseline had fewer subsequent emergency room visits.

Another approach to improving communication during pediatric asthma visits is through an intervention that focuses on changing the behavior of youth during visits. Cancer researchers have found that giving cancer patients "question prompt lists" before their visits increased the number of questions that cancer patients asked their doctors, improved patient recall of information, and prompted doctors to give patients more information (17–20).

We designed an asthma question prompt list/video intervention based on social cognitive theory (SCT) that is described elsewhere (21,22). The intervention first has caregivers and adolescents watch an 11 minute educational video in English or Spanish on the importance of youth being involved during visits. The video had six themes (asthma triggers, staying active with asthma, how to get mom off your back, tracking asthma symptoms, how to talk to your doctor, and having confidence with asthma). Each theme had its own video that ranged in length from 1–2 minute.

Based on our youth focus group results, the video was designed as teens talking to teens like they were newscasters in six different scenes (22). This fits well with prior work that has shown if teens associate themselves with their educators that this maximizes the impact of the education (23,24). Adolescents are more likely to model behaviors when they perceived the models as similar to themselves (24). Rhee et al. (24) found that youth in an asthma self-management camp program who had peer-leaders reported a more positive experience than those who had health professional leaders.

Another part of our intervention is an asthma question prompt list that adolescents can complete during pre-visit wait time. Application of SCT in asthma populations has shown that technical advice

from providers is an external factor that can improve asthma management self-efficacy (25). Our team found in prior work that asthma management self-efficacy was associated with youth asthma quality-of-life (26).

Additionally, our team found that the asthma question prompt list/video intervention significantly increased whether youth asked one or more questions about asthma and increased provider education about asthma during visits (27). Therefore, the purpose of this manuscript was to examine our hypothesis that youth who received an adolescent "asthma question prompt list" with a supportive educational video intervention before their baseline and 6-month asthma visits would be more likely to have their asthma controlled and have better quality-of-life at 12 months than youth who received usual care.

Materials and methods

Procedure

The study was approved by our Institutional Review Board. Participants were enrolled from June 2015 to November 2016 at four pediatric clinics. Three clinics were private practices and one was an academic practice. Clinics were chosen because they served large numbers of adolescents with persistent asthma from diverse racial/ethnic backgrounds. Clinic staff referred potentially eligible patients who were interested in learning more about the study to a research assistant. During pre-visit wait time, the research assistant explained the study, obtained informed written caregiver consent and adolescent assent, and administered an eligibility screener to the caregiver (3,21). Children were eligible if they were: ages 11–17 years; spoke and read English or Spanish; had persistent asthma; were present for an acute or follow-up asthma visit or a well-child visit; and had previously visited the clinic at least once for asthma. Adolescents' caregivers were eligible if they were at least 18 years of age, spoke and read English or Spanish, and were the legal guardian of the adolescent. The research assistant recorded the reasons why individuals declined to participate.

The study statistician prepared the randomization envelopes for the research assistants to use. Adolescents were randomized within providers and opaque envelopes were prepared for the research assistants at each site. Eligible adolescents of participating providers were then randomized to the intervention or usual care group. Youth in the intervention group watched the video with their parents on an iPad. They then completed the asthma question prompt list to use during their visit

with their provider. The final one-page asthma question prompt list had 14 questions about asthma medications, eight questions about triggers and asthma in general, and an area where adolescents could write in questions (27); see Appendix (Supplementary material). The question prompt list took adolescents in the intervention group less than 4 minutes to complete. The usual care group did not receive any intervention; they just had their usual visits with their providers.

Providers were blinded to the adolescent's group assignment. All adolescents' baseline visits were audio-tape recorded. All adolescents were interviewed at baseline after their medical visits by a research assistant while their caregivers completed questionnaires. Therefore, outcomes were assessed after the medical visits. Research assistants reviewed the caregiver questionnaires before families left the clinics to ensure data quality. Adolescents and caregivers each received \$25 for their time.

Adolescents in the intervention group received the question prompt list to complete again before their 6-month visits and all youth had their visits audio-taped at 6 months if they returned to clinic. The adolescents were interviewed after visits and their caregivers completed questionnaires. If the adolescent did not return to the clinic at approximately 6 or 12 months to see their provider for a follow-up visit, the research assistant met the family at a location of their choice to interview the child and to have the caregiver complete a questionnaire. Each patient was followed for 12 months.

Measurement

Sociodemographic variables

Youth and provider age, years the teen has been living with asthma, and caregiver years of education were measured as continuous variables. Teen, caregiver, and provider gender were measured as dichotomous variables. Teen and provider race was coded into five categories: Caucasian, African American, Native American/American Indian, Hispanic, or Other. Caregiver race was coded as White and nonwhite. Asthma severity was classified as mild persistent versus moderate/severe persistent according to the National Heart Lung and Blood Institute's guidelines (6,7). The research assistant administered an eligibility screener to the caregiver that had questions pertaining to symptoms and medication use to determine severity. Using information from the eligibility screener that parents completed with the research assistant, persistent asthma was defined as experiencing asthma-related daytime symptoms more than twice a week, asthma-related

nighttime symptoms more than twice a month, or receiving one or more long-term controller therapies for asthma (3,11). Whether the child was on a control medication at baseline was measured as a dichotomous variable. Primary language spoken at home was measured as a dichotomous variable (English, Spanish).

Asthma management self-efficacy and outcome expectations

Youth reported asthma management self-efficacy at baseline and 12 months was measured using a 14-item scale that has a reliability of 0.87 (Cronbach's $\alpha = 0.83$) (28). Respondents are asked how sure they can do things to help their asthma such as have inhalers with them when they have an attack, knowing how to use an inhaler correctly, avoiding allergens, etc. We calculated the total asthma management self-efficacy score as a continuous measure; higher scores indicate greater self-efficacy.

Youth asthma management outcome expectations at baseline and 12 months was measured as a continuous variable using an adapted version of Holden's 5-item asthma outcome expectations scale (29). The scale has a reliability of 0.64, and higher scores represent more positive outcome expectations for following asthma treatment strategies.

Youth and caregiver reported problems in using asthma medications

Number of youth reported medication problems was measured as a continuous variable with a range from 0–6 (30). Youth reported problems were: side effects, hard to remember when to take medications, hard to use medicines at school, not sure they are using their inhalers like they are supposed to, hard to understand the directions on the medicines, and hard to read the print on the package. Number of caregiver reported problems was measured as a continuous variable with a range from 0–7 (30). Caregiver reported medication problems were: child has side effects, hard for child to remember when to take, not sure they are using their inhaler correctly, hard to understand the directions, hard to read the print on the package, hard to pay for, and hard to get refills on time.

Youth question-asking during visits

All audiotapes of the medical visits were transcribed verbatim. Three research assistants were trained to code the transcripts using a detailed coding tool developed and used in prior asthma communication studies (3,9,10). The three coders coded 34 of the same transcripts throughout the study period to assess inter-

ater reliability. We measured whether the adolescents asked one or more questions during the baseline or 6-month visit. The inter-coder reliability for whether an adolescent asked one or more questions at baseline or six months was 0.98.

Asthma control and quality-of-life at baseline and 12 months

Asthma control was measured using the 5-item asthma control test which is a valid and reliable measure of asthma control (31–33). We received permission to use the scale. Using a 5-point Likert scale, responses are summed to indicate a score ranging from 5 (poor asthma control) to 25 (complete asthma control). Scores above 19 are considered “well controlled”, 16–19 are considered not well controlled, and scores 15 or below are considered “very poorly controlled” (6). We measured asthma as being controlled if an adolescent had a score of above 19 and an adolescent was considered not controlled if they had a score of 19 or below. Studies have shown the Asthma Control Test to be reliable, valid, and responsive to temporal changes in asthma control (31).

Adolescent quality-of-life was measured as a mean score. We used the 23-item standardized version of the Juniper pediatric asthma quality-of-life questionnaire which has a reliability of 0.84 (34).

Analysis

A sample of 359 adolescents afforded over 80% power with a type I error rate of 5% for each of the between-groups differences for these outcomes variables. We expected a 20% attrition rate over 12 months based on our prior work but we only had 7% attrition (3,35). We had powered the study planning on ending up with 143 families in each group after attrition and we expected increase of 20% in asthma control, as well as an expected increase in adolescent quality-of-life by at least one half of a point, which equates to effect sizes of 0.45 to 0.6. Our estimates for the usual care group come from our prior work (3,4,11).

All analyses were conducted using SPSS (IBM SPSS, Armonk, NY, USA). Youth and provider race/ethnicity were recoded into dichotomous variables (White, nonwhite). First, we computed descriptive statistics for all variables. Second, we examined bivariate relationships between the variables using Pearson chi-square statistics or independent *t*-tests. Generalized estimating equations (i.e., the GEE method) (36) were used to analyze the data, which allowed families to be nested within providers. We used GEE to investigate

how: (a) study group (intervention, usual care), (b) whether an adolescent’s asthma was controlled at baseline, (c) adolescent sex, age, race/ethnicity, years living with asthma, asthma severity, child is on a control medication, asthma management self-efficacy, asthma management outcome expectations, number of adolescent reported medication problems, (d) years of parent education, number of caregiver reported medication problems, language spoken at home, and (e) provider age, sex, and race/ethnicity affected the primary outcome asthma control at 12 months in adolescents. Next, we conducted a subgroup analysis to understand how the intervention and question asking work together to affect the primary outcome. First, we looked only at those adolescents in the intervention group and examined asthma control at 12 months by whether adolescents asked one or more questions during their baseline or 6-month visits using a Pearson chi-square. We then repeated this analysis using only those adolescents in the usual care group.

Finally, we used GEE to examine how (a) study group (intervention, usual care), (b) an adolescent’s asthma quality-of-life at baseline, (c) adolescent sex, age, race/ethnicity, years living with asthma, asthma severity, child is on a control medication, asthma management self-efficacy, asthma management outcome expectations, number of adolescent reported medication problems, (d) years of caregiver education, number of caregiver reported medication problems, language spoken at home, and (e) provider age, sex, and race/ethnicity affected an adolescent’s quality-of-life at 12 months. Next, we conducted the same subgroup analysis as described for asthma control. First, we looked at only those adolescents in the intervention group and examined asthma quality-of-life at 12 months by whether adolescents asked one or more questions during their baseline or 6-month visits using an independent *t*-test. We then repeated this analysis using only those adolescents in the usual care group.

Results

Participants

Forty-six providers agreed to participate in the study and 40 of these providers enrolled patients. Providers ranged in age from 28 to 62 (mean age = 41.2, standard deviation $n = 11.2$). Twenty-seven of the 40 providers who had patients enrolled into the study were female. Four providers were Native American, three were African American, three were Asian American, 29 were White, and one was Hispanic.

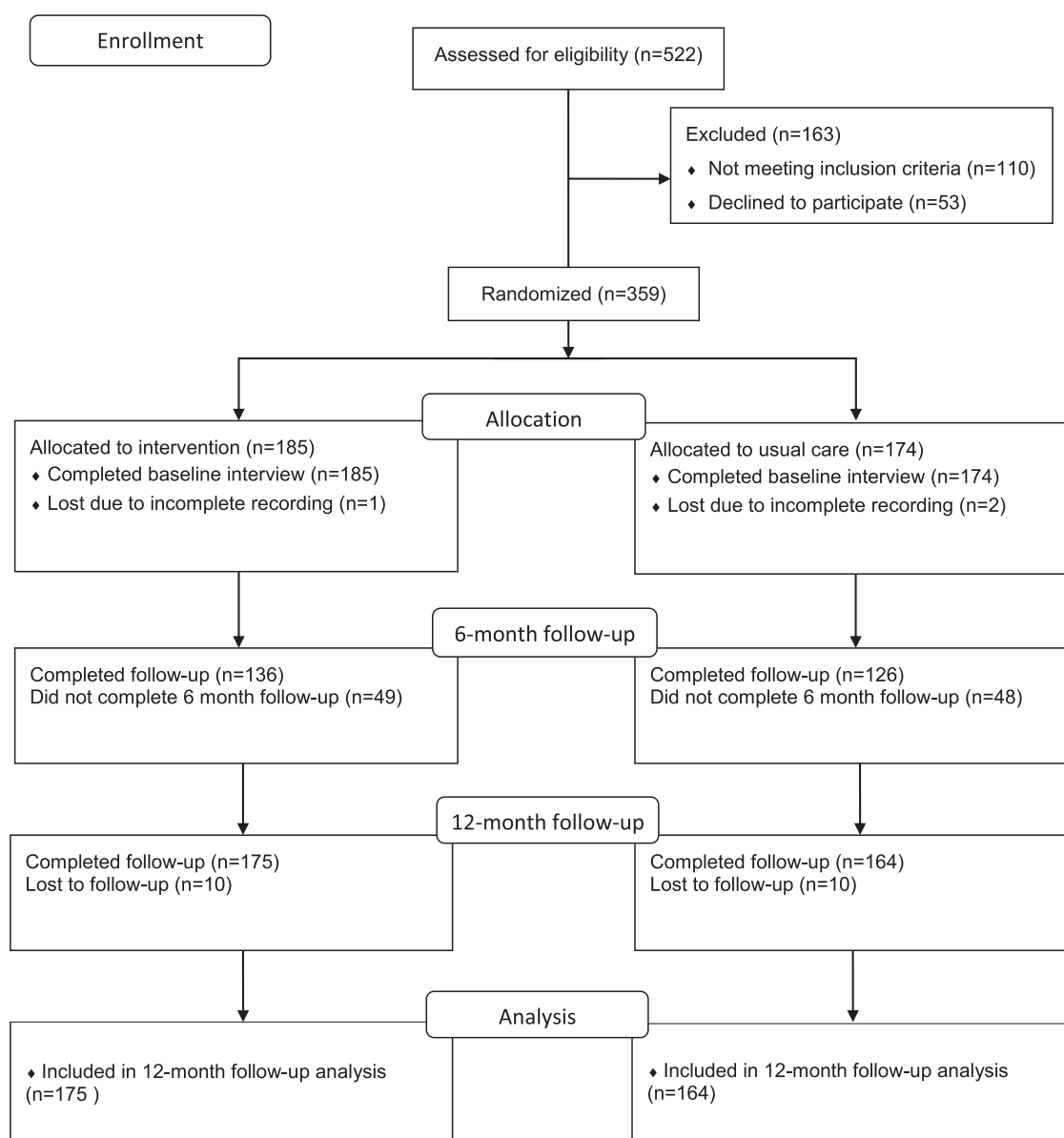


Figure 1. CONSORT diagram of randomized controlled trial participants.

The participation of the patients in the trial is shown in the CONSORT (consolidated standards of reporting trials) diagram (Figure 1). Participants were enrolled from June 2015 to November 2016. One hundred and ten participants did not meet inclusion criteria. The main reasons for not meeting inclusion criteria included: had not been seen at clinic before for asthma, no legal guardian present, and adolescent did not have persistent asthma. Of the 412 eligible patients, 359 agreed to participate and 53 refused (87% participation rate). Reasons for not participating included: lack of time ($N=27$), caregiver is not interested because child's asthma is under control ($N=8$), adolescent does not believe he/she has asthma ($N=2$),

caregiver does not believe adolescent has asthma ($N=3$), adolescent going away to college ($N=3$), adolescent refused and no reason given ($N=6$), caregiver not interested and no reason given ($N=3$), and father said that he needs to consult with mother first ($N=1$). A devastating hurricane hit North Carolina during the 6-month follow-up period and two of our clinics and many of our enrolled families were impacted which influenced follow-up at 6 months. We were able to complete 262 (73%) of the 6-month follow-up visits. However, 94% ($N=339$) of families were followed up with at 12 months but only 166 of these families returned to the clinic at that time for a medical visit.

Table 1. Adolescent and provider characteristics ($N = 359$).

Characteristics	Intervention group ($N = 185$) Percent (N)	Usual care group ($N = 174$) Percent (N)	p Value
<i>Adolescent sex</i>			0.52
Male	58.9 (109)	55.2 (96)	
Female	41.1 (76)	44.8 (78)	
<i>Adolescent race/ethnicity</i>			0.51
Caucasian	32.4 (60)	40.2 (70)	
African American	38.4 (71)	36.2 (63)	
Hispanic	14.1 (26)	10.9 (19)	
Native American	13.0 (24)	9.8 (17)	
Other	2.2 (4)	2.9 (5)	
<i>Language spoken at home</i>			0.26
English	93.1 (162)	89.7 (166)	
Spanish	6.9 (12)	10.3 (19)	
<i>Asthma severity</i>			0.40
Mild	49.2 (91)	44.3 (77)	
Moderate/severe	50.8 (94)	55.7 (97)	
<i>Asthma is controlled at baseline</i>	55.0 (101)	60.0 (105)	0.27
<i>On a control medication</i>	54.6 (101)	60.3 (174)	0.30
<i>Provider sex</i>			0.82
Male	33.5 (62)	32.2 (56)	
Female	66.5 (123)	67.8 (118)	
<i>Provider race/ethnicity</i>			0.97
Caucasian	73.0 (135)	73.0 (127)	
African American	11.4 (21)	10.9 (19)	
Asian American	4.9 (9)	6.3 (11)	
Hispanic	1.6 (3)	1.1 (2)	
Native American	9.2 (17)	8.6 (15)	
Other	0 (0)	0 (0)	
<i>Provider type</i>			0.96
Physician	62.2 (115)	62.6 (109)	
Physician Assistant	18.9 (35)	17.8 (31)	
Nurse Practitioner	18.9 (35)	19.5 (34)	
	Mean (Standard Deviation)	Mean (Standard Deviation)	p Value
Adolescent age	13.2 (1.9)	13.2 (1.9)	0.66
Years living with asthma	9.2 (4.3)	9.9 (3.9)	0.10
Caregiver age	41.8 (7.7)	43.4 (9.3)	0.10
Caregiver educational level-years	13.5 (3.1)	13.8 (3.5)	0.39
Provider age	44.2 (11.5)	44.0 (11.4)	0.91
Baseline youth asthma management self-efficacy	55.9 (8.0)	56.0 (8.2)	0.80
Baseline youth asthma management outcome expectations	39.5 (5.2)	38.8 (6.2)	0.30
Number of youth reported medication problems at baseline	1.5 (1.2)	1.6 (1.3)	0.80
Number of caregiver reported medication problems at baseline	1.3 (1.2)	1.3 (1.1)	0.70
Baseline asthma quality-of-life	5.7 (1.2)	5.8 (1.2)	0.50

Of the 359 enrolled families, 185 were randomly allocated to the experimental intervention group and 174 were allocated to the control group or usual care. Table 1 presents the demographic characteristics by whether adolescents were randomized to the intervention or usual care. The groups were balanced on all adolescent and provider demographic characteristics.

Nine percent of caregivers reported that they spoke Spanish at home. Forty-five percent of the adolescents followed until 12 months asked one or more asthma questions at their baseline or 6 month visits; 58% of adolescents in the intervention group asked one or more questions compared to 32% in the usual care group.

Asthma control

At baseline, 60% of adolescents in the usual care group had well controlled asthma, as compared to

55% of adolescents in the intervention group (Pearson chi-square = 1.12, $df = 1$, $p = 0.27$). At 12 months, 78% of adolescents in the usual care group and 70% of adolescents in the intervention group had well controlled asthma (Pearson chi-square = 3.15, $df = 1$, $p = 0.08$). Unadjusted for covariates, the improvement in both groups was statistically significant ($p = 0.001$ for intervention and $p = 0.000$ for usual care).

Table 2 presents the GEE results predicting whether the youth's asthma was controlled at 12 months. Adolescents in the intervention group were less likely to have their asthma controlled at 12 months than adolescents in the usual care group (odds ratio = 0.61 95% confidence interval = 0.39, 0.93). Adolescents who had their asthma controlled at baseline were significantly more likely to have it controlled at 12 months (odds ratio = 4.09, 95% confidence interval = 2.50, 6.67). Adolescents with moderate/severe persistent asthma were significantly

Table 2. Generalized estimating equation predicting whether adolescent's asthma is controlled according at 12 months to asthma control test ($N = 338$).

Independent variables	Odds ratio (95% CI)
Treatment group – intervention	0.61 (0.39, 0.93)*
Asthma was controlled at baseline	4.09 (2.50, 6.67)***
Adolescent gender – male	0.89 (0.50, 1.59)
Adolescent race – White	1.13 (0.62, 2.04)
Adolescent age	0.84 (0.71, 1.00)
Adolescent asthma management self-efficacy at baseline	0.98 (0.94, 1.02)
Adolescent asthma management outcome expectations at baseline	0.99 (0.95, 1.04)
Asthma severity – moderate/severe	0.54 (0.32, 0.94)*
On a control medication at baseline	2.92 (1.23, 6.84)*
Years living with asthma	1.1 (1.01, 1.21)*
Caregiver years of education	0.99 (0.90, 1.09)
Language spoken at home – Spanish	0.93 (0.31, 2.75)
Provider age	0.99 (0.97, 1.02)
Provider race – White	0.88 (0.55, 1.42)
Provider gender – female	0.88 (0.49, 1.57)
Number of adolescent reported medication problems at baseline	0.78 (0.59, 1.03)
Number of caregiver reported medication problems at baseline	1.08 (0.85, 1.35)

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

less likely to have their asthma controlled than adolescents with mild persistent asthma (odds ratio = 0.54, 95% confidence interval = 0.32, 0.94). Adolescents on a control medication were significantly more likely to have their asthma controlled than adolescents who were not on a control medication (odds ratio = 2.92, 95% confidence interval = 1.23, 6.84).

Asthma control: Subgroup analysis

Adolescents in the intervention group who asked one or more questions about asthma were significantly more likely to have their asthma controlled than adolescents in the intervention group who did not ask questions (Pearson chi-square = 8.7, $df = 1$, $p = 0.003$). In the intervention group, 69% were controlled at 12 months. A higher proportion of intervention group adolescents who asked one or more questions were controlled at 12 months: 78% of those who asked one or more questions at their baseline or 6-month visits, compared to 57% who asked no questions during visits. In the usual care group, adolescents who asked one or more questions were not significantly more likely to have their asthma controlled at 12 months than youth who did not ask questions (Pearson chi-square = 2.79, $df = 1$, $p = 0.09$).

Asthma quality-of-life

The mean quality-of-life score at baseline was 5.7 in the intervention group and 5.8 in the usual care group (t -test = -0.72 , $df = 357$, $p = 0.47$). At 12 months, the mean quality-of-life score was 6.1 in the intervention

Table 3. Generalized estimating equation predicting adolescent asthma quality-of-life at 12 months ($N = 338$).

Independent variables	Beta (95% CI)
Treatment group – intervention	0.02 (–0.10, 0.16)
Asthma quality-of-life at baseline	0.45 (0.34, 0.57)***
Adolescent gender – male	–0.04 (–0.28, 0.20)
Adolescent race – White	–0.01 (–0.19, 0.18)
Adolescent age	0.05 (–0.01, 0.10)
Adolescent asthma management self-efficacy at baseline	0.01 (–0.01, 0.02)
Adolescent asthma management outcome expectations at baseline	0.01 (–0.01, 0.02)
Asthma severity – moderate/severe	0.01 (–0.20, 0.22)
On a control medication at baseline	–0.26 (–0.58, 0.06)
Years living with asthma	0.05 (0.08, 0.01)**
Caregiver years of education	0.03 (–0.01, 0.06)
Language spoken at home – Spanish	0.31 (–0.15, 0.76)
Provider age	–0.01 (–0.02, 0.01)
Provider race – White	0.08 (–0.05, 0.21)
Provider gender – female	–0.01 (–0.17, 0.17)
Number of adolescent reported medication problems at baseline	–0.07 (–0.16, 0.03)
Number of caregiver reported medication problems at baseline	0.01 (–0.09, 0.11)

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

group and 6.2 in the usual care group (t -test = -0.65 , $df = 336$, $p = 0.52$). The mean quality-of-life score improved from baseline to 12 months in both groups (intervention group: t -test = 4.25, $df = 173$, $p = 0.000$; usual care group: t -test = 4.57, $df = 163$, $p = 0.000$).

Table 3 presents the GEE results predicting youth asthma quality-of-life at 12 months. Adolescents with a better quality-of-life at baseline were significantly more likely to have better quality-of-life at 12 months (beta = 0.45, 95% confidence interval = 0.34, 0.57). Adolescents who had asthma longer were significantly more likely to report worse quality-of-life at 12 months (beta = -0.05 , 95% confidence interval = -0.08 , -0.01).

Quality-of-life: subgroup analysis

Adolescents in the intervention group who asked one or more questions about asthma were significantly more likely to have better asthma quality-of-life than adolescents in the intervention group who asked no questions (t -test = 1.94, $df = 171$, $p = 0.03$). Adolescents in the usual care group who asked one or more questions about asthma were not significantly more likely to have better quality-of-life at 12 months than adolescents in the usual care group who did not ask questions (t -test = 1.06, $df = 160$, $p = 0.14$).

Discussion

Asthma control and asthma quality-of-life improved significantly from baseline to 12-month follow-up in both groups. Asthma control and asthma quality-of-life did not improve significantly more in the intervention group than in the control group. However, we

found an interesting interaction effect of our intervention and whether youth asked one or more questions during their visits. Adolescents in the intervention group who asked one or more questions at baseline or 6 months about their asthma were significantly more likely to have their asthma controlled and better asthma quality-of-life. Adolescents in the usual care group who asked one or more questions at baseline or 6 months about their asthma were not significantly more likely to have their asthma controlled and better asthma quality-of-life. Perhaps adolescents in the intervention group asked more questions related to asthma self-management than adolescents in the usual care group. We haven't compared the types of questions by the intervention and usual care groups, so maybe the intervention group is asking "better" questions.

Future work should examine if the types of questions asked by adolescents vary between those who use the prompt list and those who do not. Also, future research should investigate why 42% of the youth who received the video/question prompt list intervention before their visits did not ask their providers any questions. Youth could be asked immediately after visits if they asked any questions of their provider during their visits and why or why not.

As our research team has reported elsewhere (27), the asthma question prompt list with video intervention resulted in adolescents being more likely to ask one or more questions about medications, triggers, and environmental control and providers being more likely to educate youth about rescue medications, triggers, and environmental control during their visits. This is similar to prior research in the cancer area which found that when adult patients used question prompt lists they asked more questions during visits and providers gave them more information (17–20). Unlike the cancer area, we attempted to assess how youth use of question prompt lists were associated with the asthma outcomes of quality-of-life and asthma control. Baseline asthma control and baseline asthma quality-of-life each respectively significantly predicted asthma control and quality-of-life at 12 months. Future research that examines the impact of the intervention on patient outcomes should include only patients whose asthma is not controlled or those with poor quality-of-life. For example, of those patients who were successfully followed for 12 months, 57% ($N=194$) already had their asthma controlled at baseline.

Youth who were on a control medication were three times more likely to have their asthma controlled than youth who were not on a control medication. This finding emphasizes the need for providers

to assess and make sure that adolescents are on control medications if they are needed. It is interesting that being on a control medication was not significantly associated with adolescent quality-of-life at 12 months. Baseline asthma quality-of-life was strongly associated with 12-month quality-of-life. Providers should make sure to ask adolescents about their asthma quality-of-life and help strategize with youth on how to improve their quality-of-life with asthma.

Youth who had asthma longer were also significantly more likely to report worse asthma quality-of-life at 12 months. Providers should work with adolescents to help them problem solve on how to make their quality-of-life better.

The study is limited in generalizability in that it was conducted in four pediatric clinics in North Carolina. We recruited youth from primary care clinics; the results might have differed if youth were recruited from specialty clinics or non-clinic settings. Another limitation is that we do not know how many patients who the clinic staff referred to the research assistant chose not to talk to the research assistant. However, we could not ask the clinic staff to track these numbers because of the busyness of the clinics and our promise not to interrupt flow. Asthma control and quality-of-life could have improved in both the intervention and usual care groups because of the Hawthorne effect (families knew they were being observed). We also did not know if the teen saw their usual primary care provider when they enrolled into the study or the years the provider had been in practice. Unfortunately we did not assess why adolescents in the intervention group either asked or did not ask questions.

Asthma control and quality-of-life did not improve significantly more in the intervention group than in the usual care group. However, the intervention developed and used in this work shows promise and should be tested in future work. The question prompt list and video intervention is brief, easy to implement, and inexpensive. The English and Spanish videos are on YouTube channels <https://www.youtube.com/watch?v=Pvjnc09Y3-Q&index=1&list=PLeqYkDk62jJCjWY1fDUJdRnxqGqtF-75z> and https://www.youtube.com/watch?v=5ZKrO_kqv20&list=PLeqYkDk62jJBKVRMJMq7RY66pvnvVFKYv, respectively.

Declaration of interest

The authors have indicated they have no financial relationships relevant to this article to disclose.

Funding

This work was supported through Patient-Centered Outcomes Research Institute CDR-1402-09777. Two authors are also supported by the National Center for Advancing Translational Sciences (NCATS), National Institutes of Health, through Grant Award Number UL1TR002489.

ORCID

Betsy Sleath  <http://orcid.org/0000-0002-8861-6955>
 Delesha Carpenter  <http://orcid.org/0000-0003-2025-8140>
 Scott A. Davis  <https://orcid.org/0000-0001-6593-9850>
 Charles Lee  <https://orcid.org/0000-0001-6449-1791>
 Nacire Garcia  <https://orcid.org/0000-0003-0894-413X>
 Daniel S. Reuland  <http://orcid.org/0000-0002-7839-6581>
 Gail Tudor  <http://orcid.org/0000-0003-2093-0515>
 Ceila E. Loughlin  <http://orcid.org/0000-0003-0505-7893>

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Appendix: Asthma Question Prompt List

Read these questions and put checks by the ones you want to ask the doctor.

Questions about asthma

- ☐ What causes my asthma?
- ☐ How do I prevent breathing problems?
- ☐ Can you tell me what asthma triggers are?
- ☐ How can I make my asthma better?
- ☐ How severe is my asthma?
- ☐ What can I do if someone is smoking around me?
- ☐ When should I stay indoors?
- ☐ Can I be around my pet?

Questions about asthma medicines:

- ☐ What do you call my asthma medicine?
- ☐ What medicine do I use when my chest is tight or when I wheeze or cough?
- ☐ Which asthma medicine do I take every day and why?
- ☐ How do I use a spacer?
- ☐ When should I use my medicine?
- ☐ How much medicine should I take each time I use it?
- ☐ How long do I hold my breath after I inhale my medicine?
- ☐ Why do I hold my breath after I inhale my medicine?
- ☐ How many times a day do I take it?
- ☐ Should I use my asthma medicine before I play or exercise?
- ☐ Is it okay to take my asthma medicine with my other medicines?
- ☐ Can you show me how to use my medicine?
- ☐ Can I show or tell you how I use my medicine so you tell me if I am doing it right?
- ☐ Should I always carry my asthma medicine with me?

Write any other questions you have in the space below:
