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Health-Related Internet Use among Adolescents with Uncontrolled Persistent Asthma

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ABSTRACT

Objectives: To describe internet use for health information among adolescents with uncontrolled persistent asthma, and to examine whether health-related internet use is associated with responsibility for home asthma management.

Methods: We analyzed baseline data from the School-Based Asthma Care for Teens (SB-ACT) Trial, which included adolescents (12-16 years) in an urban school district who had uncontrolled persistent asthma per caregiver report. We asked adolescents whether they had ever used the internet to look for health or medical information (Y/N). Teens then described family responsibility for 9 asthma management tasks (e.g., full caregiver responsibility, shared responsibility, or full teen responsibility). We examined responsibility sum scores in addition to responsibility for individual management tasks. We used bivariate and multivariate analyses to compare health-related internet use with participant characteristics, teen-reported asthma symptoms, and management responsibility.

Results: We examined data for 425 adolescents (mean age 13.4 years). Almost half (45%) reported seeking health information on the internet. In adjusted analyses, health-related internet use was strongly associated with teen responsibility (sum score and tasks relating to carrying and using medications); internet use was also more likely among teens who were older, female, or reported uncontrolled disease.

Conclusions: Adolescents with persistent asthma who share responsibility for home management or report uncontrolled disease are more likely to seek health information online. Future interventions to support teens who co-manage asthma should work to engage patients in both clinical and digital spaces, and ensure that all patients can access accurate, patient-centered asthma information when needed.

INTRODUCTION

Adolescents with persistent asthma bear increasing responsibility for medication use as they get older.¹ According to asthma treatment guidelines, each of these teens should be prescribed two classes of medication: a fast-acting rescue medication for acute symptoms, and a daily controller medication to prevent future morbidity.² We recently found that adolescents are often unable to differentiate between their own rescue and controller medications by the time they are responsible for daily use.³ This raises a question of whether adolescents who have responsibility for home asthma management also have access to essential information about their disease and medications.

Education about childhood asthma management and the importance of controller medications often does not occur in ambulatory care settings.⁴ When clinic-based conversations about disease management do occur, children are frequently excluded,^{5,6} even though most pediatric patients would prefer to actively participate.⁷ Teen participation in clinic conversations and physician-patient engagement gradually increase as patients get older,^{7,8} yet asthma education resulting from these increased interactions may not address patient learning needs. In fact, adolescents routinely leave outpatient visits without asking providers the questions they have about asthma.⁹ Thus, it is perhaps unsurprising that adherence with daily controller medications for childhood asthma is lowest among older teens.¹⁰

In considering unmet educational needs, it is unclear how often adolescents with asthma are seeking health and medical information from non-clinical sources, such as the internet, or whether health-related internet use differs among teens who share responsibility for home asthma management. This is of particular interest since daily internet use is ubiquitous among teens in the United States,¹¹ and teens often seek health information online despite concerns of whether

internet-based information is reliable.¹² Our objectives for this study were to describe internet use for health information among a group of adolescents with uncontrolled persistent asthma, and examine whether health-related internet use is associated with responsibility for asthma management. Anticipating that patients with more asthma management responsibility would have a greater need for medical information to guide their home care practices, we hypothesized that they would be more likely than patients without management responsibility to seek this information on the internet.

METHODS

Our data were from the School-Based Asthma Care for Teens (SB-ACT) study, a randomized controlled trial that included in-school daily administration of controller medication paired with counseling sessions using motivational interviewing to promote independent adherence. Young adolescents (12-16 years) were eligible if they had a physician diagnosis of asthma, caregiver-reported uncontrolled/symptomatic persistent asthma in accordance with National Asthma Education and Prevention Program (NAEPP) guidelines,² and attended a partner school within the Rochester, NY metropolitan area. Exclusion criteria included no access to a working phone, an inability to speak English, or the presence of another chronic diagnosis that could interfere with asthma assessments (e.g., cystic fibrosis, congenital heart disease, other chronic lung pathology). We analyzed data from in-home baseline surveys (prior to any intervention), administered to caregivers and teens during the study (2014-2019). We obtained consent from caregivers and assent from teens prior to enrollment. The study was approved by the Institutional Review Board at the University of Rochester Medical Center.

We asked adolescents whether they had ever used the internet to look for health or medical information (“health-related internet use”; Y/N). Teens also described family responsibility for 9 asthma management tasks using a scale adapted from similar published instruments that assessed home management responsibility in childhood asthma and diabetes.^{13,14} For each task, such as obtaining prescription refills, deciding when to seek care, or using medications (controller or rescue), teens could select from 3 different response options: the caregiver is responsible almost all of the time (“full caregiver responsibility”; 1 point); the caregiver and teen share responsibility equally (“shared responsibility”; 2 points); or, the teen is responsible almost all of the time (“full teen responsibility”; 3 points). Overall responsibility for asthma management is reported as the sum of points generated from the full panel of questions (range: 9-27 points), with higher scores indicating greater teen responsibility.

Finally, we used teen-reported recent asthma symptoms and rescue medication use (past month) and use of oral corticosteroids (past year) to characterize level of control in accordance with NAEPP guidelines.² Although each teen had uncontrolled asthma at eligibility screening per caregiver report, we wanted to additionally determine whether teens similarly reported symptoms consistent with poorly controlled disease. Caregivers separately reported family/participant characteristics, and also reported whether the teen was using a controller medication (Y/N).

We compared health-related internet use with patient characteristics, disease characteristics (i.e., teen-reported control, caregiver-reported controller medication use), and teen-reported responsibility using Pearson chi-square and t-tests for categorical and continuous variables, respectively. In addition to the overall responsibility score, we performed bivariate comparisons between health-related internet use and each of the 9 asthma management tasks included in the panel. This approach was informed by an a priori assumption that teens may be less likely to

have primary responsibility for certain tasks, such as obtaining refills or deciding to go to the emergency room, due to financial and transportation barriers. In contrast, previous research has demonstrated that children develop primary responsibility for using inhaled medications during mid-adolescence.¹ We decided to examine whether teen responsibility for each individual task was independently associated with health-related internet use. For each task, we dichotomized teen responsibility for medications as “full caregiver responsibility” vs “shared or full teen responsibility,” with the intent of exploring health-related internet use once teens start to engage in responsibility behaviors. A 2-sided alpha <0.05 was considered statistically significant. For all significant bivariate comparisons, we determined effect size (odds ratios with 95% confidence intervals) using binomial logistic regression analyses modeling internet use as the dependent variable.¹⁵

Next, we performed a series of multivariate logistic regression analyses to examine the relationship between teen internet use (dependent variable) and teen asthma responsibility after controlling for potential covariates. The first set of analyses included the responsibility sum score as the independent variable of interest. We performed additional regression analyses using different management tasks as the independent variable representing responsibility (instead of sum score) when bivariate comparisons between the management task and health-related internet use yielded a P-value of ≤ 0.10 . This threshold was also used to select other independent variables for inclusion as potential covariates. All analyses were performed using SPSS (version 26).

RESULTS

We enrolled 430 adolescents into the SB-ACT trial over a 5-year period (enrollment rate 79%; mean age 13.4 years, 56% Black, 32% Hispanic, 84% public insurance). Information on health-related internet use was missing for 5 subjects. Almost half of the adolescent respondents (45%) reported using the internet to look up health or medical information. Compared with teens who did not seek health information on the internet, teens who used the internet were more likely to be older (13.6 vs 13.3 years, OR=1.24, 95% CI 1.06-1.45), female (52% vs 38%, OR=1.83, 95% CI 1.24-2.70), and report recent symptoms consistent with poor disease control (70% vs 57%, OR=1.73, 95% CI 1.16-2.59) (**Table 1**).

A majority of teens reported having shared or full responsibility for 7 of the 9 asthma management tasks; just under half (49%) had responsibility for deciding when to go to a doctor or the emergency room for asthma care, and only 12% were responsible for obtaining prescription refills. Compared with teens who did not seek health information online, teens who used the internet for health information endorsed greater personal responsibility for overall asthma management (19.0 points vs 17.9 points, OR=1.11, 95% CI 1.05-1.18). These teens were also significantly more likely to report having shared or full responsibility for using controller medications (91% vs 81%, OR=2.21, 95% CI 1.23-3.98), using rescue medications (89% vs 77%, OR=2.36, 95% CI 1.38-4.04), having medication available when away from home (74% vs 54%, OR=2.38, 95% CI 1.58-3.60), and talking with their doctor when they have questions about asthma (74% vs 64%, OR=1.62, 95% CI 1.07-2.47) (**Table 1**).

Our findings were similar between bivariate and multivariate regression models. After adjusting for age, gender, and teen-reported disease control, health-related internet use remained significantly associated with a higher responsibility sum score (aOR 1.09, 95% CI 1.02-1.16). Among individual management tasks, internet use was significantly associated with shared or

full teen responsibility for using controller medication (aOR 2.09, 95% CI 1.15-3.82), using rescue medication (aOR 2.28, 95% CI 1.32-3.82), and having medication when away from home (aOR 2.31, 95% CI 1.51-3.53); teen responsibility for talking with the doctor about asthma-related questions was not associated with internet use in adjusted analysis. Health-related internet use was also associated with increasing age, female gender, and poor disease control in most regression analyses, although age was not associated with internet use in the model which included the responsibility sum score (**Table 2**).

DISCUSSION

Nearly half of these young adolescents with uncontrolled persistent asthma have sought health or medical information online. Prior research has demonstrated similar rates of health-related internet use among adolescents with other chronic conditions including diabetes and juvenile arthritis.¹⁶ Consistent with our hypothesis, the teens in this study were more likely to seek online health information when they perceived greater personal responsibility for their asthma management: the odds of health-related internet use increased by 9% for each additional point in the responsibility sum score, indicating a small but significant effect.

Responsibility specific to individual management tasks was more strongly associated with health-related internet searches than overall responsibility: the odds of internet use were more than doubled among teens who shared responsibility for using medications or having them available when not at home, compared with teens whose caregivers completely managed medications. We suspect that the strength of these associations relative to the sum score may be explained by adolescents who start to co-manage medications before engaging with other management tasks included in the panel. Although a majority of teens in this study had partial or

shared responsibility for many tasks, most teens reported full caregiver responsibility for refilling prescriptions and deciding when to seek medical care for asthma. By including tasks that many teens don't routinely engage in, the measure of overall responsibility may not be as helpful in identifying patients who need additional information to support home management. However, we also identified several tasks (i.e., deciding when to stop playing to prevent symptoms, avoiding asthma triggers) that almost 4 in 5 teens reported responsibility for doing, yet were not associated with online information-seeking. It is possible that health-related internet use is specifically associated with responsibilities for carrying and using medications independently, rather than a broader concept of management responsibility.

Our finding that female gender and participant age each had a small but significant effect on internet use is consistent with other studies of health-related internet use.¹⁶ All subjects enrolled in the SB-ACT trial had uncontrolled asthma per caregiver report; it was interesting to discover that teens who also reported symptoms of uncontrolled disease were more likely to seek health information online. Collectively, these findings may point to a subgroup of pediatric patients with asthma who are actively seeking additional health support from non-clinical sources.

While responsibility for talking with doctors was not associated with health-related internet use in the adjusted model, we were unable to examine clinician-patient engagement in this study, or whether clinician-led interactions may have in fact stimulated a drive for self-learning among teens. Nevertheless, previous work has demonstrated that pediatric patients do not consistently receive necessary or desired asthma management information in clinic settings,^{4,7,9} and find the internet to be an accessible¹⁶ (if potentially unreliable)¹² resource for health information. Our results compliment these earlier findings by suggesting the possibility of an unfulfilled need for

health information among adolescents, and an attempt to address that need by seeking information online.

Future studies should examine whether teen-reported internet use for health and medical information might serve as an indicator to ensure adolescents have appropriate and reliable educational support. Qualitative research may help clarify why adolescents turn to internet sources of information. This will include exploring whether home dynamics or previous clinical experiences (i.e., provider engagement, delivery of asthma education) influence adolescent decisions to seek information online, soliciting preferences for asthma education among adolescents with home management responsibility, and identifying internet resources that teens are accessing. Resolving these questions may lead to improvements in patient-centered care for an at-risk population of children most likely to be non-adherent with controller therapy.

This analysis is limited by a cross-sectional design, which prohibits a determination of causality between teen responsibility and health-related internet use. Although it is tempting to speculate that increased responsibility is driving online searches for supportive information, it is also plausible that teens who access health information online are seen by caregivers as more responsible and therefore given self-management responsibility. The question on internet use for health information was not specific to asthma: teens may have been looking up health/medical information unrelated to chronic disease management, reflecting a prevailing behavior among American young adults.¹⁷ Were this the case, though, it is unclear why health-related internet use would differ among teens based on responsibility for managing medications, or recent asthma control. Adults with chronic illnesses who seek health information online often look up medications or other acute treatments.¹⁸ Further studies are necessary to understand what type of health information is being sought by teens with chronic illnesses, the frequency with which

searches occur, and what role (if any) that emerging social media platforms might play. Finally, our study included a group of young urban teens with uncontrolled persistent asthma, and our results may not be generalizable to all adolescents with asthma.

This study indicates that adolescents with persistent asthma often seek health information online, particularly when they share responsibility for home management and medication use or report symptoms of uncontrolled disease. Pediatric providers have long recognized the importance of efforts that enhance the delivery of care beyond the walls of traditional clinical environments. Future interventions to support adolescents who co-manage asthma should similarly work to engage with and support patients in the digital spaces that they increasingly occupy, and ensure that all patients can access accurate, patient-centered management information.

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Table 1. Teen-reported internet use to look up health information (Bivariate Analyses)

	Health-Related Internet Use				
	Overall N=425	No 232 (55%)	Yes 193 (45%)	P- value	OR (95% CI)*
<u>Participant Characteristics</u>					
Age (years)	13.4 (1.2)	13.3 (1.1)	13.6 (1.3)	0.007	1.24 (1.06, 1.45)
Race (Black)	238 (56%)	127 (55%)	111 (58%)	0.57	
Ethnicity (Hispanic)	137 (32%)	74 (32%)	63 (33%)	0.87	
Gender (Female)	188 (44%)	87 (38%)	101 (52%)	0.002	1.83 (1.24, 2.70)
Public health insurance	358 (84%)	194 (83%)	164 (85%)	0.78	
Smoker(s) in home (≥1)	227 (54%)	125 (54%)	102 (53%)	0.88	
Parent education (≥High School)	269 (63%)	146 (63%)	123 (64%)	0.87	
<u>Disease Characteristics</u>					
Preventive medication use	257 (61%)	142 (61%)	115 (60%)	0.74	
NAEPP Control (teen report)					
Poor control	268 (63%)	133 (57%)	135 (70%)	0.007	1.73 (1.16, 2.59)
<u>Teen-Reported Responsibility</u>					
Sum score (range 9-27)	18.4 (3.4)	17.9 (3.4)	19.0 (3.3)	<0.001	1.11 (1.05, 1.18)
Shared/Full Teen Responsibility for:					
1. Using controller medicine	364 (86%)	189 (81%)	175 (91%)	0.007	2.21 (1.23, 3.98)
2. Getting medicine to use when needed	281 (66%)	148 (64%)	133 (69%)	0.27	
3. Obtaining refills when needed	52 (12%)	25 (11%)	27 (14%)	0.31	
4. Using rescue medicine	349 (82%)	178 (77%)	171 (89%)	0.001	2.36 (1.38, 4.04)
5. Having medicine when away from home	267 (63%)	125 (54%)	142 (74%)	<0.001	2.38 (1.58, 3.60)
6. Avoiding known triggers	334 (79%)	178 (77%)	156 (81%)	0.30	
7. Deciding to stop playing and rest to avoid symptoms	355 (84%)	195 (84%)	160 (83%)	0.84	
8. Deciding when to go to the doctor or emergency room for asthma care	207 (49%)	105 (45%)	102 (53%)	0.12	
9. Talking to the doctor when there are asthma questions	291 (68%)	148 (64%)	143 (74%)	0.02	1.62 (1.07, 2.47)

Data presented as N (%) or mean (SD)

*Odds ratio (95% confidence interval)

Table 2. Teen-reported internet use to look up health information (Multivariate Regression Analyses)

Independent Variable	a. Sum Score	b. Using controller medicine	c. Using rescue medicine	d. Having medicine when not at home	e. Talking to the doctor about asthma
Teen Responsibility (a-e)	1.09 (1.02, 1.16)**	2.09 (1.15, 3.82)*	2.28 (1.32, 3.96)**	2.31 (1.51, 3.53)***	1.39 (0.90, 2.14)
Age (years)	1.16 (0.98, 1.37)	1.22 (1.04, 1.43)*	1.21 (1.03, 1.42)*	1.19 (1.01, 1.40)*	1.20 (1.02, 1.41)*
Gender (Female)	1.59 (1.07, 2.38)*	1.64 (1.10, 2.44)*	1.63 (1.09, 2.43)*	1.59 (1.06, 2.39)*	1.63 (1.09, 2.43)*
NAEPP control (poor control)	1.64 (1.08, 2.49)*	1.62 (1.07, 2.45)*	1.66 (1.09, 2.51)*	1.74 (1.14, 2.66)*	1.59 (1.05, 2.40)*
Constant	0.01	0.02	0.02	0.03	0.03

Data presented as adjusted odds ratio (95% confidence interval)

P<0.05; **P<0.01; *P<0.001*