

An Electronic Asthma Self-Management Intervention for Young African American Adults



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What is already known about this topic? Young African American adults with asthma have significantly worse outcomes. Educational interventions that can recruit and retain these patients are needed.

What does this article add to our knowledge? A 6-week tailored electronic asthma self-management intervention was successful in retention of young African American adult asthma participants, with more than 80% completing the program. Improvements in asthma quality of life and asthma control were also observed.

How does this study impact current management guidelines? Asthma education for a traditionally difficult-to-reach population may best be delivered through a theory-based electronic intervention that is tailored to the specific challenges and goals of the participant.

BACKGROUND: Health disparities are seen in many chronic conditions including asthma. Young African American adults represent a population at high risk for poor asthma outcomes due to both their minority status and the difficult transition from adolescence to adulthood. Recruitment and retention has been challenging in this demographic stratum, and traditional asthma education is often not feasible.

OBJECTIVE: The objective of this study was to develop and assess the feasibility of an electronic asthma self-management program for young African American adults.

METHODS: A total of 44 African American adults (age 18-30 years) with uncontrolled persistent asthma were enrolled in an asthma self-management program. The 6-week Breathe Michigan program (predicated on the social cognitive theory) was tailored specifically to the concerns and preferences of young African American adults. The entire program was completed electronically, without any specialized human support. At 2

weeks and 3 months after program completion, participants were contacted for follow-up.

RESULTS: A total of 89% of enrolled subjects completed the 6-week intervention, and 77% were available for evaluation at 3 months. All subjects completing the 2-week postprogram survey reported that the program was helpful, and 97% would recommend it to others. Asthma control as measured by the Asthma Control Test improved from 16.1 to 19.3 ($P < .01$), and asthma quality of life as measured by the Mini Asthma Quality of Life Questionnaire improved from 4.0 to 5.1 ($P < .01$).

CONCLUSIONS: The Breathe Michigan program is feasible for recruitment and retention, and demonstrated an improvement in asthma control and quality of life for young African American adults. © 2015 American Academy of Allergy, Asthma & Immunology (J Allergy Clin Immunol Pract 2016;4:89-95)

Key words: Asthma; African American; Health disparities; Adolescent; Young adult; Asthma education; Asthma self-management; Health information technology; Electronic; Computer

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Health disparities are seen in many chronic conditions, including asthma. In the United States, asthma prevalence and disease burden disproportionately affect African Americans compared with white Americans. From 2008 to 2010, the annual US asthma prevalence was 11.9% for African Americans compared with 8.1% in Caucasians.¹ Although the prevalence rate is somewhat higher, the control measures, morbidity, and mortality rates are much worse among African Americans. From 2007 to 2009, the mortality rate from asthma was 0.23 per 1000 patients per year for African Americans versus 0.13 per 1000 patients per year for whites.¹ In addition, from 2001 to 2009, compared with white patients, African American patients had a greater number of emergency department visits (18.4 vs 6.1 visits per 100 patients per year) and hospitalizations (2.8 vs 1.3 visits per 100 patients per year) due to asthma.

Young African American adults represent a population particularly at risk for poor asthma outcomes due to both their minority status and the difficult transition from adolescence to

*Abbreviations used**ACT- Asthma Control Test**AQLQ- Mini Asthma Quality of Life Questionnaire*

adulthood—a challenging time for the majority of individuals regardless of race. In young adulthood, individuals may be faced with new responsibilities including family care/romantic relationships, finances, living independently, employment, education, and responsibility for their own health care.² Therefore, it is critically important to implement programs to improve asthma management in this population.

Our team has previously identified barriers to optimal asthma management in young African American adults with asthma through detailed focus group analyses.³ These barriers include a busy lifestyle, poor medication compliance, and lack of support from asthma health care providers. This population, however, was motivated to participate in an asthma self-management program. They were especially interested in programs that provided information to better manage their asthma, as well as interventions that could be delivered electronically (thereby allowing intervention completed at a time convenient to the learner) and included actors of color.³

Previous investigation and implementation of asthma self-management interventions have proven beneficial in other populations, such as older adults and women.^{4,5} However, dropout rates can be high, especially among young adults and minority populations.^{6,7} In addition, self-management interventions appear most effective when predicated on a behavioral theory of change.⁸ The goal of this study was to assess if a theory-based electronic asthma self-management program could successfully retain young African American adult participants, and if such a program could have positive effects on asthma control and quality of life.

METHODS

Subjects

Potential subjects were recruited who met the following inclusion criteria: age 18 to 30 years, self-identified as African American, accessed email at least 3 times per week, and had a primary care physician. Participants also had to have uncontrolled persistent asthma, which was defined as currently using a controller medication (inhaled corticosteroids, inhaled corticosteroids plus long-acting β -agonist, cromolyn, or a leukotriene modifier) on a daily basis or using a rescue medication more than 2 times per week. During the eligibility screening interview, potential subjects were asked to rate their asthma control over the past month. If they rated their asthma as “not at all controlled,” “poorly controlled,” or “somewhat controlled,” they were eligible for participation. Those who stated that their asthma was “well controlled” or “completely controlled” were excluded from participation, unless they stated that they were using their rescue medication more than 2 times per week. Participants were excluded if they had any other significant cardiopulmonary disease, had a greater than 20 pack-year smoking history (as this level has been associated with the development of chronic obstructive pulmonary disease),⁹ had a significant cognitive impairment that would make participation in the program impossible, or were pregnant at the time of enrollment (as the Breathe Michigan program was not optimized to address unique issues of asthma in pregnancy).

Participants were recruited from the University of Michigan and 2 community clinics. One of the community clinics is a federally qualified health center, which provides care for individuals without insurance. The other clinic served adolescents and young adults exclusively, often without insurance. A convenience sample approach was adopted to reach the targeted sample size, utilizing an asthma registry at each site. Baseline information collected included age, school and employment status, children, history of smoking, age of asthma diagnosis, number and type of asthma medications prescribed, use of peak flow meter or asthma action plan, and asthma control and asthma quality of life as measured by the Asthma Control Test (ACT)¹⁰ and the Mini Asthma Quality of Life Questionnaire (AQLQ),¹¹ respectively. Participants were provided a total of \$120 over the 3-month program to encourage participation. The study was approved by the University of Michigan Institutional Review Board, and all subjects provided written informed consent.

Intervention

The Breathe Michigan program is based on the social cognitive theory, which utilizes the principles of self-regulation with support. Social cognitive theory has been well described in the literature and has been used extensively in interventions dealing with human health behavior.^{12,13} Briefly, the theory postulates that the most influential way in which a person develops expectations and solidifies a behavioral change is through personal experience. Through this self-regulatory process, the person is able to observe and learn from their experience and determine ways for changing behavior. This process has been shown to build confidence and strengthen the commitment to continuing new behavior.

The Breathe Michigan program was created and tailored specifically to the challenges facing young African American adults with asthma.³ It was completed entirely electronically and, therefore, could be done at a time and place convenient to the participant. As the intervention was completed electronically online, it required no specialized human support unless initiated by the participant.

Through the Breathe Michigan program, participants were introduced step by step to a self-regulatory problem-solving process, specifically designed within their cultural context. The Breathe Michigan program was completed over a period of 6 weeks. Approximately every 3 days, participants were asked to log in to a website and complete a specific assignment. These assignments included choosing problems related to asthma for their situation, identifying barriers to optimal care, and receiving tailored messages of support to overcome barriers. The asthma problems were selected from a list of 13 problems frequently experienced by young African American asthma patients based on our previous research, and are listed in Table E1 (available in this article's Online Repository at www.jaci-inpractice.org/). For the barrier selection, participants had the option of choosing 4 choices from among a list of 21 barrier options, again based on previous research.³ These options are listed in Table E2 (available in this article's Online Repository at www.jaci-inpractice.org/). After barrier selection, participants received a tailored message every 3 days describing methods to overcome one of the 4 barriers selected. Each barrier support message was written by the study team members (with assistance from social work specialists as appropriate), and contained 1 to 2 paragraphs of information along with relevant links to additional videos and websites as appropriate.

During the program, participants watched 5 educational videos. The videos were produced by the study team exclusively for the Breathe Michigan program and were geared to the communication

style and specific concerns of the target population. Young African American adults provided the acting and narration for the videos and assisted with script editing. Each video was 2–5 minutes in length, and included topics related to asthma control, asthma triggers, symptom monitoring, and proper medication technique (all consistent with the National Asthma Education and Prevention Program [NAEPP] guidelines).¹⁴

To facilitate the self-regulation process, participants underwent a 2-week period of self-observation with an online asthma diary. During this period, participants were asked to monitor peak flow measurements twice daily and record the values in their online asthma diary. In addition, they were asked to record asthma symptom triggers and steps used to control the symptoms. The information obtained from the online asthma diary was used by participants to help identify and select barriers to optimal asthma care. After the 2-week period, participants had the option of continuing to record in the asthma diary if they wished.

If a participant had a lapse in participation (defined as not logging in to the program for over 10 days), a reminder email was sent every 3 days until the participant logged in and continued advancement through the program. If after an additional 10 days the participant did not log in despite the reminder email messages, a reminder phone call was made by an undergraduate student research assistant. This research assistant would simply ask the participants if they had any difficulty accessing the program, verify that they wanted to continue, and encourage them to log in.

Outcome

The primary endpoint was the feasibility of a computer-based asthma self-management program, defined as the ability to retain subjects for program completion of all steps over a 6-week period. A sample size of 40 participants was assessed as adequate for this purpose. Information was gathered from the telephone interview 2 weeks after program completion, at which time participants provided feedback on the Breathe Michigan program. Specifically, participants were asked if they found the program helpful; if they would recommend the program to others; elements of the program considered most beneficial; helpfulness of the online diary; and for suggestions for improvement. The purpose of collecting these and additional secondary endpoints was to obtain end-user information on components of the Breathe Michigan program considered most beneficial for future optimization.

The AQLQ,¹¹ ACT,¹⁰ and demographic information were completed through online questionnaires at 2 weeks and 3 months after program completion. Secondary outcomes included the differences in asthma control and asthma quality of life as measured by the ACT and AQLQ, respectively, at 2 weeks and 3 months after program completion as compared with baseline. The ACT, AQLQ, and diary use were all specifically chosen to conform to recent guidelines on asthma endpoints in clinical trials.¹⁵

Statistical analysis

All variables were examined for completeness and accuracy. A mean score was calculated for each participant for the ACT and AQLQ according to the developer's instructions. Changes in the mean values of the ACT and AQLQ scores were compared between baseline and each follow-up time point using 2-sided paired *t* tests and a significance level of 0.05. Severity at baseline was determined based on prescribed asthma medications. Nonsevere asthma was defined as having been prescribed albuterol or a monotherapy controller medication (inhaled corticosteroid, leukotriene receptor

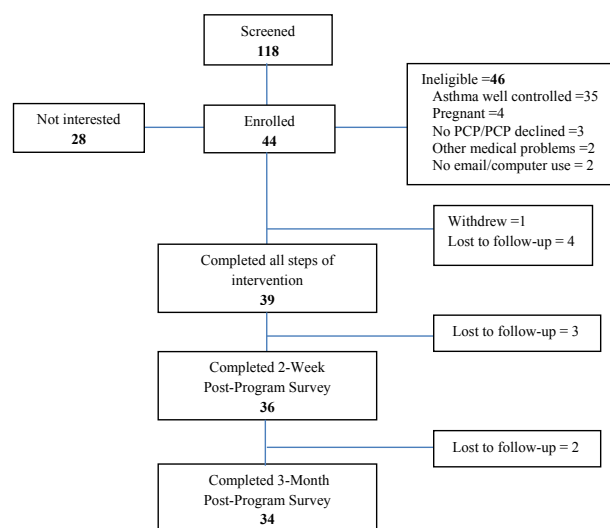


FIGURE 1. Subject outcomes.

antagonist, or cromolyn). Severe asthma was defined as having been prescribed an inhaled corticosteroid and at least 1 additional controller medication. To examine the effectiveness of the intervention by severity, a stratified analysis was conducted comparing mean values of ACT and AQLQ within each severity group (severe and nonsevere) between baseline and each follow-up time point using 2-sided paired *t* tests and a significance level of 0.05. For barriers and goals, the frequencies from all responses were calculated and the percentage was based on the number of respondents replying to at least one of the questions. All statistical analyses were conducted using SAS/STAT Software, Version 9.3 of the SAS System for Windows (SAS Institute Inc., Cary, NC).

RESULTS

A total of 118 potential subjects were contacted. Of those contacted, 28 declined participation and an additional 46 potential subjects expressed interest, but were ineligible. The most common reason for ineligibility was well-controlled asthma (76%). A total of 44 participants were enrolled. One participant withdrew and 7 were lost to follow-up. Thirty-nine participants (89%) completed all steps of the 6-week intervention. Thirty-six participants (82%) completed the 2-week postprogram evaluation, and 34 participants (77%) completed the 3-month postprogram evaluation (Figure 1). The number of participants who completed each individual step of the intervention is included in Figure E1 (available in this article's Online Repository at www.jaci-inpractice.org/). Of the 44 subjects who enrolled in the program, 24 (54.5%) required at least 1 reminder phone call for lapses in participation.

Baseline characteristics are shown in Table I. All participants self-identified as African American. The average age of participants was 24.7 ± 3.6 years, and the average age of asthma diagnosis was 7.4 ± 6.9 years. A busy lifestyle was evidenced by the percentage of subjects currently in school (43%), currently working (59%), married (16%), and being parents (36%). Poor asthma control and poor asthma quality of life were demonstrated by a mean score on the ACT of 16.2 ± 4.0 , consistent with "uncontrolled" asthma by the NAEPP guidelines,¹⁶ and a mean AQLQ score of 4.1 ± 1.3 , respectively.^{17,18} Subjects also

TABLE I. Baseline subject characteristics, n = 44

Clinical characteristics	
Age (y), mean (SD)	24.7 (3.6)
African American race, n (%)	44 (100)
Gender, female, n (%)	34 (77)
Currently in school, n (%)	19 (43)
Currently working, n (%)	26 (59)
Hours worked per week (for those currently working), mean (SD)	31.5 (12.2)
Currently married, n (%)	7 (16)
Parent, n (%)	16 (36)
Current smoker, n (%)	9 (21)
Former smoker, n (%)	6 (14)
Currently living with a smoker, n (%)	15 (34)
Age at asthma diagnosis (y), mean (SD)	7.4 (6.9)
Asthma medications, n (%)	
Rescue medication only	12 (27)
Monotherapy controller	14 (32)
ICS+1 additional controller	13 (30)
ICS+≥2 additional controllers	5 (11)
Own a peak flow meter, n (%)	27 (61)
Have a written asthma action plan, n (%)	20 (45)
Unscheduled office visits in previous year due to asthma, mean (SD)	1.6 (1.6)
ED visits in previous year due to asthma, mean (SD)	1.1 (1.4)

ED, Emergency department; ICS, inhaled corticosteroid.

reported difficulty in reaching their health care providers to discuss their asthma care (46%), decreased satisfaction with their asthma medical care (32%), and a perception that their asthma medications were only somewhat effective in achieving asthma control (43%) (data not shown). Baseline characteristics were compared between the 34 subjects who completed the 3-month follow-up and the 10 subjects who withdrew or were lost to follow-up, and no significant differences were found (data not shown).

During the course of the program, participants were asked to choose 2 problems to address regarding their asthma as well as 4 barriers that they felt negatively affected their asthma control. The 5 most commonly selected problems and the 5 most common barriers to optimal asthma management chosen are listed in [Tables II and III](#), respectively.

Qualitative comments about the program

At the telephone interview conducted 2 weeks after program completion, participants provided qualitative comments regarding their experiences with the program. All 36 participants (100%) who completed the 2-week postintervention phone survey found the program to be helpful, and all but one (97%) would recommend it to others. Many participants noted that the program was helpful for increasing their asthma acceptance and overall knowledge. One representative comment was as follows:

"I was in denial about my asthma diagnosis, and this helped me accept it."

The educational videos were frequently cited as a positive aspect of the program, which may have been due to the fact that

TABLE II. Most commonly selected problems related to asthma

Problems (n = 43 respondents)	Frequency cited, n (%)
My asthma is unpredictable	19 (44.0)
Asthma limits things in my life I would like to do	17 (39.5)
Have to use my albuterol inhaler a lot	12 (28.0)
Have frequent asthma symptoms, wish they would stop	11 (25.6)
My asthma makes it hard to sleep	9 (20.9)
Hard to do sports because of my asthma	9 (20.9)

TABLE III. Most commonly selected barriers related to optimal asthma control

Barriers (n = 39 respondents)	Frequency cited, n (%)
Season/weather changes make my asthma flare up	29 (74.4)
Have lots of responsibilities, forget to take care of my asthma	17 (43.6)
Forget to take my asthma medications regularly	13 (33.3)
Exercise causes asthma to act up	12 (30.8)
Do not feel I need to take my asthma medications every day	11 (28.2)

the actors in the videos were of the same age and race as the participants, making the videos more relatable.

One participant noted:

"The videos definitely made me a lot more aware about my asthma and the different types of symptoms to look for."

Multiple participants found the tailored messages with advice on how to overcome specific asthma management barriers beneficial. In addition, many participants (74%) reported finding the online asthma diary to be helpful. When referring to the online asthma diary, one participant responded:

"Being in this program made me want to monitor my asthma more...it made me look at it differently."

Although the program was highly rated overall, there were some suggestions for improvements. Some participants noted forgetting to log in to the program or to check their peak flow values due to responsibilities at school and work and generally being too busy. One participant suggested that integrating text message reminders into the program would provide a helpful reminder to continue to log in regularly. At least 35% of participants used their smartphones to view the videos and/or log in to the program, and many participants suggested optimizing the program for smartphone use.

Secondary outcomes

Secondary outcomes included improvement in asthma control and asthma quality of life as measured by the ACT and AQLQ, respectively, at baseline, 2 weeks and 3 months after program completion. As shown in [Figure 2](#), the average ACT score increased significantly from 16.3 ± 4.2 to 19.0 ± 4.7 ($P < .001$). The improvement was sustained as the average ACT score 3 months after the program was 19.4 ± 3.6 , and was also

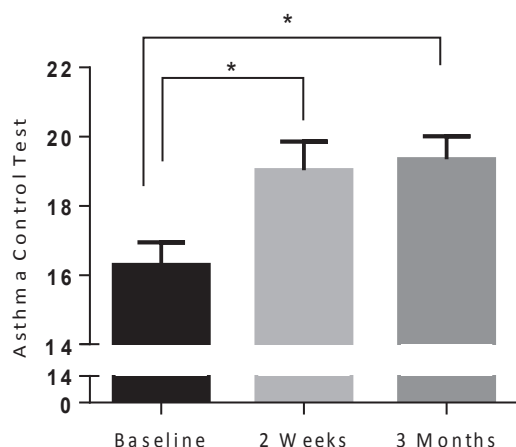


FIGURE 2. Asthma Control Test score at baseline, 2 weeks, and 3 months after program completion. Data presented as mean $\pm$ SEM. * $P < .001$.

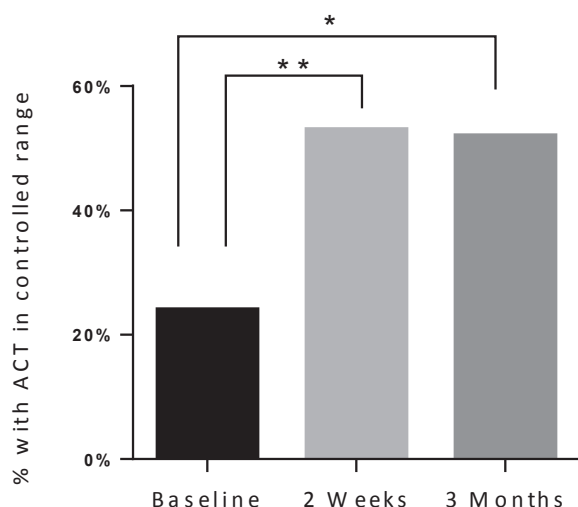


FIGURE 3. Percentage of subjects with a controlled Asthma Control Test (ACT) score (ACT $\geq$ 20) at baseline, 2 weeks, and 3 months after program completion. Data presented as mean $\pm$ SEM. * $P < .05$, ** $P < .01$.

significantly improved from baseline ($P < .001$). The improvement of over 3 points at 3 months is greater than the minimally important difference on the ACT.¹⁹ In addition, the percentage of subjects who were considered “controlled” (ACT $\geq$ 20) improved over the course of the intervention (Figure 3). At baseline, 24.1% of the subjects were controlled; at 2 weeks this value was 53.1% ($P = .006$); and at 3 months, 51.6% of the subjects remained controlled ($P = .029$).

The mean AQLQ score at baseline was 4.1 ± 1.3 , which significantly increased to 5.1 ± 1.2 at 2 weeks after program completion ($P < .001$). As with the ACT, the increase in the AQLQ score was sustained at 3 months after program completion with an average score of 5.2 ± 1.3 ($P < .001$), which was also significantly increased from baseline (Figure 4). This increase was also greater than the minimally clinically important

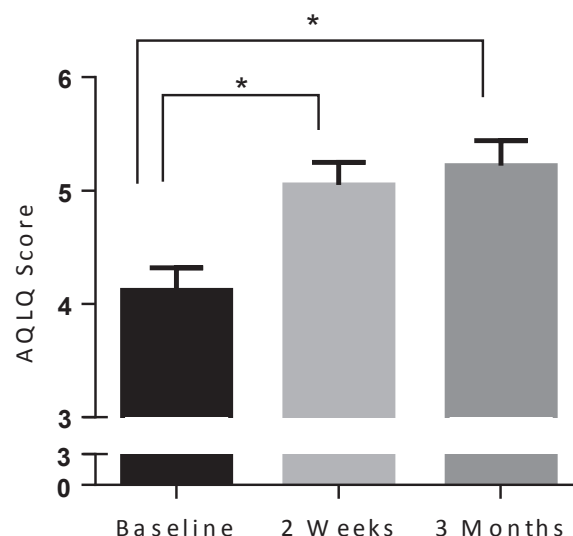


FIGURE 4. Mini Asthma Quality of Life Questionnaire (AQLQ) score at baseline, 2 weeks, and 3 months after program completion. Data presented as mean $\pm$ SEM. * $P < .001$.

difference of 0.5 for AQLQ scores.²⁰ The intervention worked well for both severe and nonsevere asthmatics. Both severe (those requiring more than 1 controller medication) and nonsevere asthmatics showed a statistically significant increase in ACT and AQLQ scores at 2 weeks and 3 months after program completion compared with baseline (Table E3, available in this article’s Online Repository at www.jaci-inpractice.org), with greater improvements noted among nonsevere participants.

Overall, use of the online asthma diary was also successful. Thirty-five participants (79.5%) utilized the diary at least once to record peak flow values, asthma symptoms, asthma triggers, or medications used. Subjects who did and did not use the online diary achieved improvement in the AQLQ score. However, only those subjects who used the asthma diary had improvement in the ACT score at both the 2-week and 3-month endpoints (Table E4, available in this article’s Online Repository at www.jaci-inpractice.org). For both the ACT and AQLQ scores, improvements were greater among those who used the diary at least once compared with those who did not use it at all.

DISCUSSION

Minority populations in the United States have significantly worse health outcomes in asthma.²¹ It is therefore essential to implement appropriate solutions to decrease health care disparities. Young African American adults are a group at risk for poor health outcomes due to both their minority status and age. This age group may have difficulties with access to asthma care due to competing responsibilities including lack of financial resources, child care duties, work responsibilities, school, role of caretaker for other family members, inadequate insurance coverage, and household chores.³ Because of these responsibilities, young adults may be less likely to attend in-person asthma management and behavioral education sessions.^{22,23} In addition, lack of tailored and culturally relevant programs may also disenfranchise minority populations from optimizing their asthma care.²⁴ Original self-management programs must therefore be developed. An

asthma self-regulation intervention that can be delivered electronically allows the program to be personalized to the subject's time, interest, and priorities.

A careful review of the literature reveals that among minority populations with asthma, only 11 randomized controlled trials using different forms of electronic media have been reported.²⁵⁻³⁵ All but one of the previously reported studies was conducted in children or adolescents, and the study performed in adults was not successful.³² The duration of these studies ranged from 1 month to 1 year, and nearly all required special staffing (ie, nurses, asthma counselors, or asthma coaches) for completion. Unfortunately, in urban areas with limited resources, this is often not possible. In addition, staff turnover, temperament, and training can result in varying degrees of program fidelity and participant commitment.^{36,37} The design of the Breathe Michigan program ensures that content will be reproducible in any setting, without the requirement for special staffing. Although 54.5% of the participants did require a phone call (indicating that some human intervention is needed), this was done by an undergraduate student who did not have any asthma education training or knowledge.

Overall, the Breathe Michigan program was shown to be feasible as evidenced by the percentage of participants who completed the intervention (89%) and were available for follow-up at 3 months postintervention (77%). Previous studies among young African American adults have found retention and completion rates of 36% at 3 months postintervention,³⁸ 63% during a 6-week trial,³⁹ and 75% at 1 month postintervention (though much lower among those below 25 years of age).⁴⁰ Although these trials were not conducted in asthmatic patients, they do highlight retention difficulties in this target population. One study found that young African American adults felt time commitment was the greatest impediment to participation in research trials.⁴¹ The Breathe Michigan program was completed electronically, allowing the program to be done at any time and place convenient to the participant, which likely augmented our completion and retention rates.

Of those who completed the program, 100% found the program to be helpful and 97% would recommend it to others. The educational videos were cited most often as the participants' favorite aspect of the program, in part because they were designed to specifically address the concerns of young African American adults and also utilized models of color, allowing the participants to relate to the video content.⁴² In addition, the videos were brief (all less than 5 minutes), which made it more likely that the participants could watch each video in its entirety without losing interest.⁴² The Breathe Michigan program was efficacious with statistically significant and clinically meaningful improvements in ACT and AQLQ from baseline to 2 weeks and baseline to 3 months after program completion (Figures 2 and 3). Although this is an uncontrolled pilot study, the short-term results are promising, and deserve further investigation.

There are limitations to this study. A number of eligible subjects (24%) declined enrollment, and therefore the program may only benefit participants with sufficient motivation. Spirometric data were not measured, and therefore we cannot assess the effects on lung function. We did not examine the specific mediators of effectiveness (eg, self-efficacy, medication adherence, asthma knowledge, or attitudes). The Breathe Michigan program could have theoretically impacted any of these, and further investigations should determine the mediator most

responsible for change. The study was not long enough in duration to measure outcomes such as emergency department visits and hospitalizations. Socioeconomic status, education level, and health literacy level were not obtained, and could influence response to the program. Finally, the Breathe Michigan program is not publically available, and therefore extensive real-world testing is not currently possible.

In conclusion, the Breathe Michigan program is a well-received online asthma education program tailored to the needs and preferences of young African American adults with asthma. The program proved to be both feasible and successful, and was able to improve asthma control and asthma quality of life (albeit in an uncontrolled trial). Further investigations should examine whether such a program can lead to long-term improved outcomes and potentially decrease health care disparities.

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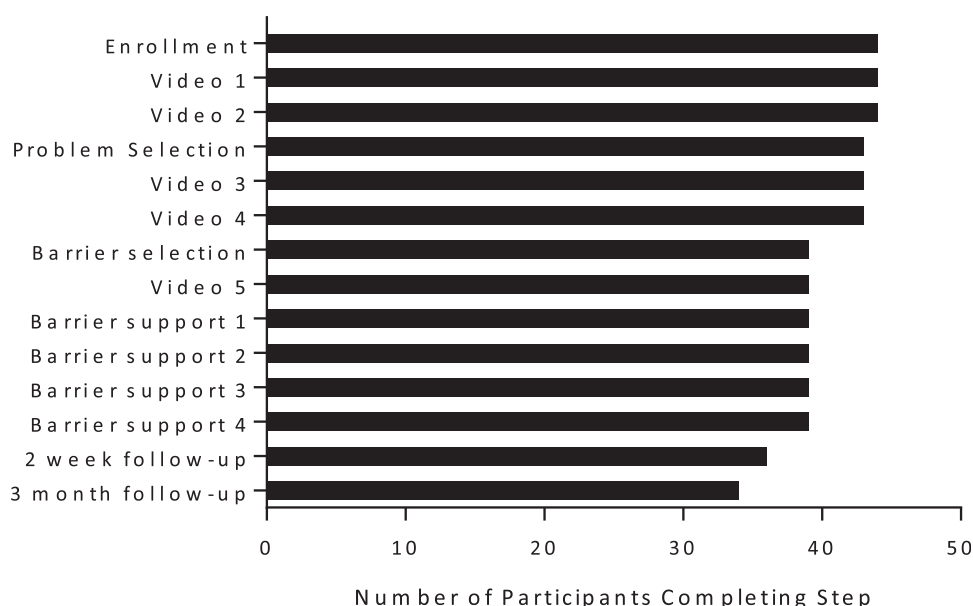


FIGURE E1. Number of participants completing each step.

TABLE E1. Problem choices (participants select 2)

Problem choices
Asthma limits the things in my life I would like to do
It is hard to participate in sports because of my asthma
I'm scared to exercise because my asthma might act up
Asthma makes it hard for me to do my job
I have frequent asthma symptoms, and wish they would stop
My asthma is unpredictable. I never know when it will flare up
I have to go the emergency room or urgent care clinic frequently because of my asthma
I have to use my albuterol inhaler a lot more than I would like
I have a hard time keeping my house clean or helping around with household chores because of my asthma
I can't play with my children like I want to because of my asthma
I'm worried I might die or won't be able to control my asthma during an attack
My asthma makes it hard to sleep
My problem is not listed here. It is _____

TABLE E2. Barrier choices (participants choose 4)

Barrier choices
I'm not sure what triggers my asthma
I forget to take my asthma medications on a regular basis
I have lots of responsibilities (like work, family, or taking care of others), so I forget to take care of myself and my asthma
I don't feel I need to take my asthma medications every day
I don't feel my asthma medications working
I can't afford my asthma medications
I'm not sure which asthma medication to take when my asthma acts up
I'm concerned about side effects of my medications
I don't have insurance
I feel like home remedies can help treat my asthma
I don't like carrying my medication around with me
I am around smokers
Season changes and weather changes make my asthma flare up
There are things in my home (like mold, pets, and cockroaches) that can worsen my asthma
Exercise causes my asthma to act up
There are people around me who wear strong perfume/cologne
I don't know if it is asthma or something else (like muscle pain, heart pain, or being out of shape) that is making me feel short of breath
I have a hard time getting in touch with my doctor
I feel rushed at the doctor's office
I don't have transportation to get to my doctor
I smoke

TABLE E3. Asthma Quality of Life Questionnaire (AQLQ) and Asthma Control Test (ACT) score summary by asthma severity

	Baseline			2 weeks				3 months			
	N	Mean	SD	N	Mean	SD	P value	N	Mean	SD	P value
AQLQ score											
Overall	44	4.12	1.3	36	5.05	1.2	<.0001	34	5.22	1.3	<.0001
Severe asthmatics*	18	4.54	1.2	14	5.13	1.3	.0295	13	5.50	1.3	.0033
Nonsevere asthmatics	26	3.83	1.4	22	5.00	1.2	<.0001	21	5.05	1.3	<.0001
ACT score											
Overall	41	16.29	4.2	32	19.03	4.7	<.0001	31	19.35	3.6	<.0001
Severe asthmatics	16	17.31	4.0	13	18.31	4.9	.0120	12	19.92	3.4	.0119
Nonsevere asthmatics	25	15.64	4.3	19	19.53	4.5	.0002	19	19.00	3.8	.0009

*Severe: prescribed an inhaled corticosteroid and at least one other controller medication at baseline. Nonsevere: prescribed albuterol only or a monotherapy controller medication at baseline.

TABLE E4. Asthma Quality of Life Questionnaire (AQLQ) and Asthma Control Test (ACT) score summary by diary usage

	Baseline			2 weeks				3 months			
	N	Mean	SD	N	Mean	SD	P value	N	Mean	SD	P value
AQLQ score											
Overall	44	4.12	1.3	36	5.05	1.2	<.0001	34	5.22	1.3	<.0001
Never used diary	9	4.36	1.0	5	5.15	1.1	.0261	5	4.43	0.7	.0275
Used diary at least once	35	4.06	1.4	31	5.04	1.3	<.0001	29	5.36	1.3	<.0001
ACT score											
Overall	41	16.29	4.2	32	19.03	4.7	<.0001	31	19.35	3.6	<.0001
Never used diary	9	16.44	4.8	5	18.80	4.8	.2278	5	18.20	4.0	.1748
Used diary at least once	32	16.25	4.1	27	19.07	4.7	<.0001	26	19.58	3.6	<.0001

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