Evaluation of a Web-Based Asthma Management Intervention Program for Urban Teenagers: Reaching the Hard to Reach

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Abstract

Purpose: Asthma interventions targeting urban adolescents are rare, despite a great need. Motivating adolescents to achieve better self-management of asthma is challenging, and the literature suggests that certain subgroups are more resistant than others. We conducted a school-based, randomized controlled trial (RCT) to evaluate Puff City, a Web-based, tailored asthma intervention, which included a referral coordinator, and incorporated theory-based strategies to target urban teens with characteristics previously found to be associated with lack of behavior change.

Methods: To identify eligible teens, we administered questionnaires on asthma diagnoses and symptoms to ninth through 12th graders of participating schools during a scheduled English class. We randomized eligible, consenting students to Puff City (treatment) or generic asthma education (control).

Results: We randomized 422 students (98% African-American, mean age = 15.6 years). At 12-month follow-up, adjusted odds ratios (aORs) (95% confidence intervals) indicated intervention benefit for treatment teens for symptom-days and restricted activity days (analyzed as categorical variables) as aOR = .49 (.24-.76), p = .006 and .53 (.32-.86), p = .010, respectively. Among teens meeting baseline criteria for rebelliousness, treatment teens reported fewer symptom-days, symptom-nights, school absences, and restricted activity days: aOR = .30 (.11-.80), .29 (.14-.64), .40 (.20-.78), and .23 (.10-.55); all p < .05. Among teens reporting low perceived emotional support, treatment students reported only fewer symptom-days than controls: aOR = .23 (.06-.88), p = .031. We did not observe statistically significant differences in medical care use.

Conclusions: Results suggest that a theory-based, tailored approach, with a referral coordinator, can improve asthma management in urban teens. Puff City represents a viable strategy for disseminating an effective intervention to high-risk and hard-to-reach populations.

Implications and contribution

Asthma deaths are higher for African-American adolescents aged 15-19 years compared to younger children. Needed for adolescents are interventions encouraging patient self-management, in partnership with a physician. Results suggest Puff City, a theory-based, tailored intervention, is a viable strategy for improving asthma control in urban teens, including potentially unresponsive subgroups.

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disparities in asthma are also reflected in statistics describing asthma morbidity and mortality among U.S. adolescents [1]. Compared with white adolescents and children aged 0–14 years, African-American adolescents aged 15–19 years have lower rates of preventive care, such as primary care visits, but higher rates of acute care, such as hospitalizations and emergency department (ED) visits [1]. Non-white teens also have higher asthma mortality rates [1]. The literature suggests that these trends most likely result from uncontrolled and undermanaged disease, which indicates the need for better clinical and patient self-management [3,4]. Effective asthma interventions targeting this age group could help improve patient self-management and encourage teens to partner with physicians toward the ultimate goal of better asthma control.

Few trials of asthma management programs have been conducted among high school students. In 2007, our group published a Web-based, computer-tailored intervention called Puff City [5]. We developed a revised Puff City program that included new submodules designed to target teens with characteristics shown to be associated with lack of behavior change in the previous trial [6]. The objectives of this report were to present the results of a randomized controlled trial (RCT) conducted to evaluate the new version of Puff City and to examine subgroups targeted by the added submodules. We hypothesized that urban, African-American high school students with asthma randomized to receive Puff City would report fewer symptom-days than teens randomized to a control group.

Methods

Development of Puff City

Development and content of Puff City, with the exception of the submodules and booster, were described in earlier publications [5,6]. Briefly, Puff City focuses on three behaviors: controller medication adherence, keeping an inhaler nearby, and smoking reduction or cessation. Health messages and information based on theoretical models and approaches to behavior change relevant to asthma control (e.g., Health Belief Model, Attribution Theory, motivational interviewing) are presented for these three behaviors, allowing the delivery of information both central and peripheral to the behavior [7–10]. The program also includes information on trigger avoidance, device usage (e.g., how to use a diskus, terbuhaler, spacer, etc.), and basic asthma physiology. A radio disk jockey delivers the scientifically sound advice that is tailored to each teen. All Puff City surveys are voiced-over to accommodate literacy limitations. A medication module with visual aids helps teens identify current asthma medications.

Puff City uses tailoring to apply behavioral theory. Tailoring is the “assessment and provision of feedback based on information that is known or hypothesized to be most relevant for each individual participant of a program” [11,12]. During sessions, computer algorithms use teen responses to questions on attitudes and beliefs to select the appropriate information from a message library and assemble preprogrammed, tailored feedback, creating an extensive array of message permutations. Medical experts and behavioral scientists created the message library.

Referral coordinator

As was done in the original Puff City, a risk assessment report generated by the data management system collated student responses to selected questions. A referral coordinator used it to proactively contact students in the treatment group, referring them to community agencies and resources as needed. Flags for the referral coordinator included presence of severe or persistent asthma symptoms, sharing asthma medication with a friend or relative, lack of a physician or health insurance, lack of any asthma medication, and a positive response to five of seven questions about depressive symptoms from the Diagnosis Interview Schedule for Children Predictive Scales [13]. Referral coordinators did not provide education.

Submodules

Based on previous analyses, we created submodules to address low perceived emotional support, low motivation, and potential resistance to change.

Low perceived emotional support. We determined this characteristic using questions adapted from the Multidimensional Scale of Perceived Social Support [14] and deﬁned it as <2 on a scale of 1 to 5, where 5 = high support in response to the question “How much support do you feel you have when it comes to controlling your asthma?” Students answered the question for family, friends, and others. Messages helped teens brainstorm about how they might capitalize on support within existing networks or how they might identify new sources of support.

Low motivation. We deﬁned students with low motivation as selecting a response of ≤5 on a scale of 1 to 10, where 10 = high motivation in response to the question “How motivated are you to change [core behavior]...?” We borrowed messages and exercises in this module from motivational interviewing concepts and used a values-based exercise to reveal dissonance between the behaviors and values reported by students [15,16].

Resistant to change. This submodule targeted students who exhibited no change after one or more sessions. The submodule uses values linkage to promote greater autonomous (or intrinsically derived) self-regulation [17,18].

Rebelliousness. The above submodules also addressed rebelliousness. The criterion for rebelliousness at baseline was a score >2.5 on a five-point rebelliousness scale [19], where 5 = high rebellion. These students also received messages from an edgier character using a tone designed to show empathy with the user. During online sessions, the appropriate submodule was delivered to students meeting the above criteria. Afterward, students were returned to the original flow of the program.

A booster addressed resistance and attempted to correct early stages of relapse (defined as a return to negative behavior: showing positive behavior). The booster borrowed concepts from attribution, or relapse prevention, theories [9,20], and motivational interviewing [15]. During the 6-month follow-up survey, the computer retrieved information from previous sessions to detect relapse or resistance, and delivered booster messages accordingly.

Randomized trial

The Institutional Review Boards of Henry Ford Health System, Detroit Public Schools Office of Research, Evaluation, and Assessment, University of Michigan, and Georgia Health Sciences
University approved the study methods. To identify students eligible for the RCT, we informed caregivers of all ninth through 12th graders of six public high schools by mail of a screening questionnaire (Lung Health Survey) to be administered during a scheduled English class [5,21]. Caregivers could opt out of having their student participate in the Lung Health Survey by signing and returning the letter to the school. The recruitment period was from fall 2007 to fall 2008.

Items on the Lung Health Survey requested information on asthma diagnosis, respiratory symptoms (including items from the International Survey of Asthma and Allergies in Childhood questionnaire) [22], and health care utilization. Students were eligible if they met study criteria for current asthma, defined as report of ever having a physician or health care provider diagnosis of asthma accompanied by day or nighttime symptoms, use of medication for asthma symptoms in the past 30 days, medical care use for asthma in the past year, and 1 refill of beta agonists in the past year [5,21]. Students were also eligible if they did not report a physician diagnosis, but answered positively to items on the International Survey of Asthma and Allergies in Childhood questionnaire and reported symptom frequencies similar to those used in the Expert Panel Report (EPR) 2 and 3 for classification of mild, intermittent asthma.

We invited eligible students providing written assent and parental consent to enroll in the RCT [5]. We mailed packets with study information and assent and consent forms to the homes of eligible students by a district-affiliated contractor, to maintain student confidentiality [5,21].

Using computers at school, participating students completed an online baseline survey followed by four online asthma management sessions (15–30 minutes in length) to be completed in ≤180 days, with ≥1 week between sessions. Follow-up surveys occurred at 6 and 12 months postbaseline. Caregivers completed phone surveys at baseline and at 12-month follow-up.

Control websites

Controls received four sessions of generic asthma education to match the experience of students in the treatment group. After login, we provided control students with a link to four generic asthma websites using a combination of Windows (Microsoft, Redmond, WA) system policies and the school district’s proxy server. To regulate dosage, control teens received a “time expired” message after 30 minutes of browsing, which corresponded to the maximum time needed to complete a tailored session. We selected control websites from recognized U.S. and Canadian organizations that had a history of providing evidence-based information on asthma management [23].

Asthma severity

We adapted the classification of asthma severity from EPR3's Guidelines for Diagnosis and Treatment of Asthma, Figure 14, Classification of Asthma Severity ≥12 months of age, using nighttime symptoms [24]. As in previous studies, investigators interpreted and assigned numeric values when terms such as “frequent” and “continual” were used in the EPR3 criteria. We adapted the classification of asthma control from Figure 15, Classification of Asthma Control (≥12 years of age), from EPR3, with the addition of school days missed and days when subjects had to change plans [24].

Statistical analysis

We used a random number generator within each unique stratum (school, grade, gender, and asthma severity) to assign individuals to the treatment or control group. We set the balance between treatment and control groups to occur at random accrual points within each stratum. Because the computer delivered the intervention, research staff was blinded to group assignment, as were statisticians and investigators. All surveys were identical for treatment and control students.

We designed our original sample size approach to apply globally across a variety of variables including ED visits, hospitalizations, days of restricted activity, and school absenteeism. With 10% power for a projected sample size of 150/group, we could detect a relative risk between treatment and control groups for ED visits and hospitalizations of ≥.5 and ≥.2, respectively, or a difference in proportions of ≥15 percentage points. For continuous variables, with 10% power and 150/group, an effect size of .35 (e.g., ≥.1 days for school days missed) could be detected.

We defined statistical significance as p < .05 and used an intention-to-treat approach. We conducted comparisons by participation and randomization arm using chi-square tests for categorical variables accompanied by pairwise comparisons when appropriate. We used Wilcoxon rank sum test for continuous and ordinal variables. We obtained unbiased estimates of mean time to completion from session 1 to 4 using the Kaplan-Meier method. For this analysis, if the teen baseline had ‘don’t know’ for physician diagnosis of asthma, we used the caregiver’s baseline report for teen asthma diagnosis.

We analyzed treatment and control comparisons of outcomes at 12-month follow-up using negative binomial regression. We calculated adjusted relative ratios with corresponding 95% confidence intervals. A base model consisted of school, sex, and asthma severity. We included baseline values for the outcome variable in the model when assessing treatment effect for specific outcomes. We assessed potential confounding by including in the final model any variable found to change the risk estimate for the association of randomization group to study outcome by ≥20%. Potential confounders included age, physician diagnosis of asthma, Medicaid enrollment, caregiver education (socioeconomic status), home environmental tobacco smoke (environmental tobacco smoke), student smoking, and number of sessions completed. We approached comparisons of indicators of uncontrolled asthma (all dichotomous variables) in a similar fashion, with adjusted odds ratios (aORs) from logistic regression models calculated with 95% confidence intervals. We conducted subgroup analyses by restricting the study sample to students meeting selected criteria (e.g., rebelliousness, moderate to severe asthma, etc.) and then applying the approach described above.

Results

Across the six schools, 98% of students were African-American and 74% qualified for free or reduced price lunch [25]. Of the 9,125 students enrolled in an English class and present on the day of questionnaire administration, 7,878 students (86.3%) completed the screening form, 1,668 of whom (21.2%) were eligible for the RCT. A total of 439 students (26.3% of those eligible) provided assent and consent, 422 of whom (94.1% of those consenting) completed a baseline and were randomized (Figure 1).
Using data from the screening Lung Health Survey for comparison, participating eligible students were significantly more likely than nonparticipating eligible students to have a physician diagnosis of asthma and report >4 days of restricted activity in the past 30 days. Nonparticipants were similar to participants with respect to age, gender, exposure to environmental tobacco smoke, teen smoking, indicators of uncontrolled asthma (with exception of days of restricted activity noted above), and reported medical care use at screening (data not shown). After randomization, we observed no significant differences between treatment and control students (Table 1). Compared with controls, fewer treatment students had a rescue inhaler at baseline.

Overall, 88.4% of students completed all four computer sessions and 90% completed the 12-month follow-up survey (Table 1). Students could access the program from school computers, but could also use non-school computers to access Puff City. Of the 240 sessions due over summer 2008 for enrolled students, 108 (45%) were completed during dates when schools were closed (data not shown). Also, 90.7% (88 of 97) of students without a home computer completed ≥3 of the 4 online sessions (data not shown).

For the outcome of symptom-days, treatment students reported significantly fewer days than controls (Table 2). Among students meeting criteria for moderate to severe asthma, adjusted risk ratios were significant for symptom-days, school-days missed, school-days missed because of asthma, and days of restricted activity (Table 2).

We evaluated self-report of ED visits and hospitalizations at 12 months (Table 2). We excluded from this analysis as outliers one student reporting >20 ED visits and one reporting 22 hospitalizations. We observed no significant differences at 12 months overall, or when restricting the analysis to students with moderate to severe asthma.

Table 3 presents categorical variables corresponding to the cutoffs used in the EPR 3 to represent indicators of uncontrolled asthma. Treatment and control comparisons were significant for the outcome of >8 symptom-days in the past 30 days (or ≥2 symptom-days/week in the past 30 days) and >4 days of restricted activity in the past 30 days.

In analyses restricted to students meeting criteria for one or more submodules, compared with controls, treatment students meeting criteria for high rebellion reported fewer symptom-days, symptom-nights, school-days missed, and days of restricted activity. We did not observe these effects in data for low-rebellion teens (Table 4). Among students meeting criteria for low perceived emotional support, fewer treatment students than controls had ≥2 symptom-days/week in a 30-day period. For students with mid to high perceived emotional support, treatment students were significantly less likely than controls to report ≥2 school-days missed/30 days and >4 days of restricted activity/30 days (Table 4).
Finally, as an exploratory analysis (and with knowledge of inherent limitations), we restricted the analysis to students in the treatment group who did not have contact with the referral coordinator (n = 33/204) with all 218 students in the control group. In this restricted analysis, we observed significant inverse odds ratios for symptom-days, days of restricted activity, and school days missed: aOR = .26, .46, and .57, respectively; all p < .05 (data not shown).

Discussion

Evaluations of Web-based asthma management interventions are scarce. In 2007, Bussey-Smith and Rossen [26] conducted a Cochrane Review of publications on the evaluation of interactive and web-based asthma interventions published since 1995. Of the nine studies reviewed, four included youths 12 and older, two of whom were in urban populations [27,28]. Of the two urban studies, one study among 6- to 17-year-old children showed significant reductions in hospitalizations (no difference in ED visits) with computer-assisted asthma management [27]. One other qualitative assessment of an internet-based self-management tool in adolescents conducted in the Netherlands reported positive changes in asthma control as measured by the Asthma Control Questionnaire [29]. We are not aware of other tailored, school- and Web-based interventions, such as Puff City, that specifically target urban high school students.

The intervention had a positive effect on the most study outcomes, especially among teens meeting criteria for moderate to severe asthma. We might expect that students meeting criteria for moderate to severe asthma (more frequent symptoms) would be more likely to report benefit from the intervention. Alternatively, these teens may be the most difficult to help. Results were similar using indicators of uncontrolled asthma as the outcome, which may be more meaningful to patients and physicians than the mean number of symptom-days [30].

Results were also positive for students with high rebellion and emotional support levels. For the latter, aORs were generally <1 (indicating intervention benefit), perhaps not reaching statistical significance because of sample size. The exceptions were school days missed overall and for asthma. At least one study has shown an association between emotional support and school attendance [31]. The importance of emotional support for asthma management has been previously supported in the literature, and has been shown to be important for other chronic diseases and disease management behaviors, such as adherence [32]. Online support—for example, through e-mail or a chat room—might be a reasonable format for Puff City and an important addition to the program.

We did not observe a significant intervention effect for ED visits, and results for students with moderate to severe asthma only suggested a trend in the hypothesized direction for hospitalizations. Krishna et al [33] were able to show reductions in self-report of ED visits using an interactive multimedia asthma intervention among patients aged 0–7 years. In that study, only 8% of participants were African-American and the percentage of teens is not clear. Moreover, retention for the final visit in the study appears to be <50%, compared with almost 90% for our study. We were unable to find other comparable studies of multimedia interventions targeting urban teens with asthma. It is possible that our analyses may underestimate an intervention benefit, because the control group received generic, Web-based asthma education and not “usual care.” The intervention might have had a greater impact on ED and hospital use if it had been initiated in a provider’s office or the ED, or if referral coordinators had interacted more closely with the student’s primary care provider.

A limitation of our study is that although we adapted the definitions of asthma severity and uncontrolled asthma from the EPR 3, both are based on symptom frequency and do not incorporate spirometry or clinician observation over a series of medical visits. Severity and control are distinct but related concepts that are not easily differentiated without objective measures and a medical history. Self-report, however, is routinely used by health care providers to determine the level of control and severity, and is used in national surveys such as the National Health and Nutrition Examination Surveys, Behavioral Risk Factor Surveillance System, and National Asthma Survey, all of which use recall periods similar to those in our study [34–36]. A second limitation is that our study design did not include...
Table 2
Self-report of functional status at 12 months for students enrolled in a randomized trial of Pub City, for all and for students meeting criteria for moderate to severe asthma

<table>
<thead>
<tr>
<th>Functional status (N = 422)</th>
<th>Treatment mean (standard deviation)</th>
<th>Control mean (standard deviation)</th>
<th>Adjusted relative risk(^a)</th>
<th>95% confidence interval</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptom-days</td>
<td>3.9 (5.9)</td>
<td>5.2 (6.4)</td>
<td>.8</td>
<td>.6–1.0</td>
<td>.019</td>
</tr>
<tr>
<td>Symptom-nights</td>
<td>2.7 (5.6)</td>
<td>2.8 (4.9)</td>
<td>1.0</td>
<td>.7–1.6</td>
<td>.82</td>
</tr>
<tr>
<td>Schooldays missed</td>
<td>2.6 (4.3)</td>
<td>3.1 (4.9)</td>
<td>.8</td>
<td>.6–1.0</td>
<td>.08</td>
</tr>
<tr>
<td>Schooldays missed because of asthma</td>
<td>.8 (2.1)</td>
<td>1.4 (3.9)</td>
<td>.8</td>
<td>.5–1.2</td>
<td>.25</td>
</tr>
<tr>
<td>Days of restricted activity</td>
<td>3.2 (5.5)</td>
<td>4.2 (6.0)</td>
<td>.8</td>
<td>.6–1.1</td>
<td>.14</td>
</tr>
<tr>
<td>Days had to change plans</td>
<td>1.7 (4.5)</td>
<td>1.8 (4.3)</td>
<td>1.0</td>
<td>.6–1.6</td>
<td>.96</td>
</tr>
<tr>
<td>Medical care use(^b)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency department visits</td>
<td>.9 (2.1)</td>
<td>.9 (2.4)</td>
<td>1.0</td>
<td>.7–1.4(^b)</td>
<td>.92</td>
</tr>
<tr>
<td>Hospitalizations</td>
<td>.3 (1.2)</td>
<td>.3 (1.0)</td>
<td></td>
<td>.5–2.6(^b)</td>
<td>.66</td>
</tr>
<tr>
<td>Moderate to severe (n = 104)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Symptom-days</td>
<td>6.2 (7.7)</td>
<td>9.2 (8.1)</td>
<td>.6</td>
<td>.5–.9</td>
<td>.013</td>
</tr>
<tr>
<td>Symptom-nights</td>
<td>5.1 (6.6)</td>
<td>6.4 (7.9)</td>
<td>.7</td>
<td>.4–1.2</td>
<td>.210</td>
</tr>
<tr>
<td>Schooldays missed</td>
<td>3.5 (5.6)</td>
<td>5.1 (7.0)</td>
<td>.5</td>
<td>.3–.8</td>
<td>.009</td>
</tr>
<tr>
<td>Schooldays missed because of asthma</td>
<td>1.3 (2.6)</td>
<td>3.3 (6.6)</td>
<td>.4</td>
<td>.2–.8</td>
<td>.007</td>
</tr>
<tr>
<td>Days of restricted activity</td>
<td>5.3 (7.4)</td>
<td>7.1 (7.6)</td>
<td>.5</td>
<td>.4–.9</td>
<td>.025</td>
</tr>
<tr>
<td>Days had to change plans</td>
<td>3.0 (5.5)</td>
<td>4.3 (5.8)</td>
<td>.6</td>
<td>.3–1.0</td>
<td>.084</td>
</tr>
<tr>
<td>Medical care use(^b)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency department visits</td>
<td>1.5 (3.4)</td>
<td>1.7 (3.7)</td>
<td>1.0</td>
<td>.5–2.0(^b)</td>
<td>.95</td>
</tr>
<tr>
<td>Hospitalizations</td>
<td>.3 (1.6)</td>
<td>.5 (1.1)</td>
<td>.6</td>
<td>.2–2.2(^b)</td>
<td>.47</td>
</tr>
</tbody>
</table>

\(^a\) Adjusted risk ratio and corresponding 95% confidence interval.
\(^b\) Self-report at 12 months.

randomization within the treatment group for receipt of sub-modules. As an integral part of the program, the sub-modules cannot be evaluated as a separate entity. Moreover, because the referral coordinator saw only treatment students, this aspect of the intervention cannot be evaluated separately from other aspects of the intervention. However, in a restricted analysis of treatment students who had not seen the referral coordinator, compared with controls, we saw similar effects, which lends support to the effectiveness of tailored content. Third, recruitment for this school-based study was relatively low (roughly 25% of those eligible), despite an ambitious recruitment campaign that included a variety of activities to encourage enrollment (e.g., mailings, contests, giveaways, presentations, school incentives). We note that in the present analysis, (1) participants were similar to nonparticipants for most outcomes; and (2) baseline variables that differed significantly between treatment and control groups suggested slightly higher baseline morbidity for treatment students, which could have biased our

Table 3
Indicators of uncontrolled asthma at 12-month follow-up for students enrolled in a randomized trial of Pub City

<table>
<thead>
<tr>
<th>Indicators of uncontrolled asthma (N = 422)(^c)</th>
<th>Treatment (n [%])(^d)</th>
<th>Control (n [%])</th>
<th>Adjusted odds ratio(^b)</th>
<th>95% confidence interval</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥2 days/week over 30 days</td>
<td>23 (11.3)</td>
<td>46 (21.1)</td>
<td>.5</td>
<td>.2–.8</td>
<td>.006</td>
</tr>
<tr>
<td>No</td>
<td>181 (43.6)</td>
<td>172 (78.5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥3 symptom-nights</td>
<td>50 (24.5)</td>
<td>68 (31.3)</td>
<td>.6</td>
<td>.4–1.0</td>
<td>.074</td>
</tr>
<tr>
<td>No</td>
<td>154 (75.5)</td>
<td>149 (68.7)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;2 schooldays missed</td>
<td>68 (33.3)</td>
<td>89 (40.8)</td>
<td>.7</td>
<td>.4–1.1</td>
<td>.090</td>
</tr>
<tr>
<td>No</td>
<td>150 (96.7)</td>
<td>129 (59.2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;2 schooldays missed (asthma)</td>
<td>26 (12.8)</td>
<td>32 (14.8)</td>
<td>.8</td>
<td>.5–1.5</td>
<td>.52</td>
</tr>
<tr>
<td>No</td>
<td>178 (87.2)</td>
<td>185 (85.2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;4 days of restricted activity</td>
<td>39 (18.1)</td>
<td>68 (31.2)</td>
<td>.5</td>
<td>.3–9</td>
<td>.010</td>
</tr>
<tr>
<td>No</td>
<td>153 (81.9)</td>
<td>152 (69.8)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;4 days had to change plans</td>
<td>20 (9.8)</td>
<td>24 (11.1)</td>
<td>.8</td>
<td>.4–1.7</td>
<td>.58</td>
</tr>
<tr>
<td>No</td>
<td>184 (90.2)</td>
<td>193 (88.9)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) Classification of asthma control adapted from Figure 15, Classification of asthma control (≥12 years of age), with the exception of days changed plans and school days missed from Expert Panel 3: Guidelines for diagnosis and treatment of asthma [24].
\(^b\) Adjusted odds ratio and corresponding 95% confidence interval.
\(^c\) Number, with risk factor in assignment group per total in assignment group.
Table 4

Results for analysis of indicators of uncontrolled asthma for students enrolled in a randomized controlled trial of Puff City and restricted to students receiving submodules, by randomization group

<table>
<thead>
<tr>
<th>Indicators of uncontrolled asthma</th>
<th>High rebellion (n = 177)</th>
<th>Low rebellion (n = 245)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Treatment (n [%])</td>
<td>Control (n [%])</td>
</tr>
<tr>
<td>≥2 days/week over 30 days</td>
<td>7 (8.1)</td>
<td>22 (24.2)</td>
</tr>
<tr>
<td>≥3 symptom-nights</td>
<td>14 (16.3)</td>
<td>34 (37.4)</td>
</tr>
<tr>
<td>≥2 schooldays missed</td>
<td>25 (29.1)</td>
<td>44 (48.4)</td>
</tr>
<tr>
<td>≥1 schooldays missed (asthma)</td>
<td>11 (12.8)</td>
<td>21 (23.1)</td>
</tr>
<tr>
<td>≥4 days of restricted activity</td>
<td>11 (12.8)</td>
<td>35 (38.5)</td>
</tr>
<tr>
<td>≥4 days had to change plans</td>
<td>6 (7.0)</td>
<td>17 (18.7)</td>
</tr>
</tbody>
</table>

a Classification of asthma control adapted from Figure 15, Classification of asthma control (≥12 years of age), with the exception of days changed plans and school days missed from Expert Panel Report 3: Guidelines for diagnosis and treatment of asthma [24].

b More than 2.5% for responses to rebellion questions where 1 = strongly disagree (less rebellion) and 5 = strongly agree (more rebellion).

c Adjusted odds ratio and corresponding 95% confidence interval.

d More than 2 on an average of three scales for emotional support, where 1 = strongly disagree (less support) and 5 = strongly agree (more support).

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References


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