

## ADHERENCE AND ASTHMA CONTROL

**Asthma medication adherence among urban teens: a qualitative analysis of barriers, facilitators and experiences with school-based care**Susan W. Blaakman, PhD, APRN<sup>1,2\*</sup>, Alyssa Cohen, BA<sup>2\*</sup>, Maria Fagnano, MPH<sup>2</sup>, and Jill S. Halterman, MD, MPH<sup>2</sup><sup>1</sup>School of Nursing, University of Rochester, Rochester, NY, USA and <sup>2</sup>Department of Pediatrics, University of Rochester, Rochester, NY, USA**Abstract**

**Objective:** Teens with persistent asthma do not always receive daily preventive medications or do not take them as prescribed, despite established clinical guidelines. The purpose of this study was to understand urban teens' experiences with asthma management, preventive medication adherence and participation in a school-based intervention. **Methods:** Teens (12–15 years) with persistent asthma, and prescribed preventive medication, participated in a pilot study that included daily observed medication therapy at school and motivational interviewing. Semi-structured interviews occurred at final survey. Qualitative content analysis enabled data coding to identify themes. **Results:** Themes were classified as "general asthma management" or "program-specific." For general management, routines were important, while hurrying interfered with taking medications. Forgetfulness was most commonly linked to medication nonadherence. Competing demands related to school preparedness and social priorities were barriers to medication use. Independence with medications was associated with several benefits (e.g. avoiding parental nagging and feeling responsible/mature). Program-specific experiences varied. Half of teens reported positive rapport with their school nurse, while a few felt that their nurse was dismissive. Unexpected benefits and barriers within the school structure included perceptions about leaving the classroom, the distance to the nurse's office, the necessity of hall passes and morning school routines. Importantly, many teens connected daily medication use with fewer asthma symptoms, inciting continued adherence. **Conclusions:** Teens with asthma benefit from adherence to preventive medications but encounter numerous barriers to proper use. Interventions to improve adherence must accommodate school demands and unique teen priorities. The school nurse's role as an ally may support teens' transition to medication independence.

**Keywords**

Adolescents, asthma management, intervention, motivational interviewing, qualitative content analysis, school nurse

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**Introduction**

Asthma, an inflammatory respiratory disease, is among the most common chronic conditions of childhood [1]. Asthma disproportionately affects adolescents who have higher asthma prevalence rates and decreased preventive health care use compared to younger children. In addition, racial and ethnic differences in asthma prevalence and morbidity are greater in pediatric populations than among adults. In the most recently reported national data, Black children were 1.6 times more likely to have current asthma than White children, and Puerto Rican children had higher disease prevalence than any other ethnic group. After adjusting for differences in asthma prevalence, disparities in disease outcomes became even more evident. Death rates among non-Hispanic Black children with asthma approached nearly five times that of

their non-Hispanic White counterparts. These factors place urban minority adolescents with asthma in a uniquely high-risk group [2].

Inadequate preventive care may also contribute to asthma morbidity among urban youth. National guidelines [3] recommend daily use of anti-inflammatory medications, such as inhaled corticosteroids (ICS), for every child with persistent asthma. However, children from poor or minority families are less likely to receive these medications [2]. Even when daily preventive medications are properly prescribed, adherence is low, particularly among adolescents [4].

Efforts to improve medication use in this population have targeted self-efficacy, encouraging teens' medication adherence while promoting independence in their asthma management [5,6]. Although these studies, among others [7–9], have focused on asthma medication use among adolescents, few interventions have provided insight into teens' asthma experiences. Review of this available literature indicates that a unique combination of intrinsic and extrinsic factors may contribute to adherence behaviors for these teens. For example, a 2009 study of 15–18 year olds with moderate or severe persistent asthma combined electronic adherence

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monitoring and qualitative interview techniques to reveal several themes reflecting positive and negative perceptions of ICS therapy itself, as well as perceived barriers to using the medication properly. Many barriers were related to home life and time management [10]. Similar research, including a foundational study conducted by van Es, involving 12–16 year olds with asthma [11], has reinforced the necessity of understanding teens' daily lives in order to make the use of ICS a part of an essential routine [6,11,12]. As the evidence suggests that teen perspectives, preferences and behaviors may vary widely [7], to effectively target interventions for this developmentally diverse population, it is imperative to understand their needs fully.

This was the goal of a 2009–2010 pilot program involving the Rochester City School District (RCSD) that combined directly observed medication therapy (DOT) at the school nurse's office and motivational interviewing (MI) to boost ICS use in a small sample of urban youth. Quantitative findings demonstrated decreased daily asthma symptoms and functional impairment related to asthma and increased motivation to take medication among participants [13]. To build upon those quantitative data, an additional qualitative descriptive study was conducted. The purpose of this article is to describe the qualitative component of the larger RCSD school-based pilot study, to present the salient themes emerging from that work and to explore implications for future research and clinical practice with these at-risk teens.

## Methods

### Design and participant recruitment

Qualitative descriptive methods [14] were utilized as part of a larger pilot study approved by the University of Rochester Medical Center Institutional Review Board. Detailed methods have been reported [13].

RCSD students were screened for eligibility in fall 2009. Eligible participants were 12–15 years old, had physician-diagnosed asthma, met criteria for persistent symptoms [3] and were prescribed daily inhaled preventive asthma medications. Assent was obtained from all teens enrolled ( $n = 30$ ), while written consent was obtained from primary caregivers to allow their teen's participation. Two teens withdrew right after enrolling citing personal reasons.

The pilot intervention occurred throughout the 2009–2010 school year and was comprised of DOT in the school nurse's office and MI conducted by two trained research nurses. Staffs in the nurse's offices across schools were primarily comprised of registered nurses (RNs) who were at times assisted by school health aides. As part of the professional school nurse role, personnel are expected to educate students about proper asthma care and inhaler administration technique, although this was also reinforced by the study team upon teen enrollment and throughout the intervention. No health staff members were certified asthma educators or nurse practitioners. The term "school nurse" refers to the health personnel encountered in the school nurse's office. The MI RNs were not a part of any school's health staff.

At the beginning of the school year, students visited the school nurse daily to receive one dose of their preventive asthma medication. ICS was taken at home for evening doses,

on weekends, on days with no school and if/when teens transitioned from DOT at school to exclusively using their ICS at home. As part of the larger pilot, each teen participated in three MI counseling sessions delivered by one of the research nurses. MI counseling consisted of one 40-minute home visit, then two 20-minute phone calls, spaced approximately two weeks, one month and three months post-enrollment. The MI counseling was designed to help teens examine any positive associations with daily ICS use during DOT (e.g. less symptoms or activity restrictions) to enhance motivation to take medication independently. The research nurses provided asthma education using a non-directive approach, reliant upon non-judgmental reflecting and open-ended questioning, to elicit the teen's thoughts, values and goals related to their lives and asthma care. Still employing MI strategies [15], primary caregiver input was also invited at the end of the counseling sessions to determine from each participant how caregivers could be supporting or hindering the teen's asthma self-management. MI phone calls offered continued support for medication adherence and an exploration of benefits and/or barriers to independent adherence, individualized for each teen. The MI protocol was developed with an expert in the field who provided fidelity supervision throughout the pilot [13].

In addition, to gather survey data related to primary outcomes (e.g. symptom free days, quality of life, activity limitations and rescue inhaler use) of the larger pilot study, follow-up phone calls were completed by our research associates at two and four months, and year-end visits occurred in the teens' homes. These data collection efforts were completely separate from the MI counseling sessions [13].

Along with the quantitative year-end surveys previously described [13], the qualitative data for this aspect of the pilot study were collected *via* face-to-face, semi-structured interviews conducted by three trained research associates who did not deliver other aspects of the intervention. During the interviews, one team member acted as an observer to take qualitative field notes concerning the home environment and events relevant to the interview (e.g. notable distractions or interruptions, others present and non-verbal communication not captured by audiotape). Dialogues were digitally recorded and later transcribed verbatim. Interviews lasted on an average of 14 minutes (mean = 13:50; range 6:46–39:24) following an interview guide of broad, open-ended questions and prompts to gather more specific data when needed (Figure 1). Interviewers aimed to elicit teen perspectives regarding the intervention (DOT and MI) and about their asthma symptoms and medications. Teens were encouraged to answer honestly, request clarification and to decline any question if uncomfortable responding.

### Qualitative analysis

Qualitative content analysis of transcripts was independently performed by two researchers (A. C., S. W. B.). Each transcript was explored by reading/rereading the text. Field notes and audiotapes were consulted for clarification of manifest (actual words spoken/transcribed) and latent material (potential underlying meaning). Open coding (labeling transcript interpretations line-by-line) and analytic memos

Figure 1. Qualitative interview guide.

**Overall, what was your experience like in the asthma program?****1) What was it like to go to the school nurse each day for your asthma medication?**

- Tell me about how it was helpful.
  - Which was easier, taking asthma medicine at home or at school? Why do you think that was?
  - Did going to the nurse help you remember to take it each day?
- Tell me what was difficult about going to the nurse's office.
  - Did you ever forget to go?
  - What happened when you forgot to go to the nurse? (Did the nurse call you down to remind you? What was that like?)
  - Did you mind leaving class to go to the nurse? Why/why not?
- What could make it easier to go to the nurse?
- What would make you want to go more?
- What would help you remember to go to the school nurse?
- Do you like taking your asthma medicine at school?
- Who else could help you remember to take your medicine each day?

**2) What do you think kids your age need to help them take good care of their asthma?**

- Do you feel like you need reminders to take your asthma medicine each day?
- Do you feel like you understand your asthma and how to take care of it?
- What is the hardest part about taking care of your asthma? What is not hard?
- Who, if anyone, do you think could help you take care of your asthma? How so?
- Do you think you could take care of your asthma without the help of your family?
- How much do you want to take care of your asthma all on your own? What would it mean to you to be able to take care of your asthma all on your own?

**3) The first months of the program were based around you getting your asthma medicine at school each day to help you get used to taking your asthma medicine each day. However, sometimes different things make it hard to go to school every day. What are some of the things that influence your school attendance?**

- How often do you miss school? How often are you late to school?
- Besides when you are sick, what are other reasons you might miss school?
- Who decides if you don't go to school?
- Tell me about how you get to school. How long does it take you?
- When you don't go to school, what do you do during the day?

(notes about concepts and analytic processes) were utilized to sort data and track decision-making. As categories emerged, data were organized by coding into an unrestricted matrix [16,17]. Based on coder consensus, the matrix was iteratively rearranged to fit thematic material until redundancy was eliminated and saturation reached (no new categories or themes generated). Data were triangulated with another team member for confirmability [18,19], and a convenience sample ( $n = 7$ ) from the original cohort, who could still be reached, was re-contacted to verify themes, which further assured soundness as no discrepancies or new concepts were revealed [18]. In addition, developmental influences were explored when emerging themes varied by participant age. Dichotomous age groupings (younger,  $\leq 14$ ; older  $\geq 14$ ) allowed for closer examination of these trends when relevant.

## Results

### Demographics

At final interview, teens ( $n = 28$ ) were 14.25 years on an average (range 12–16 years) and in grades 7–10. Fifteen (54%) were Black, none (0%) White and 13 (46%) self-identified as other, which included mixed race. To indicate ethnicity, nine (32%) self-identified as Hispanic and 19 (68%) as non-Hispanic. Most teens (82%;  $n = 23$ ) were Medicaid insured, while 14% ( $n = 4$ ) had private insurance, and 1 teen

(4%) had no insurance at the time of enrollment. Additional demographic data are available elsewhere [13].

### Themes

#### *General issues related to asthma medication adherence and self-management*

*Routines, rushing and remembering.* Most teens said remembering to take their medicine was the hardest part about caring for asthma. Remembering was more difficult if teens did not have routines established or when routines were interrupted. One teen (male, 15) reported, “If I had a set schedule for everything that I did during the day, if I had, like, a routine, that would help me remember more.” Yet, even for teens with routines, rushing and hurrying were consistently mentioned impediments to taking preventive medication, particularly in the morning.

Waking up late or being late to school was thus problematic causing rushing and disrupted routines, making teens more likely to forget their medication. Almost half ( $n = 13$ ) reported frequently being late to school (range three times/month to several times/week). Often, tardiness was attributed to irregular bus schedules. Seventy-eight percent ( $n = 22$ ) reported taking a bus to school, at least sometimes, through school or public systems. Three teens specifically referenced the unreliability of public transportation, saying it

was hard to get to school whenever buses arrived earlier than scheduled.

“I always end up running out of time to take it [preventive medication] ‘cause I have to make it to my bus on time” (Female, 14). Some teens ( $n=5$ ) reported alternate means of transportation (e.g. walking and car), but this was not the majority.

*Competing demands and priorities.* In addition to trying to fit taking asthma medication into uncertain daily schedules, teens struggled to balance other responsibilities that reflected or challenged their developing values. This entailed more than just remembering medication but managing pressure around how to focus energies toward personal priorities or goals. Many conflicts involved academic preparedness regardless if teens took ICS at school or transitioned to home use. At school, teens felt hassled to make up work if visiting the nurse disrupted classroom instruction. At home, teens reported remembering their morning dose competed with “getting ready” tasks, such as preparing a backpack.

In the morning, you like, start off with desk work . . . I gotta do that first, then eat my breakfast, and then just come up there [the nurse’s office]. I ain’t got no time for that. Male, 14.

I’ll be rushing to get out of the house and then I’ll have to take my medicine . . . and then I’ll forget, like, pens or pencils . . . . Male, 13.

Age-specific personal priorities also interfered with taking asthma medications. Teens commonly mentioned competing interests such as spending time with friends, watching television, playing video games and sleeping as deterrents to medication adherence. One teen insisted that these were inadequate excuses for neglecting asthma care, however.

Sometimes at home I just forget about it, ‘cause I’m interested in texting or sleeping or watching TV. Female, 14.

Teenagers, we have a lot of distractions. We got school, we got home, we got jobs. Some people got jobs, you know, when we’re at this age, and some people are driving . . . They just need to calm it down and remember that asthma is important, ‘cause it’s your life. Female, 16.

*Strategies.* Teens offered several strategies to aid remembering their ICS. Techniques mostly involved modifying asthma care behaviors to naturally fit into established daily routines. Several teens suggested enhancing visual cues, like signs, notes or changing their paths to class to intentionally pass the nurse’s office to stimulate remembering. Placing the medication canister on a nightstand was a common strategy for teens who were taking their ICS at home by final interview (“ . . . when I wake up I see it [inhaler] and then just take it”. Female, 14).

*Importance of independence.* Teens’ perspectives regarding their transition to independent medication adherence were explored. Some participants ( $n=5$ ) were unable to differentiate between the value of taking care of their asthma independently versus taking care of it in general. When asked, “What would it mean to you to be able to take care of your

asthma all on your own?” some responded that they would have fewer symptoms or activity limitations from asthma. Others, however, reflected on their potential for self-care and mentioned feeling mature as a major benefit. Half of the teens ( $n=14$ ) stated that becoming independent with asthma medications would make them feel more responsible. Fifteen- to sixteen-year-old teens often viewed independence as a sign of “getting older.” Several ( $n=6$ ) extrapolated medication independence to a broader ability to take care of themselves, while others reported they’d be less worried and more comfortable.

It would make me feel like I could do a lot of stuff on my own. Male, 14.

Nearly every participant reported receiving help or reminders from caregivers, especially mothers, for their asthma care. Among the younger teens ( $n=3$ ; mean age = 13.25 years), avoiding caregiver “nagging” was a key advantage of becoming independent.

I wouldn’t get annoyed by a lot of people. Male, 13.

Older participants (mean age = 14.6 years) were more likely to equate fewer reminders as less reliance on others.

I don’t gotta rely on people. Female, 14.

Interestingly, one younger teen (male, 13) stated he did not feel ready for independent asthma management (“I wouldn’t be able to rely on the nurses or something to help me remember”) despite not wanting to burden others (“I wouldn’t have to bother other people to help me take it”).

While most adolescents expressed motivation toward independence, a few ( $n=4$ ) did not identify any value in taking medications on their own. For these teens, not having reminders from others was worrisome. One teen felt so comfortable with his mother’s helping role that becoming more independent in his asthma care was viewed as unimportant.

I want to [take care of my asthma on my own], kinda, but I realize that I can’t do it by myself . . . It wouldn’t mean that much because I know my mom doesn’t mind [reminding me]. Male, 15.

### *Program-specific issues*

*Nurse as ally (or not).* School nurses played an integral role in the pilot intervention, providing daily DOT. Many teens ( $n=11$ ) reported positive rapport with the school nurses, describing them as “nice” or “fun”. This partnership often promoted medication adherence by enticing teens to the nurse’s office. Teens felt supported and considered school nurses, like parents and other caregivers, as helpers in using ICS as prescribed.

. . . It end up being helpful because we [the nurse and I] have conversations every morning and then, when I didn’t

go, I would remember – ‘oh, I didn’t take it [medicine] because I didn’t talk to the nurse today’. Male, 15.

I used to talk to the nurse a lot. I just knew her well . . . she used to ask me what we were doing in photo club and everything. Female, 14.

A few teens ( $n=3$ ) mentioned that treats, like animal crackers, made visiting the nurse more positive. Others suggested this incentive might have helped them too.

In a few cases ( $n=4$ ), teens expressed that the nurse’s attitude was poor or dismissive. These participants felt rushed or ignored when visiting the school nurse. Lack of rapport discouraged these teens from taking their medications in school. Other teens ( $n=13$ ) did not offer opinions of their school nurses.

The nurses, they don’t do anything . . . they just make up an excuse. Female, 15.

Every time they come in, ‘here, just take your Advair and go to class, go straight to class . . . hurry up, hurry up. Female, 14.

Only a handful of participants ( $n=5$ ) mentioned their primary care physicians (PCPs) when discussing their asthma management. Teens that did talk about their pediatricians described practical roles, such as prescribing medication and providing refills, rather than offering encouragement or support.

*Unexpected benefits and barriers.* Although DOT aimed to decrease teens’ asthma symptoms through improved medication adherence, several unforeseen consequences arose. The most commonly reported unexpected benefit was taking a break from class. Teens enjoyed missing a boring subject, having time to stretch and walk through the halls or getting a drink of water.

It’s math class . . . it’s not that I didn’t like it, but it’s overwhelming . . . it [taking my medicine] is a little break. Female, 16.

It’s fun to leave class. Female, 15.

Conversely, some teens resented leaving classes they liked, creating an unanticipated barrier to daily DOT.

I don’t like to be disturbed when I’m in art. Male, 13.

I minded [leaving class to go to the nurse] because I wanted to learn . . . I’ll be in shop class and I wanted to be in shop class. Female, 15.

In the urban schools, the activity of visiting the nurse presented occasional challenges. Some teens had difficulty moving swiftly through security scanners or attaining hall passes, and some were questioned by staff when walking to the nurse’s office. Others found the distance between the classroom and the nurse’s office excessive, especially when separated by stairs. Teens eating school-sponsored breakfast had additional morning constraints.

It takes, like, a long time to get through the scanner and breakfast . . . Female, 15.

Peer influence presented barriers to medication use for some and benefits for others. Some ( $n=7$ ) participants reported feeling embarrassed when the school nurse called their classroom, and one teen said the nurse sometimes sent another student to find him, which was not desirable. For most teens, peer influence was not problematic, and many ( $n=9$ ) received helpful reminders from friends to visit the nurse.

*Understanding asthma.* Several teens ( $n=7$ ) understood the connection between daily ICS use and decreased asthma symptoms. The pilot MI counseling intervention afforded teens with customized information and encouragement to proactively control their asthma, while personal experiences strengthened this link.

I actually started taking [my medicine] and my symptoms stopped so . . . I was like, ‘wow, it’s really working’. Female, 14.

I know I’m not feeling better for just no reason. Female, 14.

When I didn’t used to take my Flovent, it . . . wasn’t how I was now, like I could breathe better and I could do more stuff now. Male, 15.

For some, the purpose of taking preventive medications remained unclear. These teens characterized their asthma symptoms as unpredictable or were confused about their medications. One teen used a rescue inhaler on days that he forgot to take his preventive medication, regardless of symptoms.

I don’t think I’ll ever be able to understand it, ‘cause sometimes I can run around for hours and it won’t . . . trigger it and then, other days, I can just run for a short period of time and . . . I’m wheezing and stuff . . . it’s like you never know when it will start. Male, 15.

I wanna do something but asthma keeps on coming. Asthma takes me out of my fun time. Male, 14.

Few teens ( $n=5$ ) mentioned other ways of managing asthma (e.g. avoiding triggers) besides medication adherence. Interviewers did not directly prompt this dialogue, although MI sessions exposed teens to the content. The average age of teens that discussed asthma triggers (15.2 years) was greater than that of the entire cohort (14.5 years). A summary of main themes is presented in Table 1.

## Discussion

Through qualitative content analysis of semi-structured interviews, we aimed to elucidate adolescents’ experiences with asthma medication management, generally, and pertaining to an urban school-based pilot intervention that included DOT and MI counseling [5,13]. These teens were uniquely poised to describe their asthma management experiences and desires. Responses varied in ways that were consistent with and divergent from existing literature.

Regarding *general issues related to asthma management*, it was not surprising that teens reported difficulty remembering to take their daily ICS. Consistent with previous findings, an

Table 1. Main themes reported by teens.

| Themes                                  | Examples                                                                                                                                  |
|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| <b>General asthma management issues</b> |                                                                                                                                           |
| Routines, rushing and remembering       | “If I had a set schedule for everything that I did during the day, if I had, like, a routine, that would help me remember more”. Male, 15 |
| Competing demands and priorities        | “Sometimes at home I just forget about it, ‘cause I’m interested in texting or sleeping or watching TV”. Female, 14                       |
| Strategies                              | “...when I wake up I see it [inhaler] and then just take it”. Female, 14                                                                  |
| Importance of independence              | “It would make me feel like I could do a lot of stuff on my own”. Male, 14                                                                |
| <b>Program-specific issues</b>          |                                                                                                                                           |
| Nurse as ally (or not)                  | “...I would remember – ‘oh, I didn’t take it [medicine] because I didn’t talk to the nurse today’”. Male, 15                              |
| Unexpected benefits and barriers        | “It takes, like, a long time to get through the scanner and breakfast...”. Female, 15                                                     |
| Understanding asthma                    | “I know I’m not feeling better for just no reason”. Female, 14                                                                            |

established daily routine was vital for teens to use medications as prescribed [10–12]. Interrupted routines or rushing posed problems that particularly affected teens utilizing public buses. Transportation issues also contributed to school tardiness and absenteeism that disrupted school activities, including DOT.

Despite struggles getting to school, academic preparedness was important for many. Medication management was sometimes suppressed by academic tasks (e.g. gathering supplies, completing deskwork), which teens prioritized [10]. Some evidence indicates that children with poorly controlled asthma are more likely to experience inadequate school readiness and excessive absenteeism [20–22], yet our teens sometimes sacrificed proper asthma care striving for scholastic goals.

Many teens did try to remember their daily ICS. Their strategies included visual cues [10] and commonly involved placing inhalers in plain sight. During DOT, some teens modified routes to class to pass the nurse’s office, visually prompting a visit. These adaptations ultimately highlighted the importance of routines in this group. Once established, teens reported their strategies as effective despite competing demands. It also suggests that interventions tailored by teens to fit into their lifestyles may be successful.

Most teens also expressed independent medication management as a goal, though reasons were diverse and revealed age-related trends. Consistent with other studies [23], younger teens were likely to perceive parental help as “nagging” and felt independence would relieve this nuisance. Older teens often viewed medication independence as a sign of maturity or increasing responsibility. Some older adolescents remained reluctant, however, affirming that age is a debatable indicator of self-management readiness [7–9]. Although our participants were of similar ages, their cognitive and developmental processes differed. Clinicians, thus, must consider teens’ developmental stage, illness understanding, motivation and competence for self-care when negotiating this transition.

Pertaining to *program-specific issues*, participants described the pilot intervention as beneficial and acceptable [13]. The school setting provided a useful link between study team members, healthcare providers and adolescents. Perhaps the most pivotal personnel were school nurses, who supported the intervention and improved teen outcomes [13]. Many teens similarly reported positive experiences with DOT.

Nurses became allies and part of the asthma “team” that usually includes caregivers, friends and doctors [22,23]. Although several studies have explored nurse opinions on school-based asthma management, few have explored student views of the nurse as a helper [24,25]. The role of the school nurse in asthma management is reportedly five-tiered [3,26]. School nurses (1) monitor asthma control, (2) treat acute asthma episodes, (3) provide asthma education, (4) obtain asthma action plans and (5) encourage regular medical visits [26,27]. Their proximity to teens’ daily activities makes them key players in health instruction and care [27]. Accessibility combined with perceived trust and support, position school nurses to engage teens and facilitate medication adherence. This has special salience as our teens almost never named their PCPs as helping with their asthma beyond writing prescriptions. This may be due to the design of the pilot intervention that did not emphasize PCP roles and of the qualitative interviews (Figure 1) that did not directly ask teens about PCPs. Still, this finding contrasts with typical interpretations of a chronic disease management team where the PCP is central. Communication with healthcare providers is crucial for asthma management [28], but teens may lack enough experience interacting with PCPs to rate them as allies. Future interventions might reinforce that connection.

In addition, the structure of the school day influenced teens’ experiences. Missing class to visit the nurse was differentially perceived by teens, often depending on opinions of the content missed. Many teens thought going to the school nurse provided a much-needed break. However, the timing of the DOT was not always in the teens’ control, which created dissatisfaction. The urban school setting presented specific barriers. The necessity of security scanners, policing of hallways, “desk work” in secondary school and in-school breakfast programs were unanticipated challenges. These, combined with varying bus schedules and physical accessibility of the nurse’s office, made barriers highly individualized, which require creative targeting.

Nevertheless, teens were largely willing to take their medications at school. Many teens reported no embarrassment and cast their friends in “helper” roles. This was both similar [10,11] and dissimilar [8,23,29,30] to prior findings. Social influences were more concerning outside of school, when teens prioritized fun activities over proper asthma medication use. The short-term benefits of fun activities were

valued over those associated with taking medication long-term. For some, the benefits of daily medication adherence never became apparent. These teens lacked full understanding of ICS therapy, which requires consistent adherence for optimal effect. In addition, avoiding triggers was not addressed by most participants when discussing asthma control. The few teens that mentioned asthma triggers were older than the average age of the group and more likely to conceptualize a multi-faceted approach to meet their asthma care needs. This was possibly due to their advancing developmental capacities for abstract thinking [31], an essential consideration for future practice and research.

## Conclusions

Overall, qualitative interviews revealed valuable data about how a sample of teens experienced asthma management and a school-based pilot intervention. Working with teens to establish routines that facilitate medication adherence and fit into existing lifestyles could be an important focus for clinicians, in conjunction with logically aligning asthma management with teens' other goals and priorities. Technology (e.g. cell phone alarms/texting, websites and telemedicine) for cuing and support was not explored but may be promising [32–34]. Furthermore, theory (e.g. self-determination theory) [34–36] that complements the spirit of MI [15,37] and considers teens' choices, values, abilities and relationships can guide ongoing efforts to support asthma management, including self-care. Positive relationships between the school nurse [22,26], teens, peers [38,39] and inter-professional providers [40] clearly merit exploration, as they could yield more effective, less costly healthcare models, especially for vulnerable teens.

## Declaration of interest

The authors report no conflicts of interest. The authors are solely responsible for the writing and content of this paper.

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